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The hinterland: compilation of nearby brown dwarfs and ultracool stars

By

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The hinterland: compilation of nearby brown dwarfs and ultracool stars

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This work is a compilation and analysis of ultracool dwarfs (UCDs) and brown dwarfs within 25 parsecs. It supplements the work of Stauffer et al. [2010] who updated the reputable and widely relied upon *Third Catalog of Nearby Stars* [Gliese & Jahreiß 1991] with revised coordinates and cross-matched each object with the 2MASS point source catalog [Cutri et al. 2003]. I began by incorporating newly discovered (post 1991) cool companions to Gliese-Jahreiß stars that had been previously undetectable. I then expanded the compilation to include isolated UCDs and other nearby systems with at least one UCD component. Multiple systems are a panacea for astrophysical problems: by applying Kepler's laws, the model-independent mass of brown dwarfs and low mass stars can be determined and hence serve to constrain theory. This work puts this data into context by exploring the history of brown dwarf theory and reviewing open questions concerning their nature.

Key words: brown dwarfs, binaries, low-mass, stars, thesis

DEDICATION

A world full of fear and despair cries out for the uplifting light of knowledge. To hold up the torch, burn away the ignorance, and reach down with an empathetic hand is the obligation of the learnèd natural philosopher. One is a bridge for the many; the many the support of one.

I'll always reach for the stars; but no matter how far I get, I'll never forget where I came from and who I left. I dedicate this thesis to my family and friends. While science and reason guide me, my love for them is what drives me.

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NOMENCLATURE

a
semimajor axis

AU
the astronomical unit, the ostensible separation between the Earth and the Sun, defined as 149,597,870,700 m

B class star
with a surface temperature ranging from 10,000 to 31,500 K, identified by neutral helium and strong hydrogen

brown dwarf
a stellar object unable to sustain core fusion of hydrogen, yet able to fuse deuterium

celestial sphere
the projection of earth's latitude and longitude system onto the sky

CNS3
the *Third Catalog of Nearby Stars*

DBML
the Deuterium Burning Mass Limit, mass threshold for the fusion of deuterium;

epoch 2000
refers to coordinates in terms of year 2000 equatorial positions on the celestial sphere

GJ
Gliese-Jahreiß, catalog acronym for objects in the *CNS3*

HBML
the Hydrogen Burning Mass Limit, mass threshold for the fusion of hydrogen

HIRES
high resolution echelle spectrometer, instrument of the Keck observatory in Hawaii

J2000
an equinox of J2000 refers to an equatorial coordinate system defined by the Earth's orientation in year 2000

JHK_s
a set of infrared photometry filter standards, centered on 1.2, 1.6, and 2.2 μm, respectively

L dwarf
with a surface temperature ranging from about 1,300 to 2,200 K, identified by absence of hydrogen and presence of metallic hydrides, alkali metals

M dwarf
with a surface temperature ranging from about 2,200 to 4,000 K, identified by neutral metals and little sign of hydrogen

mas
milliarcsecond

metallicity
the proportion of a star made up of elements other than hydrogen and helium

$M_{\oplus}$
Earth Mass

M_{Jup}
Jupiter Mass

$M_{\odot}$
Solar Mass

Myr
megayear, or 1,000,000 years

O class star
with a surface temperature ranging from about 31,500 to 49,000 K, identified by ionized and neutral helium, weak hydrogen

parallax
the apparent displacement, in arcseconds, of a star in the sky due to the perpendicular change in position of an Earthbound observer by 1 AU

Population I and II
stars that are young and metal rich and stars that are old and metal poor, respectively

pc
parsec, the distance corresponding to a parallax angle of 1,000 mas and approximately equivalent to 3.26 light-years

q
the stellar mass ratio of secondary to primary

QSO
quasi-stellar object, very distant and very energetic electromagnetic sources embedded in the cores of young galaxies

solar star
a star with a spectral falling between F6 and K3

T dwarf
with a surface temperature ranging from about 700 to 1,300 K, identified by methane llines

UCD
ultracool dwarf, a dwarf star with a spectral type later or equal to M6

VLM
very low mass, $\mathrm{M} \lesssim 0.1\ \mathrm{M}_{\odot}$

V	visual photometry standard, Johnson V is centered on 544.8 nm, with a FWHM of 84 nm
Y dwarf	with a temperature less than about 700 K, identified by ammonia lines

CHAPTER 1

THE NATURE OF BROWN DWARFS: AN OVERVIEW

1.1 What is a brown dwarf? – a provisional definition

Brown dwarfs are often described as “failed stars” because, while composed predominantly of hydrogen, they lack the mass to sustain core fusion of hydrogen. Shiv Kumar [1963b] originally denoted these objects “black dwarfs” as it was predicted that their low mass would cause them to contract into degenerate objects soon[1] after formation; however, the astronomy community decided upon “brown dwarf”[2] with the coining of the term by Jill Tarter [1975]. According to Burrows et al. [1997; 2001] and Chabrier et al. [2005], the lower mass limit of a brown dwarf is ~13 and ~12.5 M_{Jup} respectively[3]. The upper mass limit is, according to Burrows & Liebert [1993] and Chabrier et al. [2000], ~0.08 $M_\odot$ and ~0.07 $M_\odot$ respectively[4]. These figures are based upon the ability to fuse deuterium on the lower mass limit and the inability to fuse hydrogen[5] on the upper mass limit [Burrows & Liebert 1993; Kumar 1963b]. Provisionally, one may think of brown dwarfs as star-like objects, in that they are formed out of a giant molecular cloud and are composed mostly of hydrogen, falling within the aforementioned mass spectrum. The International Astronomical

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[1] Kumar [1963a] showed that objects with mass $M < 0.1\ M_\odot$ would contract to a radius of about 0.1 $R_\odot$ over the course of about 1 billion years as opposed to over a hundred billion as previously thought.

[2] Ironically, brown dwarfs would appear magenta in color to the naked eye [Burgasser 2008].

[3] See section 1.4 for more details.

[4] $1.0000\ M_\odot = 1.0474\times10^3\ M_{Jup}$.

[5] Unless otherwise specified, “hydrogen” refers to the hydrogen isotope “protium”.

Union (IAU) Working Group on Exoplanets provides a three-point provisional definition of a planet [Boss et al. 2007], which is also pertinent to the understanding of brown dwarfs:

> Objects with true masses below the limiting mass for thermonuclear fusion of deuterium (currently calculated to be 13 Jupiter masses for objects of solar metallicity) that orbit stars or stellar remnants are “planets” (no matter how they formed). The minimum mass/size required for an extrasolar object to be considered a planet should be the same as that used in our Solar System.
>
> Substellar objects with true masses above the limiting mass for thermonuclear fusion of deuterium are “brown dwarfs”, no matter how they formed nor where they are located.
>
> Free-floating objects in young star clusters with masses below the limiting mass for thermonuclear fusion of deuterium are not “planets”, but are “sub-brown dwarfs” (or whatever name is most appropriate).

There is much speculation and many open questions regarding the true nature of these objects. This section aims to cover the history of the brown dwarf: from early theory, to discovery, to recent theory.

1.2 Motivation

As the first ultracool objects were found, four principal questions were raised:

1. Though brown dwarfs are defined as astronomical objects that lack sufficient mass to fuse hydrogen, how exactly do they form and evolve?
2. How do brown dwarfs differ from stars?
3. How do brown dwarfs differ from planets?
4. Can the above questions be answered unambiguously in terms of observables?

Brown dwarfs come from the same can of soup as stars and planets, so understanding the nature of these hinterland objects is critical to understanding the formation and evolution of all stellar systems [Mohanty & Jayawardhana 2006]. Several formation mechanisms have been proposed: dynamical ejection [Watkins et al. 1998; Reipurth & Clarke 2001; Bate et al. 2002], turbulent fragmentation of the molecular cloud [Padoan 1995; Padoan et al. 1997; Whitworth & Stamatellos 2006], turbulent fragmentation of the protostellar disk [Matzner & Levin 2005; Vorobyov & Basu 2006; Whitworth & Stamatellos 2006; Faherty et al. 2011], and hybrid mechanisms [Basu & Vorobyov 2012]. Which is correct?

Additional questions include, but are not limited to, the following: how complete is the survey of brown dwarf frequency[Artigau et al. 2010; Kirkpatrick et al. 2012]? Why is the mass ratio distribution for very low mass binaries (VLM; $M \lesssim 0.1\ M_{\odot}$) peaked near unity [Burgasser et al. 2007b]? Why is the frequency of brown dwarf companions in close[6] orbits around sunlike stars low[7] [Marcy et al. 1998; Marcy & Butler 2000; Grether & Lineweaver 2006; Sahlmann et al. 2011; Dieterich et al. 2012]? What are the limitations of the lithium test, which may indicate the substellar nature of an object by virtue of lithium detection [Rebolo et al. 1992]?

Red dwarfs are the most common star in the known universe. Henry et al. [1999] placed them at >70% of the Galactic population. On the other hand, Kirkpatrick et al. [2012] found that M dwarfs outnumber L, T, and Y dwarfs combined by a factor ~2 and that stars in general appear to outnumber brown dwarfs (at least T and Y dwarfs) by a factor of six. Kirkpatrick et al. [2012] also noted that while the census of nearby stars is well-known, that for T and Y dwarfs is still incomplete. This is indeed exciting because the less rare these objects are the more manageable understanding them will be; Kirkpatrick et al. [2012]

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[6] Less than 10 AU Sahlmann et al. [2011]; 5-70 AU Dieterich et al. [2012]

[7] This phenomenon is known as the “Brown Dwarf Desert”.

suggested that equipment more sensitive than the Wide-field Infrared Survey Explorer will discover still cooler objects. Objects that form like stars, but that lack the mass to even fuse deuterium may be classified as “nomads” [Strigari et al. 2012] or “sub-brown dwarfs” [Boss et al. 2007]. Understanding what mechanism determines the relative number of stars with different masses will bring into finer focus our place in the universe [Mohanty & Jayawardhana 2006] and it will also expand the search for life as some planets may even be bounded to brown dwarfs [Andreeshchev & Scalo 2004]. As the lowerright corner of the Hertzsprung-Russell diagram is charted out in greater detail, we will find ourselves increasingly prepared to answer astronomical questions with implications both anthropic and astrobiological.

1.3 Discovery!

The existence of brown dwarfs in nature was unambiguously demonstrated some thirty years after the pioneering theoretical work of Kumar [1963a;b], Hayashi & Nakano [1963]. Nakajima et al. [1995] reported the discovery of GJ 229 B; the clear detection of methane in the atmosphere by Oppenheimer et al. [1995] implied a cool temperature and its substellar nature. The young brown dwarf Teide 1 was discovered earlier the same year by Rebolo et al. [1995], though its substellar nature wasn’t widely agreed upon until the following year [Rebolo et al. 1996; Basri et al. 1996]. Hundreds of brown dwarfs were discovered in the subsequent years, solidifying the mysterious object’s place in the astronomer’s lexicon and challenging our understanding of both stars and planets.

Rebolo et al. [1995] searched the nearby, young cluster known as the Pleiades[8]. They deemed that its proximity and age made it an optimal target for the discovery of brown dwarfs. While there had been many successful discoveries of brown dwarf candidates in clusters of open stars, Nakajima et al. [1995] noted that the observable differences between young brown dwarfs and very low mass stars is modest. They decided that it would be easier to look for the distinctive spectral features of older, cooler brown dwarfs orbiting nearby stars: the parallax of the primary would permit an accurate determination of the dim secondary's luminosity and along with the detection of methane would serve as corroborating evidence.

1.4 Evolution

By examining the behavior of fully convective models[9] for stars of various masses and taking into account non-relativistic degeneracy, Kumar [1963b] was able to show that there is a lower limit to the mass of a main sequence star dubbed the "hydrogen burning mass limit" (HBML)[10]. Kumar [1963b] determined this threshold to be ~$0.07\ M_\odot$ for Population I stars and ~$0.09\ M_\odot$ for Population II stars. By examining models for Population I stars composed of a radiative core and convective envelope, Hayashi & Nakano [1963] obtained similar results: they found that "stars" less massive than $0.08\ M_\odot$ contract towards high electron-degeneracy configurations without sustaining hydrogen fusion.

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[8] Stauffer et al. [1998] placed it at ~130 pc with an age of 125±8 Myr

[9] The temperature differential due to deuterium fusion drives material from the core to the surface [Hayashi 1961; Burrows et al. 1997]

[10] In this context, "burning" actually means "fusing".

The size and luminosity of a main sequence star is determined by the balance of gravitational contraction with the internal radiation pressure generated by fusion. For stars more massive than the sun, the carbon-nitrogen-oxygen (CNO) catalytic cycle dominates energy production. OB stars[11], very hot and massive, may play an important role in brown dwarf formation: through photoionization, they may halt accretion by eroding away the outer layers of a prestellar core [Whitworth & Zinnecker 2004]. Equation 1.1 summarizes the CNO cycle:

$$4^1H \rightarrow {}^4He + 2\beta^+ + 2\nu_e + 3\gamma \tag{1.1}$$

The principal fusion reaction pathways in stars with masses on the order of a solar mass are the proton-proton chains. These account for about 98% of the Sun's energy output. The primary chain can be summarized thusly:

$$4^1H \rightarrow {}^4He + 2\beta^+ + 2\nu_e + 2\gamma \tag{1.2}$$

Brown dwarfs are not massive enough to reach the ~ $10^7\ K$ necessary to sustain stable core hydrogen fusion [Ryden et al. 2010] and so hydrogen fusion is not an important contributor their energy output. They are, however, massive enough to fuse deuterium with hydrogen at their cores as follows:

$${}^2H + {}^1H \rightarrow {}^3He + \gamma \tag{1.3}$$

Kumar [1963b] theorized that a protostar with a mass below the HBML would become "degenerate" as a consequence of gravitational contraction. That is, because these objects are not massive enough to sustain core fusion of hydrogen, they cannot prevent the core density

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[11] O or early B class stars in an association of many other such stars.

from rising to the point where the core plasma becomes a partially degenerate electron gas [Burgasser 2008]. A newborn brown dwarf will generate energy by converting gravitational potential energy into kinetic energy through contraction over a period known as the Kelvin-Helmholtz time scale. Hydrostatic equilibrium is reached when the combined degeneracy and gas pressure match the gravitational pressure [~10^8 yr; Chabrier & Baraffe 1997]. All the while the core of the brown dwarf becomes hotter, but never quite hot enough to fuse hydrogen; unlike stars, their diminutive mass prevents them from maintaining thermal equilibrium. In time, the brown dwarf's temperature will peak, reaching a minimum radius and complete degeneracy, and with the passing of an eternity it fades into a black dwarf[12] [Kumar 1963a].

In order to distinguish brown dwarfs from low mass stars, Rebolo et al. [1992] proposed a useful diagnostic now known as the "lithium test": the detection of abundant lithium via observation of the Li I resonance doublet at 670.8 nm can corroborate a substellar object's brown dwarf status. Significant "lithium burning" occurs at ~ 3×10^6 K, which is below the core temperature of objects with masses beyond the HBML, in brown dwarfs with masses ≥$0.065\ M_\odot$.

These ideas were explored further by Nelson et al. [1993], who examined the evolution of lithium, beryllium, and boron in models of very low mass stellar objects with the express goal of differentiating between brown dwarfs and low mass main sequence stars. They

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[12] A hypothetical object that has cooled to the point of thermal equilibrium with the background temperature of space and not to be confused with original name for brown dwarfs given by Kumar.

defined a transition range as between 50% of a light element burned to 90% of a light element burned. The relevant reactions are as follows:

$$^{7}Li + {}^{1}H \rightarrow 2{}^{4}He \tag{1.4a}$$

$$^{6}Li + {}^{1}H \rightarrow {}^{3}He + {}^{4}He \tag{1.4b}$$

$$^{9}Be + {}^{1}H \rightarrow {}^{2}H + 2{}^{4}He \tag{1.5a}$$

$$^{9}Be + {}^{1}H \rightarrow {}^{6}Li + {}^{4}He \tag{1.5b}$$

$$^{10}B + {}^{1}H \rightarrow {}^{4}He + {}^{7}Be \tag{1.6a}$$

$$^{11}B + {}^{1}H \rightarrow 3{}^{4}He \tag{1.6b}$$

For ^{6}Li, they found that 50 and 90% of the initial abundance would be burned in brown dwarfs with masses of ~0.051 and ~0.053 $M_{\odot}$, respectively. For ^{7}Li, they found that 50 and 90% of the initial abundance would be burned in brown dwarfs with masses of ~0.059 and ~0.062 $M_{\odot}$, respectively. Due to its larger proton cross section, the ^{6}Li in the 0.062 $M_{\odot}$ brown dwarf takes $\log_{10} t[yr]$ ~ 8.8 to burn 90% of the initial abundance while the 0.053 $M_{\odot}$ brown dwarf takes $\log_{10} t[yr]$ ~ 8.6 to burn 90% of the initial abundance of ^{7}Li.

Brown dwarfs and low mass stars are highly convective so even young objects are expected to show significant lithium depletion if they are massive enough [Rebolo et al.

1996]; however, in stars more massive than $0.9\ M_\odot$, lithium depletion is not completed due to the early retreat of convection [Stahler & Palla 2005].

While brown dwarfs may be distinguished, at least in principle[13], from low mass stars on the basis of the HBML, what of their low mass limit? Burrows et al. [1995] examined models of so-called extrasolar giant planets (EGPs). They determined[14] that less than 50% of the initial deuterium would fuse over the lifetime of an EGP less massive than $13\ M_{Jup}$. Whether or not an EGP near this mass should be classified as a "brown dwarf," "sub brown dwarf," "planet" or "nomad" is generally considered an issue of semantics provided that mass is the sole basis of categorization; however, Burrows et al. [1995] suggested that the mode of formation may be used to distinguish brown dwarfs and planets in this mass regime. Spiegel et al. [2011] reviewed multiple factors that determine the deuterium burning boundary: the helium abundance, the metallicity, the initial deuterium abundance, and on what constitutes sufficient deuterium burning. The boundary ranges from ~11 M_{Jup} (three times solar metallicity, 10% of initial deuterium burned) to ~16.3 M_{Jup} (zero metallicity, 90% of initial deuterium burned). Because the boundary between brown dwarfs and sub-brown dwarfs is fuzzy, perhaps the nature of these objects is better understood in terms of formation history. Taxonomically, this might be the easier route; however, such information is not necessarily accessible. The philosophical problem of boundary vagueness forces the imposition of a standard (e.g.: defining a specific fraction of the initial abundance burned in order to qualify as a brown dwarf), while the practical problem of determining formation

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[13] Though practically with the detection of the Li I resonance.

[14] See Spiegel et al. [2011] for contemporary analysis of the border between brown dwarfs and planets.

history of a given object will necessitate ambiguous classifications. Assuming that brown dwarfs and stars have a shared origin, how do their formation pathways differ?

1.5 Formation

While it is well established that stars form from dense cores of gas embedded in molecular clouds – and often within filaments – the specifics of core formation, collapse, and fragmentation are still debated [Hennebelle 2012]. Brown dwarfs are expected to have masses between planets and stars; but, do they form as do stars or as do planets?

The core-accretion model is the most widely accepted scenario for giant planet formation [Baraffe et al. 2010]: first, planetesimals form from the leftover dust and gas of the circumstellar disk; second, several earth masses agglomerate into a rocky core [at least ~10 $M_\oplus$ to capture gas; Mizuno 1980]; and third, an envelope of gas is captured from the disk [Hubickyj et al. 2005]. However, this process limits the most massive objects to 10 to 15 M_{Jup} Mohanty & Jayawardhana [2006]. While this process could create sub-brown dwarfs and low-mass brown dwarfs, it can not explain the origin of brown dwarfs of greater mass. So, if the planetary method is not sufficient, then it is required that we take a step back in time and space.

Within vast, cold clouds of gas and dust[15] that may stretch hundreds of parsecs across, the stellar nurseries may be found [Humensky 2008]. These tenuous entities are found in interstellar space and are known as giant molecular clouds (GMC). Embedded within, are the gravitationally bound regions, known as "cores", where stars form. Cores may fragment

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[15] This medium is composed of interstellar dust (1%) and gas (99%): the dust is composed of silicates carbon and ice; the gas is composed of 75% hydrogen and 25% helium.

into smaller entities known as “embryos” and subsequently grow in mass as the surrounding media rains inward. If brown dwarfs do form this way, what mechanism stunts the growth of the embryos?

Stars have the greatest chance of forming in the coldest, densest regions of the interstellar medium Humensky [2008]. For simplicity’s sake, consider a spherical self-gravitating collection of gas – a core – that is under hydrostatic equilibrium; the outward gas pressure is balanced by the inward gravitational pressure. An external shock would disturb this balance, inducing the transmittance of a pressure wave inward [Hennebelle 2012]. The sudden increase of gravitational pressure at the surface would lead to further contraction; naturally, this contraction boosts the outward gas pressure. If the inward wave takes longer than the freefall time to reach the center of the core, the core would collapse [Hennebelle 2012]. The condition for collapse is give by Equation 1.7,

$$\frac{1}{\sqrt{G\rho_o}} < \frac{R_o}{C_s} \tag{1.7}$$

where C_s is the speed of sound in the gas, R_o is the initial radius of the core, ρ_o is the initial density, and *G* is the universal gravitational constant. The left hand side represents the freefall time while the righthand side represents the sound crossing time. If the freefall time were greater than the sound crossing time, then the sphere of gas and dust would remain intact; if the freefall time were less than the sound crossing time, the core will collapse. From Equation 1.7, a critical length known as the “Jeans length” λ_J can be derived.

$$\lambda_J = \sqrt{\frac{\pi C_s^2}{G\rho_o}} \tag{1.8}$$

The mass contained within this core of gas is known as the “Jeans mass” M_{Jeans}:

$$M_{Jeans} = \frac{1}{6}\left(\frac{\pi^5}{\rho_o}\right)^{1/2}\left(\frac{C_s}{G}\right)^3 \tag{1.9}$$

The law of conservation of angular momentum restrains the collapse of the core and causes the formation of a rotationally supported disk known as a protoplanetary disk. At the center of this disk is the protostar: this object does not (yet) possess sufficient mass to fuse hydrogen. As viscous torques and the protostar’s nascent solar wind carry away angular momentum, gas rains down on the protostar as it becomes first massive enough to fuse deuterium and then massive enough to fuse protium. At this point, a star is born. However, even after fusion has commenced, the newborn star will continue to contract until it has reached thermal equilibrium [Nelson 1990]: the radiated energy must be equivalent to that generated by the fusion within.

The gravo-turbulent theory emphasizes the role of turbulent density fluctuations while fragmentation theory emphasizes the role of disk instabilities [Hennebelle 2012]. Since the Jeans mass of an isothermal gas decreases as the density goes up (Equation 1.9), Hoyle [1953] postulated that cores could fragment as they collapse as part of a grand scheme of hierarchal fragmentation or recursive fragmentation. As each successive step occurs over a shorter and shorter timescale, there comes a point when the “daughter” cloud is optically thick and unable to radiate away its contraction energy (pdV) fast enough – causing it to warm up [Whitworth et al. 2007]. This is known as the “opacity limit”: hierarchal fragmentation terminates when the N^{th} daughter generation is unable to radiate its gravitational contraction energy on the free-fall time-scale [Rees 1976].

Hennebelle [2012], however, suggested that these theories should be treated simultaneously and as a continuum via the simulation approach. This approach provides direct statistics that can be compared with observational data, though it may be difficult to verify the reliability of simulation predictions or to interpret the physical mechanisms at play. It is the simulation approach that led to the idea that brown dwarfs could form by ejection and within dense filaments induced by gravity collapse, though both rely on strong density enhancements triggered by gravity.

Watkins et al. [1998] and Reipurth & Clarke [2001] suggested that core ejection[16] could explain why some embryos never obtain enough mass to fuse hydrogen; this idea was quantified by simulations by Bate et al. [2002] and Bate [2012]. They describe a stochastic process by which embryos compete for mass, the smallest maintaining the greatest chance for exile. This suggests a natural solution for the question of the brown dwarf desert: the rarity of close brown dwarf companions to stars [Marcy et al. 1998; Marcy & Butler 2000]. The ejection scenario may also explain the rarity of wide brown dwarf binaries as ejection dynamics would render them unstable; only tightly bound binaries would survive ejection [Reipurth & Clarke 2001].

Bonnell et al. [2008] examined low-mass star and brown dwarf formation by filaments. When a "core" of gas embedded within a molecular cloud fragments, it forms a cluster that serves as a focal point to draw in gas from the surrounding medium. Filaments begin to grow in the cluster, forming high density regions. In this dense gas environment, the Jeans mass is low and allows for fragmentation. Because fragmentation requires strong

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[16] See Basu & Vorobyov [2012] for a computational analysis hybridizing core ejection with disk fragmentation.

gravitational potential, brown dwarfs should be more frequent in stellar clusters than in distributed populations of young stars; however, this does not explain the formation of isolated brown dwarfs.

In Padoan [1995] and Padoan et al. [1997], it is argued that all stars form as a consequence of "turbulent fragmentation": that is, "fragmentation due to a complex of strong interacting shocks, formed in a field of random supersonic motions" [Padoan et al. 1997]. The molecular clouds fragment into sheets, filaments, cores, and low density "voids" [Padoan & Nordlund 2002]. They explain that due to the intermittent nature of the log-normal probability density function (PDF) that there is a finite chance that some cores will be substellar: cores normally too small to collapse are induced to do so when compressed by turbulence. So, rather than there being competition amongst core fragments (embryos), some cores simply begin with substellar masses.

A protostellar disk is supported by angular momentum. As a cloud of gas collpapses, the ratio of ratational energy to gravitational energy (E_{rot}/E_{grav}) goes up; the centrifugal support of structure becomes increasingly relevant (known as the "centrifugal barrier"). However, if the picture was this simple, stars probably would not form. What mechanisms transfer angular momentum from the core? The Toomre criterion [Toomre 1964] governs the stability of the centrifugally supported disk and suggests that disks self regulate via the balance between gravitational stress and viscous dissipation of angular momentum. Matzner & Levin [2005] suggested that protostellar disks should have a radius $\gtrsim$60 AU; beyond which the disk fragments. This provides an appealing explanation of the brown dwarf desert and leads to cool fragments of a several Jupiter masses. Whitworth & Stamatellos

[2006] produced results similar to Matzner & Levin [2005]; however, they suggest that the protostellar disk is actually heated by stellar radiation as opposed to mechanical heating due to viscous interactions. They also suggest a larger radius for primary[17] fragmentation, pegging it at $\gtrsim$100 AU. They conclude that fragments forming closer in grow from 1-3 M_{Jup} to 0.2-0.3 $M_{\odot}$ as they migrate closer. Fragments forming beyond this radius will also migrate inward, but they undergo higher order interactions that cause them to be tossed back; thus, depriving them of a reservoir of material to grow from and keeping brown dwarfs clear of the central star. However, the work of Matzner & Levin [2005], Offner et al. [2009], and Bate [2009] suggested that radiation substantially reduces fragmentation of self-gravitation disks. Matzner & Levin [2005] concluded that it may even entirely prevent brown dwarf formation by disk fragmentation. Further complicating the picture, Vorobyov & Basu [2006] suggested that accretion may not be continuous, but rather occur in bursts: in this way, brown dwarf formation by disk fragmentation may be possible between bursts.

There are key observational differences between the ejection scenario and the turbulence scenario in brown dwarf formation [Mohanty & Jayawardhana 2006]. As a protostar becomes a star, the dust around will either rain down on it; produce planets, moons, asteroids, and planets; or be blown away by the stellar wind. If the turbulence scenario is correct, young brown dwarfs should have disks and possibly planets; however, the ejection scenario predicts that circumstellar disks should all be but stripped away. The turbulence scenario also predicts that brown dwarf binaries should have a frequency on par with stars;

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[17] Fragmentation due to efficient radiative cooling.

on the other hand, the ejection scenario predicts that widely separated binary brown dwarfs should be rare or non-existent.

CHAPTER 2

THE PROJECT

2.1 Gliese, Jahreiß, and Woolley revisited

The astrometric parameters (coordinates, proper motion, and parallax) of nearby stellar systems are known to greater precision than systems further afield; however, the proximity of these systems can be double-edged. While it is easier to determine these parameters for nearby systems, their high proper motions yield a paradoxical inaccuracy in positional data in spite of their relevance to understanding stellar evolution[1]. Stauffer et al. [2010] began the task of updating the *Third Catalog of Nearby Stars* or *GJ91* [Gliese & Jahreiß 1991] by cross-checking Gliese sources with Hipparcos[2] and 2MASS[3] positions; factoring in proper motions from the literature; and making full use of Gliese 1957 (*Gl57*), Gliese 1969 (*Gl69*), Woolley et al. 1970 (*Wo70*), and Gliese & Jahreiß 1979 (*GJ79*). Hereafter, all such catalog components will be referred to as "Gliese objects", employing designations with the "GJ" acronym as per convention.

The *GJ57* catalog was limited to stars thought to be within 20 pc of the Sun as of 1957 and is composed of 915 single and double stars with a total of 1094 components. The *Gl69* catalog was pushed out to 22.2 pc and is composed of 1529 single and multiple stars

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[1] See Reffert [2009] for more on this and a summary of astrometric techniques.

[2] High precision parallax collecting satellite: first space-based telescope dedicated to astrometry, operating between 1989 and 1993.

[3] Two Micron All-Sky Survey: an infrared survey of the entire sky conducted between 1997 and 2001.

with a total of 1890 components. The *Wo70* (the "9000" series) catalog was intended as an extension to the work of Gliese and Jahreiß. The *GJ79* catalog is a supplemental catalog composed of two lists: the first contains 294 new stars within ≥45 mas (GJ 1001 through GJ 1294 B) and the second list contains 159 stars of uncertain distance (GJ 2001 through GJ 2159). The parallax limit for the *GJ91* catalog was decreased to 39 mas. A total of 3803 stars includes most stars from earlier supplementals and 1388 new stars (GJ 3001 through GJ 4388).

Stauffer et al. [2010] were motivated by the need for accurate compilations of nearby stellar systems. In order to facilitate access to the wealth of data amassed over the 20 years since the release of *GJ91*, they sought to revise the position and photometric data and to correct any inaccuracies in the catalog. All stars in the catalog have integer second precision in right ascension and 455 stars have only arcminute precision in declination. In the end, they were able to provide JHK$_s$ photometry, accurate J2000, epoch 2000 coordinates and 2MASS cross-identifications where possible for 4251 Gliese objects[4]: 2693 based on Hipparcos positions, 1549 based on 2MASS data, and 9 from other sources.

2.2 Ultracool Companions to GJ and Other Nearby Stars

This work focuses on the tabular compilation and analysis of data pertaining to brown dwarfs within 25 pc (40 mas), though the inability to distinguish most ultracool stars in the field from brown dwarfs in the field forces the inclusion of systems without known substellar objects. This problem, however, is the primary motivation of this work. The

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[4] Includes most unique stars from *Gl69*, *GJ79*, *Wo70*. Eleven were excluded: two QSOs, two likely do not exist, four optical companions, one plate flaw, and two unrecovered.

mystery of substellar and very low mass object formation and evolution can be addressed by constructing a clear picture of our current understanding of the local volume: multiple systems allow for the determination of an object's true mass by application of Kepler's laws [Kepler 1609], which in turn places constraints on theory by breaking the mass-age-luminosity degeneracy [Burgasser 2009], which in turn clarifies our understanding of field objects, which in turn puts the Big Picture into finer focus.

In general, Stauffer et al. [2010] did not include new companions (stellar or otherwise) to Gliese objects discovered since the publication of *GJ91*. For example, GJ 229 B, one of the first confirmed brown dwarfs [Nakajima et al. 1995], was excluded. This compilation accounts for systems within 25 pc consisting of at least one ultracool dwarf component (including lone ultracool dwarfs in the field): these objects have a spectral type ≥M6. "Ultracool dwarf" serves as a convenient basket term for either a brown dwarf or a very low mass star, necessitated by the ambiguous natures of these objects vis-à-vis mass-age-luminosity degeneracy. For all systems within 25 pc with one or more ultracool dwarfs, I set out to compile relevant observable and derivable parameters: designations, coordinates, parallaxes, spectral types, photometry, masses, separations, periods, and multiplicity (see Table 2.1, Table 2.2, Table 2.3, Table 2.4, and Table 2.5).

Although the Gliese catalogs were to include only objects within 25.64 pc, the reality is that some Gliese objects lie beyond this distance. In spite of this, I included the ultracool companions to distant *GJ* objects discovered over the intervening years so that this work could serve as a useful companion to Stauffer et al. [2010]. I was also careful to fold in data on nearby systems[5] from other catalogs with ultracool dwarfs. This work accounts for 576 objects comprising 464 systems. The 576 objects are classified as ultracool dwarfs, stars with spectral types earlier[6] than M6, or white dwarfs. The 511 ultracool dwarfs are composed of 248 brown dwarfs, 22 brown dwarf candidates, 12 ultracool dwarf stars, and 229 that are unspecified. While all[7] 511 of the ultracool dwarfs in my compilation are classified as such on the basis of their spectral type (≥M6) and luminosity (class V), 12 are either field objects (377), making direct measurement of their true mass impossible, otherwise do not have a mass associated with them, or I was simply not able to recover one from the literature. I accounted for 21 solar type stars; that is, stars with spectral types falling between F6 and K3 [Raghavan et al. 2010]. A further explanation of these statistics and others can be found in section 3.2 and a statistical summary can be found in Table 2.6.

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[5] This includes single ultracool field dwarfs and binary ultracool field dwarf systems.

[6] The descriptors "earlier" and "later" when referring to the spectral type are historical. At the time, it was believed that a star's temperature was purely due to Kelvin-Helmoltz contraction; nuclear fusion was unknown. However, a brown dwarf's temperature *is* due to this contraction.

[7] GJ 4052 C is the one exception presented here. It's mass was inferred astrometrically from the primary GJ 4052 A [Reffert & Quirrenbach 2011]

Table 2.1 Objects Comprising Nearby Ultracool Systems

Line	Address	Primary Name	Secondary Name	Tertiary Name
1	CRAT001::1.0.0.0	2MASS J00001354+2554180	SDSS J000013.54+255418.6	⋯
2	CRAT002::1.1.0.0	GJ 1001 A	LHS 102 A	WDS J00046-4044 A
3	CRAT002::1.2.1.0	GJ 1001 B	LHS 102 Ba	WDS J00046-4044 Ba
4	CRAT002::1.2.2.0	GJ 1001 C	LHS 102 Bb	WDS J00046-4044 Bb
5	CRAT003::1.0.0.0	WISE J000517.48+373720.5	⋯	⋯
6	CRAT004::1.0.0.0	2MASS J00113182+5908400	LSR J0011+5908	GAT 1367
7	CRAT005::1.0.0.0	2MASS J00134659-0457371	LHS 1042	LP 644-1
8	CRAT006::1.0.0.0	WISE J001505.87-461517.6	⋯	⋯
9	CRAT007::1.0.0.0	2MASS J00192626+4614078	2MUCD 10013	⋯
10	CRAT008::1.0.0.0	2MASS J00194579+5213179	2MUCD 10014	⋯
11	CRAT009::1.0.0.0	2MASS J00242463-0158201	2MUCD 10018	DY Piscium
12	CRAT010::1.1.0.0	GJ 2005 A	LHS 1070 A	WDS J00247-2653 A
13	CRAT010::1.2.1.0	GJ 2005 B	LHS 1070 B	WDS J00247-2653 B
14	CRAT010::1.2.2.0	GJ 2005 C	LHS 1070 C	WDS J00247-2653 C
15	CRAT011::1.1.0.0	2MASS J00275592+2219328 A	WDS J00279+2220 A	LP 349-25 A
16	CRAT011::1.2.0.0	2MASS J00275592+2219328 B	WDS J00279+2220 B	LP 349-25 B
17	CRAT012::1.0.0.0	WISE J003231.09-494651.4	⋯	⋯
18	CRAT013::1.0.0.0	2MASS J00325584-4405058	⋯	⋯
19	CRAT014::1.0.0.0	ULAS J003402.77-005206.7	CFBDS J003402.77-005206.7	⋯
20	CRAT015::1.0.0.0	2MASS J00345157+0523050	⋯	⋯
21	CRAT016::1.0.0.0	2MASS J00361617+1821104	2MUCD 20029	⋯
22	CRAT017::1.0.0.0	WISE J003829.05+275852.1	⋯	⋯
23	CRAT018::1.1.0.0	GJ 27 A	HD 3651 A	WDS J00394+2115 A
24	CRAT018::1.2.0.0	GJ 27 B	HD 3651 B	WDS J00394+2115 B
25	CRAT019::1.0.0.0	WISE J004024.88+090054.8	⋯	⋯
26	CRAT020::1.0.0.0	2MASS J00452143+1634446	2MUCD 20037	⋯
27	CRAT021::1.0.0.0	WISE J004945.61+215120.0	⋯	⋯
28	CRAT022::1.0.0.0	2MASS J00501994-3322402	⋯	⋯
29	CRAT023::1.0.0.0	2MASS J00525468-2705597	⋯	⋯
30	CRAT024::1.0.0.0	CFBDS J005910.90-011401.3	⋯	⋯
31	CRAT025::1.0.0.0	2MASS J01033203+1935361	⋯	⋯
32	CRAT026::1.0.0.0	2MASS J01075242+0041563	2MUCD 20052	⋯
33	CRAT027::1.0.0.0	2MASS J01090150-5100494	2MUCD 20053	DG Phoenicis
34	CRAT028::1.0.0.0	2MASS J01092170+2949255	2MUCD 20055	⋯
35	CRAT029::1.0.0.0	2MASS J01095117-0343264	2MUCD 10068	NLTT 3868
36	CRAT030::1.0.0.0	WISEP J012333.21+414203.9	⋯	⋯
37	CRAT031::1.0.0.0	CFBDS J013302+023128	⋯	⋯

Table 2.1 (continued)

Line	Address	Primary Name	Secondary Name	Tertiary Name
38	CRAT032::1.0.0.0	WISE J013525.64+171503.4	···	···
39	CRAT033::1.0.0.0	2MASS J01365662+0933473	SIMP J013656.5+093347.3	···
40	CRAT034::1.1.0.0	GJ 65 A	LHS 9	WDS J01388-1758 A
41	CRAT034::1.2.0.0	GJ 65 B	LHS 10	WDS J01388-1758 B
42	CRAT035::1.0.0.0	2MASS J01400263+2701505	LSPM J0140+2701	···
43	CRAT036::1.0.0.0	2MASS J01410321+1804502	···	···
44	CRAT037::1.0.0.0	2MASS J01443536-0716142	2MUCD 10088	···
45	CRAT038::1.0.0.0	WISE J014656.66+423410.0	···	···
46	CRAT039::1.0.0.0	WISEP J014807.25-720258.8	···	···
47	CRAT040::1.0.0.0	2MASS J01483864-3024396	2MUCD 10091	···
48	CRAT041::1.0.0.0	2MASS J01490895+2956131	···	···
49	CRAT042::1.0.0.0	ULAS J015024.37+135924.0	···	···
50	CRAT043::1.0.0.0	2MASS J01514155+1244300	BF Arietis	···
51	CRAT044::1.0.0.0	GJ 3128	LHS 1326	2MASS J02021620+1020136
52	CRAT045::1.1.0.0	2MASS J02052940-1159296 A	WDS J02055-1159 A	···
53	CRAT045::1.2.0.0	2MASS J02052940-1159296 B	WDS J02055-1159 B	···
54	CRAT046::1.0.0.0	2MASS J02132880+4444453	2MUCD 10102	···
55	CRAT047::1.0.0.0	GJ 3146	LHS 1375	2MASS J02162977+1335136
56	CRAT048::1.1.0.0	GJ 1046 A	HIP 10812 A	2MASS J02191003-3646413 A
57	CRAT048::1.2.0.0	GJ 1046 B	HIP 10812 B	2MASS J02191003-3646413 B
58	CRAT049::1.0.0.0	WISEP J022105.94+384202.9	···	···
59	CRAT050::1.0.0.0	WISEP J022322.39-293258.1	···	···
60	CRAT051::1.0.0.0	GJ 3158	LHS 1407	2MASS J02280987+0310575
61	CRAT052::1.1.0.0	GJ 1048 A	HD 16270 A	2MASS J02360075-2331167
62	CRAT052::1.2.0.0	GJ 1048 B	HD 16270 B	2MASS J02355993-2331205
63	CRAT053::1.1.1.0	GJ 105 Aa	Zkh 43	WDS J02361+0653 A
64	CRAT053::1.1.2.0	GJ 105 Ab	Zkh 45	WDS J02361+0653 C
65	CRAT053::1.2.0.0	GJ 105 B	Zkh 44	WDS J02361+0653 B
66	CRAT054::1.0.0.0	WISE J024124.73-365328.0	···	···
67	CRAT055::1.0.0.0	2MASS J02431371-2453298	···	···
68	CRAT056::1.0.0.0	WISE J024512.62-345047.8	···	···
69	CRAT057::1.0.0.0	GJ 3180	LHS 17	2MASS J02461477-0459182
70	CRAT058::1.0.0.0	GJ 3181	LHS 1443	2MASS J02463486+1625115
71	CRAT059::1.0.0.0	WISE J024714.52+372523.5	···	···
72	CRAT060::1.0.0.0	2MASS J02484100-1651216	2MUCD 10149	LP 771-21
73	CRAT061::1.0.0.0	2MASS J02511490-0352459	2MUCD 10151	···
74	CRAT062::1.0.0.0	2MASS J02530084+1652532	Teegarden's star	WISEP J025303.27+165214.2

Table 2.1 (continued)

Line	Address	Primary Name	Secondary Name	Tertiary Name
75	CRAT063::1.2.0.0	WISEP J025409.45+022359.1	2MASS J02540788+0223563	···
76	CRAT064::1.0.0.0	2MASS J02550357-4700509	2MUCD 10158	···
77	CRAT065::1.0.0.0	WISEP J031325.96+780744.2	···	···
78	CRAT066::1.0.0.0	2MASS J03140344+1603056	2MUCD 20156	···
79	CRAT067::1.0.0.0	GJ 3208	LHS 1516	2MASS J03141241+2840411
80	CRAT068::1.0.0.0	2MASS J03185403-3421292	2MUCD 10176	WISEP J031854.37-342128.7
81	CRAT069::1.0.0.0	2MASS J03205965+1854233	2MUCD 10179	NLTT 10644
82	CRAT070::1.0.0.0	WISEP J032337.53-602554.9	···	···
83	CRAT071::1.0.0.0	WISE J032517.69-385454.1	···	···
84	CRAT072::1.0.0.0	WISE J032547.72+083118.2	···	···
85	CRAT073::1.0.0.0	2MASS J03255322+0425406	SDSS J032553.17+042540.1	···
86	CRAT074::1.0.0.0	2MASS J03313025-3042383	2MUCD 10186	NLTT 11163
87	CRAT075::1.0.0.0	2MASS J03341218-4953322	LEHPM 3396	···
88	CRAT076::1.0.0.0	2MASS J03350208+2342356	···	···
89	CRAT077::1.0.0.0	WISE J033515.01+431045.1	···	···
90	CRAT078::1.0.0.0	WISE J033605.05-014350.4	···	···
91	CRAT079::1.0.0.0	2MASS J03393521-3525440	2MUCD 10201	LP 944-20
92	CRAT080::1.0.0.0	2MASS J03480772-6022270	···	···
93	CRAT081::1.1.0.0	WISE J035000.32-565830.2	···	···
94	CRAT082::1.0.0.0	2MASS J03505737+1818069	LP 413-53	NLTT 11980
95	CRAT083::1.0.0.0	GJ 3252	LHS 1604	2MASS J03510004-0052452
96	CRAT084::1.0.0.0	WISE J035934.06-540154.6	···	···
97	CRAT085::1.0.0.0	WISE J041022.71+150248.4	WISEP J041022.71+150248.5	···
98	CRAT086::1.1.0.0	GJ 164 A	LHS 1642 A	WDS J04130+5237 A
99	CRAT086::1.2.0.0	GJ 164 B	LHS 1642 B	WDS J04130+5237 B
100	CRAT087::1.0.0.0	WISE J041358.14-475039.3	···	···
101	CRAT088::1.0.0.0	2MASS J04151954-0935066	···	···
102	CRAT089::1.0.0.0	2MASS J04173745-0800007	2MUCD 10261	···
103	CRAT090::1.0.0.0	GJ 3276	LP 415-1446	2MASS J04221413+1530525
104	CRAT091::1.1.0.0	2MASS J04234858-0414035 A	WDS J04238-0414 A	···
105	CRAT091::1.2.0.0	2MASS J04234858-0414035 B	WDS J04238-0414 B	···
106	CRAT092::1.0.0.0	GJ 3289	LHS 191	2MASS J04261992+0336359
107	CRAT093::1.1.0.0	2MASS J04291842-3123568 A	WDS J04293-3124 A	···
108	CRAT093::1.2.0.0	2MASS J04291842-3123568 B	WDS J04293-3124 B	···
109	CRAT094::1.0.0.0	2MASS J04351612-1606574	2MUCD 10302	NLTT 13580
110	CRAT095::1.0.0.0	2MASS J04390101-2353083	2MUCD 10312	···
111	CRAT096::1.0.0.0	2MASS J04402325-0530082	2MUCD 10316	NLTT 13728

Table 2.1 (continued)

Line	Address	Primary Name	Secondary Name	Tertiary Name
112	CRAT097::1.0.0.0	2MASS J04433761+0002051	2MUCD 10320	···
113	CRAT098::1.0.0.0	2MASS J04455387-3048204	2MUCD 10329	···
114	CRAT099::1.0.0.0	GJ 3311	LHS 197	2MASS J04461849+4844518
115	CRAT100::1.1.0.0	WISEP J045853.89+643452.9 A	···	···
116	CRAT100::1.2.0.0	WISEP J045853.89+643452.9 B	···	···
117	CRAT101::1.0.0.0	WISEP J050003.05-122343.2	···	···
118	CRAT102::1.0.0.0	2MASS J05012406-0010452	2MUCD 20198	···
119	CRAT103::1.0.0.0	2MASS J05102012+2714032	LSPM J0510+2714	···
120	CRAT104::1.0.0.0	WISEP J051317.28+060814.7	···	···
121	CRAT105::1.0.0.0	2MASS J05153094+5911184	LSPM J0515+5911	···
122	CRAT106::1.0.0.0	2MASS J05160945-0445499	···	···
123	CRAT107::1.0.0.0	2MASS J05173766-3349027	2MUCD 10380	···
124	CRAT108::1.0.0.0	2MASS J05181131-3101529	···	···
125	CRAT109::1.1.0.0	2MASS J05185995-2828372 A	WDS J05190-2829 A	···
126	CRAT109::1.2.0.0	2MASS J05185995-2828372 B	WDS J05190-2829 B	···
127	CRAT110::1.0.0.0	2MASS J05233822-1403022	2MUCD 10390	···
128	CRAT111::1.0.0.0	WISE J052844.51-330823.9	···	···
129	CRAT112::1.0.0.0	2MASS J05325346+8246465	···	···
130	CRAT113::1.0.0.0	WISE J053516.80-750024.9	···	···
131	CRAT114::1.0.0.0	GJ 3351	LHS 207	2MASS J05381265+7931186
132	CRAT115::1.0.0.0	2MASS J05395200-0059019	SDSS J053951.99-005902.0	···
133	CRAT116::1.0.0.0	WISE J054231.26-162829.1	···	···
134	CRAT117::1.0.0.0	2MASS J05441150-2433018	2MUCD 10444	···
135	CRAT118::1.0.0.0	2MASS J05591914-1404488	···	···
136	CRAT119::1.0.0.0	2MASS J06023045+3910592	2MUCD 50010	···
137	CRAT120::1.0.0.0	WISEP J060738.65+242953.4	2MASS J06073908+2429574	···
138	CRAT121::1.1.0.0	GJ 229 A	HD 42581 A	WDS J06106-2152 A
139	CRAT121::1.2.0.0	GJ 229 B	HD 42581 B	WDS J06106-2152 B
140	CRAT122::1.0.0.0	WISEP J061213.93-303612.7	···	···
141	CRAT123::1.0.0.0	WISEP J061407.49+391236.4	···	···
142	CRAT124::1.0.0.0	WISE J061437.73+095135.0	···	···
143	CRAT125::1.0.0.0	2MASS J06143818+3950357	···	···
144	CRAT126::1.0.0.0	WISE J062309.94-045624.6	···	···
145	CRAT127::1.0.0.0	2MASS J06244595-4521548	2MUCD 20244	···
146	CRAT128::1.0.0.0	WISEP J062542.21+564625.5	···	···
147	CRAT129::1.0.0.0	WISEP J062720.07-111428.8	···	···
148	CRAT130::1.1.0.0	GJ 234 A	LHS 1849 A	WDS J06293-0248 A

Table 2.1 (continued)

Line	Address	Primary Name	Secondary Name	Tertiary Name
149	CRAT130::1.2.0.0	GJ 234 B	LHS 1850 (B)	WDS J06293-0248 B
150	CRAT131::1.1.0.0	2MASS J06304661-7643094 A	WDS J06308-7643 A	SCR J0630-7643 A
151	CRAT131::1.2.0.0	2MASS J06304661-7643094 B	WDS J06308-7643 B	SCR J0630-7643 B
152	CRAT132::1.0.0.0	2MASS J06411840-4322329	SIPS J0641-4322	···
153	CRAT133::1.1.0.0	GJ 240.1 A	HD 46588 A	2MASS J06461411+7933542 A
154	CRAT133::1.2.0.0	GJ 240.1 B	HD 46588 B	2MASS J06462756+7935045 (B)
155	CRAT134::1.1.0.0	2MASS J06523073+4710348 A	2MUCD 10601 A	···
156	CRAT134::1.2.0.0	2MASS J06523073+4710348 B	2MUCD 10601 B	···
157	CRAT135::1.0.0.0	UGPS J072227.51-054031.2	···	···
158	CRAT136::1.1.0.0	2MASS J07003664+3157266 A	WDS J07006+3157 A	···
159	CRAT136::1.2.0.0	2MASS J07003664+3157266 B	WDS J07006+3157 B	···
160	CRAT137::1.0.0.0	2MASS J07075327-4900503	2MUCD 20258	···
161	CRAT138::1.1.0.0	GJ 268 A	QY Aurigae A	2MASS J07100180+3831457 A
162	CRAT138::1.2.0.0	GJ 268 B	QY Aurigae B	2MASS J07100180+3831457 B
163	CRAT139::1.1.0.0	2MASS J07111138+4329590 A	···	···
164	CRAT139::1.2.0.0	2MASS J07111138+4329590 B	···	···
165	CRAT140::1.0.0.0	WISE J071322.55-291751.9	···	···
166	CRAT141::1.0.0.0	WISE J072312.44+340313.5	···	···
167	CRAT142::1.0.0.0	2MASS J07271824+1710012	···	···
168	CRAT143::1.0.0.0	2MASS J07290002-3954043	···	···
169	CRAT144::1.0.0.0	GJ 3444	LHS 1923	2MASS J07320173+5755439
170	CRAT145::1.0.0.0	WISE J073347.94+754439.2	···	···
171	CRAT146::1.0.0.0	WISE J073444.02-715744.0	···	···
172	CRAT147::1.1.0.0	GJ 283 A	LHS 235	WD 0738-172
173	CRAT147::1.2.0.0	GJ 283 B	LHS 234	2MASS J07401922-1724449
174	CRAT148::1.0.0.0	2MASS J07410681+1738459	2MUCD 10666	LHS 1937
175	CRAT149::1.0.0.0	2MASS J07420130+2055198	SDSS J074201.41+205520.5	···
176	CRAT150::1.0.0.0	WISEP J074457.15+562821.8	···	···
177	CRAT151::1.1.0.0	2MASS J07464256+2000321 A	WDS J07467+2001 A	···
178	CRAT151::1.2.0.0	2MASS J07464256+2000321 B	WDS J07467+2001 B	···
179	CRAT152::1.0.0.0	WISEP J075003.84+272544.8	···	···
180	CRAT153::1.0.0.0	WISEP J075108.79-763449.6	···	···
181	CRAT154::1.0.0.0	2MASS J07522390+1612157	2MUCD 10673	NLTT 18549
182	CRAT155::1.1.0.0	GJ 293.2 A	HIP 38939 A	2MASS J07580434-2537356 A
183	CRAT155::1.2.0.0	GJ 293.2 B	HIP 38939 B	2MASS J07580434-2537356 B
184	CRAT156::1.0.0.0	WISE J075946.98-490454.0	···	···
185	CRAT157::1.1.0.0	2MASS J08053189+4812330 A	SDSS J080531.84+481233.0 A	···

Table 2.1 (continued)

Line	Address	Primary Name	Secondary Name	Tertiary Name
186	CRAT157::1.2.0.0	2MASS J08053189+4812330 B	SDSS J080531.84+481233.0 B	···
187	CRAT158::1.1.0.0	GJ 3483 A	WD 0806-661 A	2MASS J08065373-6618167 A
188	CRAT158::1.2.0.0	GJ 3483 B	···	2MASS J08065373-6618167 B
189	CRAT159::1.0.0.0	2MASS J08105865+1420390	2MUCD 10699	···
190	CRAT160::1.0.0.0	WISE J081117.81-805141.3	···	···
191	CRAT161::1.0.0.0	WISE J081220.04+402106.2	···	···
192	CRAT162::1.0.0.0	2MASS J08173001-6155158	···	···
193	CRAT163::1.0.0.0	2MASS J08185804+2333522	2MUCD 10710	···
194	CRAT164::1.0.0.0	2MASS J08251968+2115521	2MUCD 10721	WISEP J082519.24+211548.5
195	CRAT165::1.0.0.0	2MASS J08283419-1309198	V484 Hydrae	···
196	CRAT166::1.0.0.0	GJ 1111	G 51-15	2MASS J08294949+2646348
197	CRAT167::1.0.0.0	2MASS J08300825+4828482	2MUCD 20301	···
198	CRAT168::1.0.0.0	2MASS J08303256+0947153	2MUCD 20302	NLTT 19663
199	CRAT169::1.0.0.0	2MASS J08304878+0128311	SDSS J083048.80+012831.1	···
200	CRAT170::1.0.0.0	GJ 3504	LHS 2026	2MASS J08323047-0134380
201	CRAT171::1.0.0.0	2MASS J08354256-0819237	2MUCD 10742	V488 Hydrae
202	CRAT172::1.0.0.0	WISEP J083641.12-185947.2	···	···
203	CRAT173::1.0.0.0	2MASS J08380224-5855583	SCR J0838-5855	···
204	CRAT174::1.0.0.0	GJ 316.1	AZ Cancri	2MASS J08402975+1824091
205	CRAT175::1.0.0.0	2MASS J08472872-1532372	2MUCD 10764	···
206	CRAT176::1.0.0.0	GJ 3517	LHS 2065	2MASS J08533619-0329321
207	CRAT177::1.0.0.0	WISEP J085716.25+560407.6	···	···
208	CRAT178::1.1.0.0	GJ 1116 A	Zkh 123	WDS J08582+1945 A
209	CRAT178::1.2.0.0	GJ 1116 B	Zkh 124	WDS J08582+1945 B
210	CRAT179::1.0.0.0	2MASS J08592547-1949268	2MUCD 10789	···
211	CRAT180::1.0.0.0	2MASS J09002359+2150054	LHS 2090	NLTT 20726
212	CRAT181::1.0.0.0	ULAS J090116.23-030635.0	···	···
213	CRAT182::1.0.0.0	WISEP J090649.36+473538.6	···	···
214	CRAT183::1.0.0.0	2MASS J09095749-0658186	···	···
215	CRAT184::1.1.1.0	GJ 337 A	81 Cancri A	WDS J09123+1500 Aa
216	CRAT184::1.1.2.0	GJ 337 B	81 Cancri B	WDS J09123+1500 Ab
217	CRAT184::1.2.1.0	GJ 337 C	81 Cancri C	2MASS J09121469+1459396 A
218	CRAT184::1.2.2.0	GJ 337 D	81 Cancri D	2MASS J09121469+1459396 B
219	CRAT185::1.1.0.0	2MASS J09201223+3517429 A	WDS J09202+3518 A	···
220	CRAT185::1.2.0.0	2MASS J09201223+3517429 B	WDS J09202+3518 B	···
221	CRAT186::1.0.0.0	2MASS J09211410-2104446	2MUCD 20336	···
222	CRAT187::1.1.0.0	2MASS J09261537+5847212 A	SDSS J092615.38+584720.9 A	···

Table 2.1 (continued)

Line	Address	Primary Name	Secondary Name	Tertiary Name
223	CRAT187::1.2.0.0	2MASS J09261537+5847212 B	SDSS J092615.38+584720.9 B	···
224	CRAT188::1.0.0.0	WISE J092906.77+040957.9	···	···
225	CRAT189::1.0.0.0	2MASS J09293364+3429527	···	···
226	CRAT190::1.0.0.0	2MASS J09312228-1717425	LP 788-1	SIPS J0931-1717
227	CRAT191::1.0.0.0	2MASS J09373487+2931409	···	···
228	CRAT192::1.0.0.0	2MASS J09393548-2448279	···	···
229	CRAT193::1.0.0.0	2MASS J09490860-1545485	···	···
230	CRAT194::1.0.0.0	WISEP J095259.29+195507.3	···	···
231	CRAT195::1.0.0.0	2MASS J10043929-3335189	···	···
232	CRAT196::1.0.0.0	2MASS J10063197-1653266	2MUCD 10877	NLTT 23415
233	CRAT197::1.0.0.0	2MASS J10073369-4555147	···	···
234	CRAT198::1.0.0.0	2MASS J10101480-0406499	2MUCD 10880	···
235	CRAT199::1.0.0.0	2MASS J10163470+2751497	2MUCD 10892	NLTT 23865
236	CRAT200::1.0.0.0	ULAS J101721.40+011817.9	···	···
237	CRAT201::1.0.0.0	WISEP J101808.05-244557.7	···	···
238	CRAT202::1.0.0.0	WISEP J101905.63+652954.2	···	···
239	CRAT203::1.1.0.0	2MASS J10210969-0304197 A	WDS J10212-0304 A	···
240	CRAT203::1.2.0.0	2MASS J10210969-0304197 B	WDS J10212-0304 B	···
241	CRAT204::1.1.0.0	GJ 9326 A	HD 89744 A	2MASS J10221057+4113466 A
242	CRAT204::1.2.0.0	GJ 9326 B	HD 89744 B	2MASS J10221489+4114266 B
243	CRAT205::1.0.0.0	2MASS J10240997+1815533	2MUCD 10906	···
244	CRAT206::1.0.0.0	CFBDS J102841+565401	···	···
245	CRAT207::1.0.0.0	2MASS J10365305-3441380	2MUCD 20378	···
246	CRAT208::1.0.0.0	WISE J103907.73-160002.9	···	···
247	CRAT209::1.0.0.0	WISE J104245.23-384238.3	···	···
248	CRAT210::1.0.0.0	2MASS J10433508+1213149	SDSS J104335.08+121314.1	···
249	CRAT211::1.0.0.0	2MASS J10440942+0429376	SDSS J104409.43+042937.6	···
250	CRAT212::1.0.0.0	2MASS J10452400-0149576	2MUCD 10929	···
251	CRAT213::1.0.0.0	2MASS J10473109-1815574	···	···
252	CRAT214::1.0.0.0	2MASS J10475385+2124234	···	···
253	CRAT215::1.0.0.0	GJ 3622	LHS 292	2MASS J10481258-1120082
254	CRAT216::1.0.0.0	DENIS J104814.6-395606	···	···
255	CRAT217::1.0.0.0	2MASS J10484281+0111580	2MUCD 20387	···
256	CRAT218::1.0.0.0	GJ 3624	LHS 2314	2MASS J10490338+0502227
257	CRAT219::1.0.0.0	WISE J105130.01-213859.7	···	···
258	CRAT220::1.0.0.0	GJ 406	CN Leonis	2MASS J10562886+0700527
259	CRAT221::1.0.0.0	2MASS J10584787-1548172	2MUCD 10949	···

Table 2.1 (continued)

Line	Address	Primary Name	Secondary Name	Tertiary Name
260	CRAT222::1.1.0.0	GJ 412 A	LHS 38	2MASS J11052903+4331357
261	CRAT222::1.2.0.0	GJ 412 B	LHS 39	2MASS J11053133+4331170
262	CRAT223::1.0.0.0	2MASS J11061897+0428327	LHS 2351	NLTT 26292
263	CRAT224::1.0.0.0	2MASS J11101001+0116130	SDSS J111010.01+011613.1	···
264	CRAT225::1.1.0.0	GJ 417 A	MN Ursa Majoris A	2MASS J11123236+3548508
265	CRAT225::1.2.1.0	GJ 417 B	MN Ursa Majoris B	2MASS J11122567+3548131 A
266	CRAT225::1.2.2.0	GJ 417 C	MN Ursa Majoris C	2MASS J11122567+3548131 B
267	CRAT226::1.0.0.0	2MASS J11145133-2618235	···	···
268	CRAT227::1.1.1.0	GJ 423 Aa	53 Ursa Majoris Aa	ADS 8119 Aa
269	CRAT227::1.1.2.0	GJ 423 Ab	53 Ursa Majoris Ab	ADS 8119 Ab
270	CRAT227::1.2.1.0	GJ 423 Ba	53 Ursa Majoris Ba	ADS 8119 Ba
271	CRAT227::1.2.2.0	GJ 423 Bb	53 Ursa Majoris Bb	ADS 8119 Bb
272	CRAT227::1.3.0.0	GJ 423 C	53 Ursa Majoris C	WISE J111838.70+312537.9
273	CRAT228::1.1.0.0	GJ 3655 A	LHS 2397a A	2MASS J11214924-1313084 A
274	CRAT228::1.2.0.0	GJ 3655 B	LHS 2397a B	2MASS J11214924-1313084 B
275	CRAT229::1.0.0.0	WISEP J112254.73+255021.5	···	···
276	CRAT230::1.0.0.0	2MASS J11240487+3808054	2MUCD 10984	···
277	CRAT231::1.0.0.0	WISE J112438.12-042149.7	···	···
278	CRAT232::1.0.0.0	2MASS J11395113-3159214	2MUCD 20419	···
279	CRAT233::1.0.0.0	2MASS J11414406-2232156	2MUCD 11005	···
280	CRAT234::1.0.0.0	WISEP J115013.88+630240.7	···	···
281	CRAT235::1.0.0.0	GJ 3693	LHS 2471	2MASS J11535267+0659561
282	CRAT236::1.0.0.0	2MASS J11553952-3727350	2MUCD 20431	···
283	CRAT237::1.0.0.0	2MASS J11554286-2224586	LP 851-346	SIPS J1155-2224
284	CRAT238::1.0.0.0	2MASS J11555389+0559577	SDSS J115553.86+055957.5	···
285	CRAT239::1.0.0.0	SDSS J115700.50+061105.2	···	···
286	CRAT240::1.0.0.0	2MASS J12035812+0015500	2MUCD 20433	···
287	CRAT241::1.0.0.0	2MASS J12074717+0244249	SDSS J120747.17+024424.8	···
288	CRAT242::1.1.0.0	2MASS J12095613-1004008 A	···	···
289	CRAT242::1.2.0.0	2MASS J12095613-1004008 B	···	···
290	CRAT243::1.0.0.0	2MASS J12154430-3420594	···	···
291	CRAT244::1.0.0.0	2MASS J12171110-0311131	···	···
292	CRAT245::1.0.0.0	WISEP J121756.91+162640.2	···	···
293	CRAT246::1.0.0.0	2MASS J12212770+0257198	2MUCD 20444	···
294	CRAT247::1.0.0.0	2MASS J12245222-1238352	2MUCD 11068	···
295	CRAT248::1.1.0.0	2MASS J12255432-2739466 A	WDS J12259-2740 A	···
296	CRAT248::1.2.0.0	2MASS J12255432-2739466 B	WDS J12259-2740 B	···

Table 2.1 (continued)

Line	Address	Primary Name	Secondary Name	Tertiary Name
297	CRAT249::1.0.0.0	WISE J122558.86-101345.0	···	···
298	CRAT250::1.1.0.0	2MASS J12281523-1547342 A	DENIS 19 A	···
299	CRAT250::1.2.0.0	2MASS J12281523-1547342 B	DENIS 19 B	···
300	CRAT251::1.1.0.0	GJ 1159 A	LHS 331	2MASS J12291453+5332448
301	CRAT251::1.2.0.0	GJ 1159 B	LHS 330	2MASS J12291427+5333060
302	CRAT252::1.1.0.0	GJ 473 A	Wolf 424 A	WDS J12335+0901 A
303	CRAT252::1.2.0.0	GJ 473 B	Wolf 424 B	WDS J12335+0901 B
304	CRAT253::1.0.0.0	2MASS J12363959-1722170	DENIS J123639.6-172216	···
305	CRAT254::1.0.0.0	2MASS J12373919+6526148	SDSS J123738.88+652613.5	···
306	CRAT255::1.0.0.0	ULAS J123828.51+095351.3	···	···
307	CRAT256::1.1.0.0	2MASS J12392727+5515371 A	WDS J12395+5516 A	···
308	CRAT256::1.2.0.0	2MASS J12392727+5515371 B	WDS J12395+5516 B	···
309	CRAT257::1.0.0.0	2MASS J12465176+3148104	2MUCD 11095	LHS 2632
310	CRAT258::1.0.0.0	2MASS J12505265-2121136	SIPS J1250-2121	···
311	CRAT259::1.0.0.0	2MASS J12531240+4034038	2MUCD 11109	LHS 2645
312	CRAT260::1.0.0.0	2MASS J12545393-0122474	SDSS J125453.90-012247.5	···
313	CRAT261::1.0.0.0	2MASS J13004255+1912354	2MUCD 11115	···
314	CRAT262::1.1.1.0	GJ 494 A	Ross 458 A	WDS J13008+1223 A
315	CRAT262::1.1.2.0	GJ 494 B	Ross 458 B	WDS J13008+1223 B
316	CRAT262::1.2.0.0	GJ 494 C	Ross 458 C	SDSS J130041.93+122114.7
317	CRAT263::1.0.0.0	ULAS J130217.21+130851.2	···	···
318	CRAT264::1.1.0.0	2MASS J13054019-2541059 A	Kelu 1 A	···
319	CRAT264::1.2.0.0	2MASS J13054019-2541059 B	Kelu 1 B	···
320	CRAT265::1.0.0.0	2MASS J13092185-2330350	2MUCD 11127	···
321	CRAT266::1.0.0.0	WISEP J131106.24+012252.4	···	···
322	CRAT267::1.1.0.0	2MASS J13142039+1320011 A	NLTT 33370 A	···
323	CRAT267::1.2.0.0	2MASS J13142039+1320011 B	NLTT 33370 B	···
324	CRAT268::1.0.0.0	ULAS J131508.42+082627.4	···	···
325	CRAT269::1.0.0.0	WISE J131833.98-175826.5	···	···
326	CRAT270::1.0.0.0	WISEP J132004.16+603426.2	···	···
327	CRAT271::1.0.0.0	WISEP J132233.66-234017.1	···	···
328	CRAT272::1.0.0.0	2MASS J13262981-0038314	2MUCD 11143	···
329	CRAT273::1.0.0.0	2MASS J13322442-0441126	2MUCD 11153	···
330	CRAT274::1.1.0.0	WISEP J133553.41+113004.7	ULAS J133553.45+113005.2	···
331	CRAT275::1.0.0.0	2MASS J13464607-3149258	LP 911-56	SIPS J1346-3149
332	CRAT276::1.0.0.0	2MASS J13464634-0031501	···	···
333	CRAT277::1.1.0.0	2MASS J13480721-1344321 A	LHS 2803 A	NLTT 35266 A

Table 2.1 (continued)

Line	Address	Primary Name	Secondary Name	Tertiary Name
334	CRAT277::1.2.0.0	2MASS J13480721-1344321 B	LHS 2803 B	NLTT 35266 B
335	CRAT278::1.0.0.0	2MASS J13540876+0846083	LSPM J1354+0846	···
336	CRAT279::1.0.0.0	2MASS J13564148+4342587	2MUCD 11177	NLTT 35769
337	CRAT280::1.0.0.0	2MASS J13595510-4034582	···	···
338	CRAT281::1.0.0.0	2MASS J14032232+3007547	2MUCD 11188	···
339	CRAT282::1.1.0.0	2MASS J14044941-3159329 A	···	···
340	CRAT282::1.2.0.0	2MASS J14044941-3159329 B	···	···
341	CRAT283::1.0.0.0	WISE J140518.39+553421.3	WISEP J140518.40+553421.5	···
342	CRAT284::1.0.0.0	2MASS J14112131-2119503	2MUCD 11194	···
343	CRAT285::1.1.0.0	2MASS J14115998-4132211 A	WT 460 A	···
344	CRAT285::1.2.0.0	2MASS J14115998-4132211 B	WT 460 B	···
345	CRAT286::1.0.0.0	2MASS J14122449+1633115	2MUCD 20553	···
346	CRAT287::1.1.0.0	2MASS J14162408+1348263 A	WDS J14164+1348 A	···
347	CRAT287::1.2.0.0	ULAS J141623.94+134836.3 (B)	WDS J14164+1348 B	···
348	CRAT288::1.0.0.0	2MASS J14213145+1827407	2MUCD 20562	···
349	CRAT289::1.1.0.0	GJ 547 A	BD+01 2920 A	2MASS J14231528+0114294 A
350	CRAT289::1.2.0.0	GJ 547 B	BD+01 2920 B	WISEP J1423+0116 (B)
351	CRAT290::1.0.0.0	2MASS J14280419+1356137	LHS 2919	NLTT 37424
352	CRAT291::1.0.0.0	GJ 3849	LHS 2924	2MASS J14284323+3310391
353	CRAT292::1.0.0.0	GJ 3855	LHS 2930	2MASS J14303787+5943249
354	CRAT293::1.0.0.0	2MASS J14320849+0811313	LHS 2935	NLTT 37646
355	CRAT294::1.0.0.0	WISEP J143602.19-181421.8	···	···
356	CRAT295::1.0.0.0	2MASS J14380829+6408363	2MUCD 11224	···
357	CRAT296::1.0.0.0	2MASS J14392837+1929150	2MUCD 20581	···
358	CRAT297::1.1.1.0	GJ 551/559 A	GJ 559 A	α Centauri A
359	CRAT297::1.1.2.0	GJ 551/559 B	GJ 559 B	α Centauri B
360	CRAT297::1.2.0.0	GJ 551/559 C	GJ 551	Proxima Centauri
361	CRAT298::1.0.0.0	2MASS J14402293+1339230	2MUCD 11230	···
362	CRAT299::1.1.0.0	GJ 9492 A	G 239-25 A	WDS J14424+6603 A
363	CRAT299::1.2.0.0	GJ 9492 B	G 239-25 B	WDS J14424+6603 B
364	CRAT300::1.0.0.0	2MASS J14441717+3002145	LP 326-21	NLTT 38263
365	CRAT301::1.0.0.0	2MASS J14442067-2019222	SSSPM J1444-2019	···
366	CRAT302::1.0.0.0	SDSS J144600.60+002452.0	···	···
367	CRAT303::1.1.0.0	GJ 564 A	HP Bo´otes A	WDS J14503+2355 A
368	CRAT303::1.2.1.0	GJ 564 B	HP Bo´otes B	WDS J14503+2355 B
369	CRAT303::1.2.2.0	GJ 564 C	HP Bo´otes C	WDS J14503+2355 C
370	CRAT304::1.1.0.0	GJ 569 A	CE Bo´otes A	WDS J14545+1606 A

Table 2.1 (continued)

Line	Address	Primary Name	Secondary Name	Tertiary Name
371	CRAT304::1.2.1.0	GJ 569 Ba	CE Bo´otes Ba	WDS J14545+1606 Ba
372	CRAT304::1.2.2.0	GJ 569 Bb	CE Bo´otes Bb	WDS J14545+1606 Bb
373	CRAT305::1.0.0.0	GJ 3877	LHS 3003	2MASS J14563831-2809473
374	CRAT306::1.0.0.0	WISE J145715.03+581510.2	···	···
375	CRAT307::1.1.0.0	GJ 570 A	HD 131977 A	WDS J14575-2125 A
376	CRAT307::1.2.1.0	GJ 570 B	HD 131976 A	WDS J14575-2125 Ba
377	CRAT307::1.2.2.0	GJ 570 C	HD 131976 B	WDS J14575-2125 Bb
378	CRAT307::1.3.0.0	GJ 570 D	···	2MASS J14571496-2121477
379	CRAT308::1.0.0.0	2MASS J15010818+2250020	2MUCD 20596	···
380	CRAT309::1.0.0.0	2MASS J15031961+2525196	···	···
381	CRAT310::1.0.0.0	SDSS J150411.63+102718.4	···	···
382	CRAT311::1.1.0.0	GJ 576 A	HIP 73786 A	2MASS J15045350+0538169 A
383	CRAT311::1.2.0.0	GJ 576 B	HIP 73786 B	ULAS J150457.65+053800.8
384	CRAT312::1.2.0.0	WISEP J150649.97+702736.0	···	···
385	CRAT313::1.0.0.0	2MASS J15065441+1321060	2MUCD 11291	···
386	CRAT314::1.0.0.0	2MASS J15072779-2000431	2MUCD 11294	···
387	CRAT315::1.0.0.0	2MASS J15074769-1627386	2MUCD 11296	···
388	CRAT316::1.0.0.0	2MASS J15101685-0241078	2MUCD 20602	···
389	CRAT317::1.0.0.0	2MASS J15111466+0607431	SDSS J151114.66+060742.9	···
390	CRAT318::1.0.0.0	2MASS J15150083+4847416	2MUCD 11314	···
391	CRAT319::1.0.0.0	2MASS J15164073+3910486	LP 222-65	NLTT 39784
392	CRAT320::1.0.0.0	WISE J151721.13+052929.3	···	···
393	CRAT321::1.0.0.0	WISEP J151906.64+700931.5	···	···
394	CRAT322::1.0.0.0	2MASS J15210103+5053230	2MUCD 11323	NLTT 40026
395	CRAT323::1.0.0.0	2MASS J15210327+0131426	SDSS J152103.24+013142.7	···
396	CRAT324::1.1.1.0	GJ 584 A	η Coronae Borealis A	WDS J15232+3017 A
397	CRAT324::1.1.2.0	GJ 584 B	η Coronae Borealis B	WDS J15232+3017 B
398	CRAT324::1.2.0.0	GJ 584 C	η Coronae Borealis C	2MASS J15232263+3014562
399	CRAT325::1.0.0.0	2MASS J15261405+2043414	···	···
400	CRAT326::1.1.0.0	2MASS J15344984-2952274 A	WDS J15348-2952 A	···
401	CRAT326::1.2.0.0	2MASS J15344984-2952274 B	WDS J15348-2952 B	···
402	CRAT327::1.0.0.0	2MASS J15345704-1418486	2MUCD 11346	···
403	CRAT328::1.0.0.0	2MASS J15394189-0520428	2MUCD 20625	···
404	CRAT329::1.0.0.0	WISE J154151.65225024.9	WISEP J154151.66-225025.2	···
405	CRAT330::1.0.0.0	WISE J154214.00+223005.2	···	···
406	CRAT331::1.0.0.0	WISE J154459.27+584204.5	···	···
407	CRAT332::1.0.0.0	2MASS J15460540+3749458	2MUCD 11439	BO Corona Borealis

Table 2.1 (continued)

Line	Address	Primary Name	Secondary Name	Tertiary Name
408	CRAT333::1.0.0.0	2MASS J15462718-3325111	···	···
409	CRAT334::1.0.0.0	2MASS J15524460-2623134	LHS 5303	DENIS J155244.6-262313
410	CRAT335::1.1.0.0	2MASS J15530228+1532369 A	···	···
411	CRAT335::1.2.0.0	2MASS J15530228+1532369 B	···	···
412	CRAT336::1.0.0.0	2MASS J15551573-0956055	···	···
413	CRAT337::1.0.0.0	2MASS J16063390+4054216	LHS 3154	NLTT 42028
414	CRAT338::1.0.0.0	WISEP J161215.94-342027.1	···	···
415	CRAT339::1.0.0.0	2MASS J16142520-0251009	LP 624-54	SIPS J1614-0251
416	CRAT340::1.0.0.0	WISEP J161441.45+173936.7	···	···
417	CRAT341::1.0.0.0	2MASS J16150413+1340079	···	···
418	CRAT342::1.0.0.0	2MASS J16154416+3559005	···	···
419	CRAT343::1.0.0.0	WISEP J161705.75+180714.3	···	···
420	CRAT344::1.1.0.0	GJ 618.1 A	LTT 6518	WDS J16204-0416 A
421	CRAT344::1.2.0.0	GJ 618.1 B	2MUCD 20665	WDS J16204-0416 B
422	CRAT345::1.0.0.0	WISEP J162208.94-095934.6	···	···
423	CRAT346::1.0.0.0	2MASS J16241436+0029158	···	···
424	CRAT347::1.0.0.0	WISEP J162725.64+325525.5	···	···
425	CRAT348::1.0.0.0	2MASS J16272794+8105075	2MUCD 11595	···
426	CRAT349::1.0.0.0	SDSS J162838.77+230821.1	···	···
427	CRAT350::1.0.0.0	2MASS J16302295+0818221	SDSS J163022.92+081822.0	···
428	CRAT351::1.0.0.0	2MASS J16322911+1904407	2MUCD 50006	WISEP J163229.39+190439.9
429	CRAT352::1.0.0.0	2MASS J16452211-1319516	···	···
430	CRAT353::1.0.0.0	2MASS J16463154+3434554	LHS 3241	NLTT 43550
431	CRAT354::1.0.0.0	WISE J164715.57+563208.3	···	···
432	CRAT355::1.0.0.0	WISEP J165311.05+444423.9	···	···
433	CRAT356::1.1.1.0	GJ 643/644 A	GJ 644 A	WDS J16555-0820 A
434	CRAT356::1.1.2.1	GJ 643/644 Ba	GJ 644 Ba	WDS J16555-0820 Ba
435	CRAT356::1.1.2.2	GJ 643/644 Bb	GJ 644 Bb	WDS J16555-0820 Bb
436	CRAT356::1.2.0.0	GJ 643/644 C	GJ 643 (C)	2MASS J16552527-0819207
437	CRAT356::1.3.0.0	GJ 643/644 D	GJ 644 C (D)	2MASS J16553529-0823401
438	CRAT357::1.0.0.0	2MASS J16580380+7027015	2MUCD 11668	···
439	CRAT358::1.0.0.0	2MASS J17054834-0516462	2MUCD 20699	···
440	CRAT359::1.0.0.0	2MASS J17071830+6439331	2MUCD 20700	···
441	CRAT360::1.1.0.0	2MASS J17072343-0558249 A	WDS J17074-0558 A	···
442	CRAT360::1.2.0.0	2MASS J17072343-0558249 B	WDS J17074-0558 B	···
443	CRAT361::1.0.0.0	WISE J171104.60+350036.8	···	···
444	CRAT362::1.1.0.0	2MASS J17114604+4029014 A	G 203-50 A	···

Table 2.1 (continued)

Line	Address	Primary Name	Secondary Name	Tertiary Name
445	CRAT362::1.2.0.0	2MASS J17114559+4028578 (B)	G 203-50 B	⋯
446	CRAT363::1.1.0.0	GJ 660.1 A	LHS 3271 A	2MASS J17125127-0507311 A
447	CRAT363::1.2.0.0	GJ 660.1 B	LHS 3271 B	2MASS J17125121-0507249 (B)
448	CRAT364::1.0.0.0	WISE J171717.02+612859.3	⋯	⋯
449	CRAT365::1.0.0.0	2MASS J17210390+3344160	2MUCD 11694	⋯
450	CRAT366::1.0.0.0	WISE J172134.46+111739.4	⋯	⋯
451	CRAT367::1.1.0.0	2MASS J17281150+3948593 A	⋯	⋯
452	CRAT367::1.2.0.0	2MASS J17281150+3948593 B	⋯	⋯
453	CRAT368::1.0.0.0	2MASS J17312974+2721233	2MUCD 20744	⋯
454	CRAT369::1.1.0.0	2MASS J17351296+2634475 A	2MUCD 20746 A	⋯
455	CRAT369::1.2.0.0	2MASS J17351296+2634475 B	2MUCD 20746 B	⋯
456	CRAT370::1.0.0.0	WISE J173835.53+273259.0	WISEP J173835.52+273258.9	⋯
457	CRAT371::1.0.0.0	WISEP J174124.26+255319.5	⋯	⋯
458	CRAT372::1.0.0.0	GJ 4029	LHS 3332	2MASS J17495948+2241069
459	CRAT373::1.0.0.0	2MASS J17502484-0016151	⋯	⋯
460	CRAT374::1.0.0.0	2MASS J17545447+1649196	⋯	⋯
461	CRAT375::1.0.0.0	GJ 4037	LHS 3339	2MASS J17553340+5824269
462	CRAT376::1.0.0.0	2MASS J17571539+7042011	2MUCD 11735	NLTT 45767
463	CRAT377::1.1.0.0	GJ 4040 A	G 204-39 A	2MASS J17575096+4635182 A
464	CRAT377::1.2.0.0	GJ 4040 B	G 204-39 B	2MASS J17580545+4633099 (B)
465	CRAT378::1.0.0.0	WISEP J180026.60+013453.1	2MASS J18002648+0134565	⋯
466	CRAT379::1.0.0.0	WISEP J180435.40+311706.1	⋯	⋯
467	CRAT380::1.0.0.0	2MASS J18071593+5015316	2MUCD 11756	⋯
468	CRAT381::1.0.0.0	WISE J180901.07+383805.4	⋯	⋯
469	CRAT382::1.0.0.0	WISE J181210.85+272144.3	⋯	⋯
470	CRAT383::1.1.0.0	GJ 4052 A	HD 168443 A	SPOCS 791
471	CRAT383::1.2.0.0	GJ 4052 C	HD 168443 C	⋯
472	CRAT384::1.0.0.0	WISE J182831.08+265037.7	⋯	⋯
473	CRAT385::1.0.0.0	2MASS J18283572-4849046	⋯	⋯
474	CRAT386::1.0.0.0	2MASS J18353790+3259545	2MUCD 11792	⋯
475	CRAT387::1.0.0.0	2MASS J18393308+2952164	LP 335-12	NLTT 46822
476	CRAT388::1.0.0.0	2MASS J18400238+7240540	LP 44-334	NLTT 46912
477	CRAT389::1.0.0.0	CE 507	⋯	⋯
478	CRAT390::1.0.0.0	GJ 4073	LHS 3406	2MASS J18432213+4040209
479	CRAT391::1.1.0.0	2MASS J18450541-6357475 A	SCR J1845-6357 A	⋯
480	CRAT391::1.2.0.0	2MASS J18450541-6357475 B	SCR J1845-6357 B	⋯
481	CRAT392::1.0.0.0	WISEP J185215.78+353716.3	⋯	⋯

Table 2.1 (continued)

Line	Address	Primary Name	Secondary Name	Tertiary Name
482	CRAT393::1.0.0.0	2MASS J18544597+8429470	···	···
483	CRAT394::1.0.0.0	WISEP J190624.75+450808.2	···	···
484	CRAT395::1.0.0.0	WISEP J190648.47+401106.8	···	···
485	CRAT396::1.1.0.0	GJ 748.1 A	HD 180777 A	2MASS J19090990+7633380 A
486	CRAT396::1.2.0.0	GJ 748.1 B	HD 180777 B	2MASS J19090990+7633380 B
487	CRAT397::1.1.0.0	GJ 752 A	HIP 94761 A	WDS J19169+0510 A
488	CRAT397::1.2.0.0	GJ 752 B	HIP 94761 B	WDS J19169+0510 B
489	CRAT398::1.1.0.0	GJ 758 A	HD 182488 A	2MASS J19233402+3313190 A
490	CRAT398::1.2.0.0	GJ 758 B	HD 182488 B	2MASS J19233402+3313190 B
491	CRAT399::1.0.0.0	WISE J192841.35+235604.9	···	···
492	CRAT400::1.0.0.0	2MASS J19360187-5502322	2MUCD 20823	SIPS J1936-5502
493	CRAT401::1.1.1.0	GJ 1245 Aa	V1581 Cygni Aa	WDS J19539+4425 Aa
494	CRAT401::1.1.2.0	GJ 1245 Ab	V1581 Cygni Ab	WDS J19539+4425 Ab
495	CRAT401::1.2.0.0	GJ 1245 B	LHS 3495	2MASS J19535508+4424550
496	CRAT402::1.0.0.0	WISEP J195905.66-333833.7	···	···
497	CRAT403::1.1.0.0	GJ 779 A	15 Sagittae A	WDS J20041+1704 A
498	CRAT403::1.2.0.0	GJ 779 B	15 Sagittae B	WDS J20041+1704 B
499	CRAT404::1.0.0.0	WISEP J201824.96-742325.9	···	···
500	CRAT405::1.0.0.0	WISE J201920.76-114807.6	···	···
501	CRAT406::1.1.0.0	GJ 791.2 A	Zkh 306	WDS J20298+0941 A
502	CRAT406::1.2.0.0	GJ 791.2 B	Zkh 307	WDS J20298+0941 B
503	CRAT407::1.0.0.0	2MASS J20370715-1137569	2MUCD 12027	···
504	CRAT408::1.1.1.0	GJ 802 Aa	···	WDS J20433+5521 Aa
505	CRAT408::1.1.2.0	GJ 802 Ab	···	WDS J20433+5521 Ab
506	CRAT408::1.2.0.0	GJ 802 B	···	WDS J20433+5521 B
507	CRAT409::1.0.0.0	SDSS J204749.61-071818.3	···	···
508	CRAT410::1.0.0.0	2MASS J20495272-1716083	LP 816-10	···
509	CRAT411::1.0.0.0	WISE J205628.91+145953.2	···	···
510	CRAT412::1.0.0.0	2MASS J20575409-0252302	2MUCD 12054	···
511	CRAT413::1.0.0.0	WISE J210200.15-442919.5	···	···
512	CRAT414::1.0.0.0	2MASS J21041491-1037369	2MUCD 12059	···
513	CRAT415::1.0.0.0	2MASS J21160629+2238462	LP 397-10	···
514	CRAT416::1.0.0.0	HB88 M18	PLX 5120.11	···
515	CRAT417::1.0.0.0	2MASS J21243234+4003599	LSPM J2124+4003	···
516	CRAT418::1.0.0.0	WISEP J213456.73-713743.6	···	···
517	CRAT419::1.1.0.0	GJ 836.7 A	HN Pegasi A	WDS J21445+1446 A
518	CRAT419::1.2.0.0	GJ 836.7 B	HN Pegasi B	WDS J21445+1446 B

Table 2.1 (continued)

Line	Address	Primary Name	Secondary Name	Tertiary Name
519	CRAT420::1.1.0.0	GJ 1263 A	Wolf 940 A	···
520	CRAT420::1.2.0.0	GJ 1263 B	Wolf 940 B	···
521	CRAT421::1.0.0.0	2MASS J21513839-4853542	···	···
522	CRAT422::1.0.0.0	2MASS J21543318+5942187	···	···
523	CRAT423::1.0.0.0	WISEP J215751.38+265931.4	···	···
524	CRAT424::1.0.0.0	2MASS J21583457+6117060	LSPM J2158+6117	···
525	CRAT425::1.1.0.0	GJ 845 A	ϵ Indi A	WDS J22034-5647 A
526	CRAT425::1.2.1.0	GJ 845 B	ϵ Indi Ba	WDS J22034-5647 Ba
527	CRAT425::1.2.2.0	GJ 845 C	ϵ Indi Bb	WDS J22034-5647 Bb
528	CRAT426::1.0.0.0	WISEP J220922.10-273439.5	···	···
529	CRAT427::1.0.0.0	WISEP J221354.69+091139.4	···	···
530	CRAT428::1.0.0.0	WISE J222055.31-362817.4	···	···
531	CRAT429::1.0.0.0	2MASS J22244381-0158521	2MUCD 12128	···
532	CRAT430::1.0.0.0	WISEP J222623.05+044003.9	···	···
533	CRAT431::1.0.0.0	2MASS J22282889-4310262	···	···
534	CRAT432::1.0.0.0	GJ 4281	LHS 523	2MASS J22285440-1325178
535	CRAT433::1.0.0.0	2MASS J22354905+1840298	LP 460-44	···
536	CRAT434::1.0.0.0	WISE J223720.39+722833.8	···	···
537	CRAT435::1.1.1.0	GJ 4287 Aa	G 216-7 Aa	2MASS J22372987+3922519 Aa
538	CRAT435::1.1.2.0	GJ 4287 Ab	G 216-7 Ab	2MASS J22372987+3922519 Ab
539	CRAT435::1.2.0.0	GJ 4287 B	G 216-7 B	2MASS J22373255+3922398 (B)
540	CRAT436::1.1.1.0	GJ 866 Aa	EZ Aquarii Aa	WDS J22385-1519 A
541	CRAT436::1.1.2.0	GJ 866 Ab	EZ Aquarii Ab	WDS J22385-1519 B
542	CRAT436::1.2.0.0	GJ 866 B	G 156-31 B	···
543	CRAT437::1.1.0.0	2MASS J22521073-1730134 A	WDS J22522-1730 A	···
544	CRAT437::1.2.0.0	2MASS J22521073-1730134 B	WDS J22522-1730 B	···
545	CRAT438::1.0.0.0	WISEP J225540.74-311841.8	···	···
546	CRAT439::1.0.0.0	WISE J230133.32+021635.1	···	···
547	CRAT440::1.0.0.0	2MASS J23062928-0502285	2MUCD 12171	···
548	CRAT441::1.0.0.0	WISEP J231336.40-803700.3	···	···
549	CRAT442::1.0.0.0	WISEP J231939.13-184404.3	···	···
550	CRAT443::1.0.0.0	ULAS J232123.79+135454.9	···	···
551	CRAT444::1.0.0.0	2MASS J23224684-3133231	···	···
552	CRAT445::1.0.0.0	WISEP J232519.54-410534.9	···	···
553	CRAT446::1.0.0.0	2MASS J23301612-4736459	APMPM J2330-4737	···
554	CRAT447::1.1.0.0	GJ 9829 A	Koenigstuhl 3 A	WDS J23315-0405 A
555	CRAT447::1.2.1.0	GJ 9829 B	Koenigstuhl 3 B	WDS J23315-0405 B

Table 2.1 (continued)

Line	Address	Primary Name	Secondary Name	Tertiary Name
556	CRAT447::1.2.2.0	GJ 9829 C	Koenigstuhl 3 C	WDS J23315-0405 C
557	CRAT448::1.0.0.0	2MASS J23312174-2749500	DENIS J233121.7-274949	···
558	CRAT449::1.0.0.0	WISE J233226.49-432510.6	···	···
559	CRAT450::1.0.0.0	2MASS J23373831-1250277	LP 763-3	NLTT 57439
560	CRAT451::1.0.0.0	WISEP J234026.62-074507.2	···	···
561	CRAT452::1.0.0.0	GJ 905	HH Andromedae	2MASS J23415498+4410407
562	CRAT453::1.0.0.0	WISE J234228.98+085620.2	···	···
563	CRAT454::1.0.0.0	WISEP J234351.20-741847.0	···	···
564	CRAT455::1.0.0.0	WISEP J234446.25+103415.8	···	···
565	CRAT456::1.0.0.0	WISEP J234841.10-102844.4	···	···
566	CRAT457::1.0.0.0	2MASS J23494899+1224386	2MUCD 12217	NLTT 58103
567	CRAT458::1.1.0.0	2MASS J23515044-2537367 A	2MUCD 12220 A	···
568	CRAT458::1.2.0.0	2MASS J23515044-2537367 B	2MUCD 12220 B	···
569	CRAT459::1.0.0.0	2MASS J23535946-0833311	2MUCD 12223	···
570	CRAT460::1.1.0.0	2MASS J23540109-3316242 A	WDS J23541-3317 A	···
571	CRAT460::1.2.1.0	2MASS J23540107-3316307 (B)	WD 2351-335	···
572	CRAT460::1.2.2.0	2MASS J23540928-3316266 (C)	APMPM J2354-3316 C	···
573	CRAT461::1.0.0.0	2MASS J23565477-1553111	···	···
574	CRAT462::1.0.0.0	WISE J235716.49+122741.8	···	···
575	CRAT463::1.0.0.0	2MASS J23584285-6245423	APMPM J2359-6246	···
576	CRAT464::1.0.0.0	WISEP J235941.07-733504.8	2MASS J23594034-7335055	···

Note. — GJ systems beyond 25 pc notwithstanding, this table includes all objects comprising ultracool systems within 25 pc. A secondary and tertiary name are provided for convenience. As well, the system address is provided to aid in visualization of the supposed configuration of the system in question. Lastly, the objects are ranked according to a two-level hierarchy: firstly by right ascension, then alphanumerically.

Table 2.2 Photometry

Line	Primary Name	Sp. Type	Ref.	V	Ref.	J	Ref.	H	Ref.	K	Ref.
1	2MA0000+2554	T4.5V	47	···	···	15.06(0.04)	35	14.73(0.07)	35	14.84(0.12)	35
2	GJ 1001 A	M3.5V	27	12.86(~)	66	8.601(0.021)	35	8.043(0.031)	35	7.737(0.040)	35
3	GJ 1001 B	L5.0±0.5V	44	···	···	(13.81(0.03))	44	(12.74(0.03))	44	12.10(0.04)	44
4	GJ 1001 C	L5.0±0.5V	44	···	···	(13.91(0.04))	44	(12.89(0.03))	44	12.20(0.04)	44
5	WIS0005+3737	T9.0V	103	···	···	···	···	···	···	···	···
6	2MA0011+5908	M6.5±0.5V	92	···	···	9.94(0.02)	35	9.39(0.03)	35	9.09(0.02)	35
7	2MA0013-0457	M6.0V	112	···	···	11.462(0.024)	35	10.866(0.022)	35	10.479(0.023)	35
8	WIS0015-4615	T8.0V	78	···	···	···	···	···	···	···	···
9	2MA0019+4614	M8.0V	7	···	···	12.603(0.021)	35	11.940(0.023)	35	11.502(0.014)	35
10	2MA0019+5213	M9.0V	7	···	···	12.792(0.023)	35	12.072(0.024)	35	11.622(0.019)	35
11	2MA0024-0158	M9.5V	112	···	···	11.992(0.035)	35	11.084(0.022)	35	10.539(0.023)	35
12	GJ 2005 A	M6.0V	112	15.35(0.04)	90	9.94(0.04)	44	9.34(0.04)	44	9.05(0.04)	44
13	GJ 2005 B	M8.5V	90	18.68(0.06)	90	10.59(0.04)	44	9.92(0.04)	44	(9.50(0.04))	44
14	GJ 2005 C	L0.0V	135	19.07(0.07)	90	10.92(0.04)	44	10.24(0.04)	44	(9.82(0.04))	44
15	2MA0027+2219A	M7.0±1V	44	···	···	(11.20(0.03))	44	(10.56(0.03))	44	10.17(0.02)	44
16	2MA0027+2219B	M8.0±1V	44	···	···	(11.56(0.03))	44	(10.91(0.03))	44	10.49(0.02)	44
17	WIS0032-4946	T8.5V	78	···	···	···	···	···	···	···	···
18	2MA0032-4405	L0.0Vγ	49	···	···	14.78(0.04)	35	13.86(0.03)	35	13.27(0.04)	35
19	ULA0034-0052	T8.5V	34	···	···	18.15(0.03)	155	18.49(0.04)	155	18.48(0.05)	155
20	2MA0034+0523	T6.5V	49	···	···	15.535(0.045)	35	15.443(0.082)	35	16.25	12
21	2MA0036+1821	L3.5V	38	···	···	12.466(0.027)	35	11.588(0.030)	35	11.058(0.021)	35
22	WIS0038+2758	T9.0V	78	···	···	···	···	···	···	···	···
23	GJ 27 A	K0.0V	152	5.88(~)	152	4.549(0.206)	35	4.064(0.240)	35	3.999(0.036)	35
24	GJ 27 B	T7.5±0.5V	101	···	···	16.16(0.03)	101	16.68(0.04)	101	16.87(0.05)	101
25	WIS0040+0900	T7.0V	78	···	···	16.502(0.123)	37	16.536(0.268)	37	15.738(~)	37
26	2MA0045+1634	L3.5V	7	···	···	13.059(0.022)	35	12.059(0.035)	35	11.366(0.021)	35
27	WIS0049+2151	T8.5V	103	···	···	···	···	···	···	···	···
28	2MA0050-3322	T7.0V	78	···	···	15.928(0.070)	35	15.838(0.191)	35	15.241(0.185)	35
29	2MA0052-2705	M8.0V	69	···	···	13.611(0.026)	35	12.984(0.032)	35	12.540(0.029)	35
30	CFB0059-0114	T8.5V	34	···	···	(18.34(0.03))	44	(18.20(0.05))	44	18.63(5)	44
31	2MA0103+1935	L6.0Vβ	49	···	···	16.288(0.080)	35	14.897(0.056)	35	14.149(0.059)	35
32	2MA0107+0041	L5.5V	154	···	···	15.824(0.058)	35	14.512(0.039)	35	13.71(0.04)	35
33	2MA0109-5100	L2.0V	15	···	···	12.228(0.024)	35	11.538(0.024)	35	11.092(0.024)	35
34	2MA0109+2949	M9.5V	119	···	···	12.912(0.021)	35	12.158(0.024)	35	11.681(0.020)	35
35	2MA0109-0343	M9.0V	7	···	···	11.694(0.021)	35	10.931(0.026)	35	10.428(0.025)	35
36	WIS0123+4142	T7.0V	78	···	···	···	···	···	···	···	···
37	CFB0133+0231	T8.5V	78	···	···	···	···	···	···	···	···

Table 2.2 (continued)

Line	Primary Name	Sp. Type	Ref.	V	Ref.	J	Ref.	H	Ref.	K	Ref.
38	WIS0135+1715	T6.0V	78	···	···	···	···	···	···	···	···
39	2MA0136+0933	T2.5V	3	···	···	13.46(0.03)	35	12.77(0.03)	35	12.562(0.024)	35
40	GJ 65 A	M5.5V	69	12.57(∼)	69	···	···	···	···	···	···
41	GJ 65 B	M6.0V	69	11.99(∼)	129	6.283(0.019)	35	5.690(0.029)	35	5.343(0.021)	35
42	2MA0140+2701	M8.5V	119	···	···	12.49(∼)	35	11.82(∼)	35	11.43(∼)	35
43	2MA0141+1804	L4.5V	7	···	···	13.875(0.025)	35	13.034(0.026)	35	12.492(0.028)	35
44	2MA0144-0716	L5.0V	7	···	···	14.191(0.026)	35	13.008(0.029)	35	12.268(0.023)	35
45	WIS0146+4234	Y0.0V	78	···	···	19.40(0.25)	78	18.71(0.24)	78	···	···
46	WIS0148-7202	T9.5V	34	···	···	18.96(0.07)	77	19.22(0.04)	77	···	···
47	2MA0148-3024	M7.5V	7	···	···	12.302(0.024)	35	11.648(0.022)	35	11.227(0.024)	35
48	2MA0149+2956	M9.5V	74	···	···	13.449(0.023)	35	12.584(0.026)	35	11.975(0.022)	35
49	ULA0150+1359	T7.5V	78	···	···	17.73(0.02)	25	18.11(0.02)	25	17.84(0.16)	25
50	2MA0151+1244	T1.0V	154	···	···	16.57(0.13)	35	15.60(0.11)	35	15.18(0.19)	35
51	GJ 3128	M6.0V	69	15.61(∼)	150	9.842(0.023)	35	9.254(0.025)	35	8.928(0.025)	35
52	2MA0205-1159A	L6.0V	130	···	···	14.587(0.030)	35	13.568(0.037)	35	12.998(0.030)	35
53	2MA0205-1159B	L6.0V	130	···	···	(A+B)	···	(A+B)	···	(A+B)	···
54	2MA0213+4444	L1.5V	7	···	···	13.494(0.025)	35	12.757(0.024)	35	12.213(0.023)	35
55	GJ 3146	M6.0V	124	15.79(∼)	129	9.871(0.021)	35	9.314(0.022)	35	8.981(0.017)	35
56	GJ 1046 A	M2.5V	61	11.62(∼)	82	7.924(0.032)	35	7.317(0.063)	35	7.031(0.02)	35
57	GJ 1046 B	···	···	···	···	(A+B)	···	(A+B)	···	(A+B)	···
58	WIS0221+3842	T6.5V	78	···	···	···	···	···	···	···	···
59	WIS0223-2932	T7.5V	78	···	···	···	···	···	···	···	···
60	GJ 3158	M6.0V	126	17.54(∼)	150	11.670(0.024)	35	11.122(0.022)	35	10.788(0.023)	35
61	GJ 1048 A	K3.5Vk	61	8.328(∼)	79	6.45(0.018)	35	5.965(0.04)	35	5.828(0.018)	35
62	GJ 1048 B	L1.0V	112	···	···	13.67(0.15)	56	12.725(0.202)	35	12.186(0.081)	35
63	GJ 105 Aa	K3.0V	61	5.83(0.05)	152	4.15(∼)	35	3.66(∼)	35	3.52(0.05)	152
64	GJ 105 Ab	M7.0V	59	(Aa+Ab)	···	(Aa+Ab)	···	(Aa+Ab)	···	(Aa+Ab)	···
65	GJ 105 B	M4.5V	69	11.66(∼)	69	7.333(0.018)	35	6.793(0.038)	35	6.574(0.020)	35
66	WIS0241-3653	T7.0V	78	···	···	···	···	···	···	···	···
67	2MA0243-2453	T6.0V	154	···	···	15.38(0.05)	35	15.137(0.109)	35	15.216(0.168)	35
68	WIS0245-3450	T8.0V	78	···	···	···	···	···	···	···	···
69	GJ 3180	M6.0V	62	16.22(∼)	150	10.970(0.024)	35	10.499(0.027)	35	10.152(0.019)	35
70	GJ 3181	M6.0V	69	16.93(∼)	150	10.971(0.020)	35	10.519(0.028)	35	10.185(0.020)	35
71	WIS0247+3725	T8.0V	78	···	···	···	···	···	···	···	···
72	2MA0248-1651	M8.0V	112	···	···	12.551(0.022)	35	11.872(0.022)	35	11.422(0.021)	35
73	2MA0251-0352	L3.0V	7	···	···	13.059(0.027)	35	12.254(0.024)	35	11.662(0.019)	35
74	2MA0253+1652	M6.5V	66	···	···	8.394(0.027)	35	7.883(0.04)	35	7.585(0.046)	35

Table 2.2 (continued)

Line	Primary Name	Sp. Type	Ref.	V	Ref.	J	Ref.	H	Ref.	K	Ref.
75	WIS0254+0223	T8.0V	77	···	···	16.557(0.156)	77	15.884(0.199)	77	>16.006	77
76	2MA0255-4700	L7.5V	32	···	···	13.246(0.027)	35	12.204(0.024)	35	11.558(0.024)	35
77	WIS0313+7807	T8.5V	78	···	···	···	···	···	···	···	···
78	2MA0314+1603	L0.0V	112	···	···	12.526(0.024)	35	11.823(0.036)	35	11.238(0.021)	35
79	GJ 3208	M6.0V	126	16.24(~)	126	10.99(~)	35	10.43(~)	35	10.09(~)	35
80	2MA0318-3421	L7.0V	49	···	···	15.569(0.055)	35	14.346(0.044)	35	13.507(0.039)	35
81	2MA0320+1854	M8.0V	69	···	···	11.759(0.021)	35	11.066(0.022)	35	10.639(0.018)	35
82	WIS0323-6025	T8.5V	78	···	···	···	···	···	···	···	···
83	WIS0325-3854	T9.0V	78	···	···	···	···	···	···	···	···
84	WIS0325+0831	T7.0V	78	···	···	···	···	···	···	···	···
85	2MA0325+0425	T5.5V	49	···	···	15.88(0.03)	35	16.24(0.03)	35	16.48(0.03)	35
86	2MA0331-3042	M7.5V	7	···	···	11.360(0.022)	35	10.700(0.022)	35	10.264(0.019)	35
87	2MA0334-4953	M9.0V	49	···	···	11.376(0.023)	35	10.823(0.026)	35	10.392(0.022)	35
88	2MA0335+2342	M8.5V	7	···	···	12.250(0.021)	35	11.655(0.022)	35	11.261(0.017)	35
89	WIS0335+4310	T9.0±2V	78	···	···	···	···	···	···	···	···
90	WIS0336-0143	T8.0±2V	78	···	···	···	···	···	···	···	···
91	2MA0339-3525	M9.0V	74	···	···	10.725(0.021)	35	10.017(0.021)	35	9.548(0.023)	35
92	2MA0348-6022	T7.0V	16	···	···	15.318(0.050)	35	15.559(0.143)	35	15.602(0.230)	35
93	WIS0350-5658	Y1.0V	105	···	···	>22.8	78	>21.5	78	···	···
94	2MA0350+1818	M8.0V	7	···	···	12.967(0.021)	35	12.213(0.022)	35	11.779(0.018)	35
95	GJ 3252	M7.5V	112	18.02(~)	150	11.302(0.024)	35	10.609(0.022)	35	10.232(0.024)	35
96	WIS0359-5401	Y0.0V	78	···	···	21.56(0.24)	78	22.20(0.43)	78	···	···
97	WIS0410+1502	Y0.0V	34	···	···	19.24(0.05)	78	19.05(0.09)	78	···	···
98	GJ 164 A	M4.5V	124	13.50(~)	150	8.77(~)	35	8.25(~)	35	7.91(~)	35
99	GJ 164 B	>M8.5V	106	···	···	(A+B)	···	(A+B)	···	(A+B)	···
100	WIS0413-4750	T9.0V	78	···	···	···	···	···	···	···	···
101	2MA0415-0935	T8.0V	12	···	···	15.70(0.06)	35	15.537(0.113)	35	15.429(0.201)	35
102	2MA0417-0800	M7.5V	7	···	···	12.182(0.030)	35	11.540(0.027)	35	11.090(0.026)	35
103	GJ 3276	M6.0V	132	···	···	12.757(0.021)	35	11.767(0.020)	35	11.276(0.020)	35
104	2MA0423-0414A	L6.0±1V	14	···	···	14.465(0.027)	35	13.463(0.035)	35	12.929(0.034)	35
105	2MA0423-0414B	T2.0±1V	14	···	···	(A+B)	···	(A+B)	···	(A+B)	···
106	GJ 3289	M6.5V	73	18.32(~)	150	11.623(0.024)	35	11.072(0.022)	35	10.693(0.023)	35
107	2MA0429-3123A	M7.5±1.5V	140	···	···	11.18(~)	130	10.55(~)	130	10.14(~)	130
108	2MA0429-3123B	L1.0±1.5V	140	···	···	12.38(~)	130	11.65(~)	130	11.12(~)	130
109	2MA0435-1606	M7.0V	7	···	···	10.406(0.026)	35	9.779(0.026)	35	9.352(0.021)	35
110	2MA0439-2353	L6.5V	49	···	···	14.408(0.029)	35	13.409(0.029)	35	12.816(0.023)	35
111	2MA0440-0530	M7.0V	7	···	···	10.658(0.024)	35	9.986(0.022)	35	9.545(0.019)	35

Table 2.2 (continued)

Line	Primary Name	Sp. Type	Ref.	V	Ref.	J	Ref.	H	Ref.	K	Ref.
112	2MA0443+0002	M9.0V	112	···	···	12.507(0.026)	35	11.804(0.024)	35	11.216(0.021)	35
113	2MA0445-3048	L2.0V	49	···	···	13.393(0.026)	35	12.580(0.024)	35	11.975(0.021)	35
114	GJ 3311	M6.0V	69	17.29(∼)	150	11.559(0.024)	35	11.056(0.035)	35	10.764(0.019)	35
115	WIS0458+6434A	T8.5V	78	···	···	···	···	17.41(0.06)	77	···	···
116	WIS0458+6434B	T9.5V	78	···	···	···	···	(A+B)	···	···	···
117	WIS0500-1223	T8.0V	78	···	···	···	···	···	···	···	···
118	2MA0501-0010	L4.0Vγ	49	···	···	14.982(0.038)	35	13.71(0.03)	35	12.963(0.035)	35
119	2MA0510+2714	M8.0Ve	92	···	···	10.698(0.020)	35	9.965(0.022)	35	9.560(0.018)	35
120	WIS0513+0608	T6.5V	78	···	···	···	···	···	···	···	···
121	2MA0515+5911	M7.0V	91	···	···	11.32(∼)	35	10.66(∼)	35	10.32(∼)	35
122	2MA0516-0445	T5.5V	49	···	···	15.984(0.079)	35	15.721(0.165)	35	15.486(0.204)	35
123	2MA0517-3349	M8.0V	7	···	···	12.004(0.022)	35	11.317(0.024)	35	10.832(0.024)	35
124	2MA0518-3101	M6.5V	112	···	···	11.878(0.029)	35	11.234(0.023)	35	10.900(0.021)	35
125	2MA0518-2828A	L6.0±1V	44	···	···	15.978(0.097)	35	14.830(0.073)	35	14.162(0.072)	35
126	2MA0518-2828B	T4.0±0.5V	44	···	···	(A+B)	···	(A+B)	···	(A+B)	···
127	2MA0523-1403	L2.5V	7	···	···	13.084(0.024)	35	12.220(0.022)	35	11.638(0.027)	35
128	WIS0528-3308	T7.0Vp	78	···	···	···	···	···	···	···	···
129	2MA0532+8246	L7.0VI	47	···	···	15.18(0.06)	35	14.904(0.092)	35	14.92(0.16)	35
130	WIS0535-7500	≥Y1.0V	78	···	···	>21.1	78	>21.6	78	···	···
131	GJ 3351	M6.0V	124	18.40(∼)	150	12.137(0.019)	35	11.638(0.028)	35	11.330(0.021)	35
132	2MA0539-0059	L5.0V	154	···	···	14.03(0.03)	35	13.104(0.026)	35	12.527(0.024)	35
133	WIS0542-1628	T6.5V	78	···	···	···	···	···	···	···	···
134	2MA0544-2433	M8.0V	112	···	···	12.532(0.022)	35	11.874(0.026)	35	11.463(0.024)	35
135	2MA0559-1404	T5.0V	38	···	···	13.802(0.024)	35	13.679(0.044)	35	13.577(0.052)	35
136	2MA0602+3910	L1.0V	7	···	···	12.300(0.022)	35	11.451(0.021)	35	10.865(0.020)	35
137	WIS0607+2429	L8.0V	29	···	···	14.22(0.03)	29	13.04(0.03)	29	12.47(0.02)	29
138	GJ 229 A	M1.0V	116	8.2(∼)	153	5.104(0.037)	35	4.393(0.254)	35	4.166(0.232)	35
139	GJ 229 B	T7.0Vp	16	···	···	14.01(0.05)	88	14.36(∼)	88	14.36(0.05)	88
140	WIS0612-3036	T6.0V	78	···	···	···	···	···	···	···	···
141	WIS0614+3912	T6.0V	78	···	···	···	···	···	···	···	···
142	WIS0614+0951	T7.0V	78	···	···	···	···	···	···	···	···
143	2MA0614+3950	L9.0±1V	115	···	···	16.59(0.14)	115	15.60(0.12)	115	15.02(0.12)	115
144	WIS0623-0456	T8.0V	78	···	···	···	···	···	···	···	···
145	2MA0624-4521	L5.0V	49	···	···	14.480(0.029)	35	13.335(0.028)	35	12.595(0.026)	35
146	WIS0625+5646	T6.0V	78	···	···	16.783(0.151)	36	16.233(0.248)	36	15.771(∼)	36
147	WIS0627-1114	T6.0V	78	···	···	···	···	···	···	···	···
148	GJ 234 A	M4.5V	112	10.98(∼)	46	6.376(0.023)	35	5.754(0.034)	35	5.486(0.016)	35

Table 2.2 (continued)

Line	Primary Name	Sp. Type	Ref.	V	Ref.	J	Ref.	H	Ref.	K	Ref.
149	GJ 234 B	M8.0V	112	14.23(~)	129	(A+B)	···	(A+B)	···	(A+B)	···
150	2MA0630-7643A	M6.0V	131	···	···	8.894(0.024)	35	8.275(0.047)	35	7.923(0.027)	35
151	2MA0630-7643B	(A+B)	···	···	···	(A+B)	···	(A+B)	···	(A+B)	···
152	2MA0641-4322	L1.5V	132	···	···	13.751(0.026)	35	12.94(0.03)	35	12.451(0.029)	35
153	GJ 240.1 A	F7.0V	1	5.55(~)	153	4.512(0.212)	35	4.262(0.146)	35	4.141(0.034)	35
154	GJ 240.1 B	L9.0±1V	98	···	···	16.26(0.09)	98	15.08(0.07)	98	14.60(0.09)	98
155	2MA0652+4710A	L3.5V	80	···	···	13.511(0.023)	35	12.384(0.024)	35	11.694(0.020)	35
156	2MA0652+4710B	L6.5V	80	···	···	(A+B)	···	(A+B)	···	(A+B)	···
157	UGP0722-0540	T9.0V	34	···	···	16.52(0.02)	100	16.20(0.02)	100	16.02(0.08)	100
158	2MA0700+3157A	L3.0±1V	44	···	···	13.23(~)	130	12.27(~)	130	11.62(~)	130
159	2MA0700+3157B	L6.5±1.5V	44	···	···	14.40(~)	130	13.45(~)	130	12.85(~)	130
160	2MA0707-4900	M8.0V	69	···	···	13.228(0.026)	35	12.538(0.03)	35	12.105(0.026)	35
161	GJ 268 A	M4.5V (A+B)	73	11.65(~)	153	6.731(0.026)	35	6.152(0.047)	35	5.846(0.018)	35
162	GJ 268 B	M5.0±1V	148	(A+B)	···	(A+B)	···	(A+B)	···	(A+B)	···
163	2MA0711+4329A	M7.0±1V	44	···	···	9.979(0.018)	35	9.467(0.016)	35	9.13(~)	35
164	2MA0711+4329B	M7.0±1V	44	···	···	(A+B)	···	(A+B)	···	(A+B)	···
165	WIS0713-2917	Y0.0V	78	···	···	···	···	···	···	···	···
166	WIS0723+3403	T9.0±1V	78	···	···	···	···	···	···	···	···
167	2MA0727+1710	T7.0V	154	···	···	15.60(0.06)	35	15.756(0.171)	35	15.556(0.194)	35
168	2MA0729-3954	T8.0V	49	···	···	15.920(0.077)	35	15.98(0.18)	35	>15.290	77
169	GJ 3444	M6.0V	69	15.16(~)	69	11.920(0.025)	35	11.379(0.030)	35	11.092(0.018)	35
170	WIS0733+7544	T6.0V	78	···	···	···	···	···	···	···	···
171	WIS0734-7157	Y0.0V	78	···	···	20.41(0.27)	78	···	···	···	···
172	GJ 283 A	DZAVII	54	···	···	12.65(~)	8	12.61(~)	8	12.52(~)	8
173	GJ 283 B	M6.5V	65	16.42(~)	129	10.155(0.022)	35	9.628(0.023)	35	9.291(0.021)	35
174	2MA0741+1738	M7.0V	112	···	···	12.011(0.022)	35	11.348(0.022)	35	10.942(0.018)	35
175	2MA0742+2055	T5.0V	49	···	···	16.19(0.09)	35	15.91(0.18)	35	>15.225	77
176	WIS0744+5628	T8.0V	78	···	···	···	···	···	···	···	···
177	2MA0746+2000A	L0.5±0.5V	10	···	···	11.759(0.020)	35	11.007(0.022)	35	10.468(0.022)	35
178	2MA0746+2000B	L1.5±0.5V	10	···	···	(A+B)	···	(A+B)	···	(A+B)	···
179	WIS0750+2725	T8.5V	78	···	···	···	···	···	···	···	···
180	WIS0751-7634	T9.0V	78	···	···	···	···	···	···	···	···
181	2MA0752+1612	M7.0V	7	···	···	10.879(0.022)	35	10.197(0.022)	35	9.846(0.019)	35
182	GJ 293.2 A	K4.0Vk	79	8.439(~)	79	6.506(0.020)	35	5.944(0.020)	35	5.833(0.017)	35
183	GJ 293.2 B	T4.5V	39	···	···	16.12(0.08)	35	15.80(0.12)	35	>15.86	35
184	WIS0759-4904	T8.0V	78	···	···	···	···	···	···	···	···
185	2MA0805+4812A	L4.5V	18	···	···	14.25(0.04)	18	13.62(0.03)	18	12.37(0.03)	18

Table 2.2 (continued)

Line	Primary Name	Sp. Type	Ref.	V	Ref.	J	Ref.	H	Ref.	K	Ref.
186	2MA0805+4812B	T5.0±0.6V	18	···	···	15.75(0.08)	18	16.01(0.14)	18	15.40(0.16)	18
187	GJ 3483 A	DQVII	144	13.73(∼)	145	13.704(0.023)	35	13.739(0.025)	35	13.781(0.043)	35
188	GJ 3483 B	Y?V	133	···	···	>23.9	102	···	···	···	···
189	2MA0810+1420	M9.0V	119	···	···	12.734(0.022)	35	12.053(0.022)	35	11.592(0.020)	35
190	WIS0811-8051	T9.5±1V	78	···	···	···	···	···	···	···	···
191	WIS0812+4021	T8.0V	78	···	···	···	···	···	···	···	···
192	2MA0817-6155	T6.0V	4	···	···	13.371(0.09)	4	···	···	13.207(0.20)	4
193	2MA0818+2333	M7.0V	112	···	···	12.175(0.021)	35	11.552(0.023)	35	11.149(0.018)	35
194	2MA0825+2115	L7.5V	38	···	···	15.100(0.034)	35	13.792(0.032)	35	13.028(0.026)	35
195	2MA0828-1309	L2.0V	112	···	···	12.80(0.03)	19	···	···	11.29(0.04)	19
196	GJ 1111	M6.5V	69	14.81(∼)	69	8.23(∼)	35	7.62(∼)	35	7.26(∼)	35
197	2MA0830+4828	L8.0V	154	···	···	15.444(0.048)	35	14.343(0.037)	35	13.676(0.038)	35
198	2MA0830+0947	M8.0V	135	···	···	11.890(0.022)	35	11.165(0.021)	35	10.756(0.023)	35
199	2MA0830+0128	T4.5V	49	···	···	16.29(0.11)	35	16.140(0.213)	35	16.36	113
200	GJ 3504	M6.0V	65	18.44(∼)	150	12.035(0.023)	35	11.477(0.021)	35	11.142(0.023)	35
201	2MA0835-0819	L5.0V	135	···	···	13.169(0.024)	35	11.938(0.024)	35	11.136(0.021)	35
202	WIS0836-1859	T8.0Vp	78	···	···	···	···	···	···	···	···
203	2MA0838-5855	M6.0V	157	···	···	10.309(0.024)	35	9.709(0.024)	35	9.268(0.021)	35
204	GJ 316.1	M6.0V	139	17.59(∼)	129	11.053(0.022)	35	10.419(0.023)	35	10.046(0.018)	35
205	2MA0847-1532	L2.0V	49	···	···	13.513(0.026)	35	12.629(0.027)	35	12.061(0.023)	35
206	GJ 3517	M9.0V	69	···	···	11.212(0.026)	35	10.469(0.026)	35	9.942(0.024)	35
207	WIS0857+5604	T8.0V	78	···	···	···	···	···	···	···	···
208	GJ 1116 A	M6.0V	134	14.06(∼)	151	7.791(0.023)	35	7.244(0.026)	35	6.889(0.023)	35
209	GJ 1116 B	M5.5V	124	(A+B)	···	(A+B)	···	(A+B)	···	(A+B)	···
210	2MA0859-1949	L7.0V	49	···	···	15.527(0.054)	35	14.436(0.042)	35	13.751(0.058)	35
211	2MA0900+2150	M6.5V	69	···	···	9.436(0.020)	35	8.836(0.023)	35	8.437(0.021)	35
212	ULA0901-0306	T7.5V	96	···	···	17.90(0.04)	97	18.46(0.13)	97	···	···
213	WIS0906+4735	T8.0V	78	···	···	···	···	···	···	···	···
214	2MA0909-0658	L0.0V	2	···	···	13.890(0.024)	35	13.090(0.021)	35	12.539(0.026)	35
215	GJ 337 A	G8.0V	107	6.78(∼)	13	5.121(0.021)	35	4.773(0.036)	35	4.664(0.017)	35
216	GJ 337 B	K1.0V	107	(A+B)	···	12.681(0.021)	35	12.242(0.017)	35	12.233(0.021)	35
217	GJ 337 C	L8.5±1V	44	···	···	(16.18(0.08))	44	(15.28(0.08))	44	14.67(0.06)	44
218	GJ 337 D	L7.5±2V	44	···	···	(16.35(0.08))	44	(15.48(0.08))	44	14.94(0.07)	44
219	2MA0920+3517A	L6.5V	80	···	···	15.625(0.063)	35	14.673(0.057)	35	13.979(0.061)	35
220	2MA0920+3517B	T2.0V	80	···	···	(A+B)	···	(A+B)	···	(A+B)	···
221	2MA0921-2104	L2.0V	112	···	···	12.779(0.024)	35	12.152(0.022)	35	11.690(0.023)	35
222	2MA0926+5847A	T3.5±1V	44	···	···	(16.52(0.08))	44	(15.79(0.10))	44	((15.95(0.20)))	44

Table 2.2 (continued)

Line	Primary Name	Sp. Type	Ref.	V	Ref.	J	Ref.	H	Ref.	K	Ref.
223	2MA0926+5847B	T5.0±1V	44	···	···	(16.79(0.09))	44	(16.42(0.12))	44	((16.53(0.21)))	44
224	WIS0929+0409	T6.5V	78	···	···	···	···	···	···	···	···
225	2MA0929+3429	L8.0V	7	···	···	16.601(0.125)	35	15.440(0.103)	35	14.644(0.104)	35
226	2MA0931-1717	M6.5V	112	···	···	11.073(0.026)	35	10.467(0.025)	35	10.069(0.024)	35
227	2MA0937+2931	T6.0Vp	16	···	···	14.65(0.04)	35	14.703(0.068)	35	15.267(0.130)	35
228	2MA0939-2448	T8.0V	16	···	···	15.61(0.09)	88	15.94(~)	88	16.83(0.09)	88
229	2MA0949-1545	T2.0V	49	···	···	16.149(0.117)	35	15.262(0.114)	35	15.227(0.168)	35
230	WIS0952+1955	T6.0V	78	···	···	···	···	···	···	···	···
231	2MA1004-3335	L4.0V	47	···	···	14.48(0.04)	35	13.49(0.04)	35	12.924(0.024)	35
232	2MA1006-1653	M7.5V	112	···	···	12.036(0.024)	35	11.392(0.021)	35	10.992(0.023)	35
233	2MA1007-4555	T5.0V	49	···	···	15.653(0.068)	35	15.69(0.12)	35	15.56(0.23)	35
234	2MA1010-0406	L7.0V	49	···	···	15.508(0.059)	35	14.385(0.037)	35	13.619(0.046)	35
235	2MA1016+2751	M8.0V	112	···	···	11.987(0.019)	35	11.331(0.022)	35	10.955(0.018)	35
236	ULA1017+0118	T8.0Vp	78	···	···	18.57(0.07)	23	19.38(0.24)	23	···	···
237	WIS1018-2445	T8.0V	78	···	···	···	···	···	···	···	···
238	WIS1019+6529	T6.0V	78	···	···	16.554(0.149)	36	16.328(~)	36	17.016(~)	36
239	2MA1021-0304A	T0.0±1V	44	···	···	(17.02(0.10))	44	(15.79(0.10))	44	15.49(0.17)	44
240	2MA1021-0304B	T5.0±0.5V	44	···	···	(16.99(0.10))	44	(16.53(10))	44	16.49(0.17)	44
241	GJ 9326 A	F7.0V	114	5.741(~)	···	4.86(~)	35	4.53(~)	35	4.45(~)	35
242	GJ 9326 B	L0.0V	76	···	···	14.90(0.04)	35	14.022(0.033)	35	13.608(0.039)	35
243	2MA1024+1815	M8.0V	112	···	···	12.275(0.021)	35	11.620(0.021)	35	11.239(0.021)	35
244	CFB1028+5654	T8.0V	78	···	···	···	···	···	···	···	···
245	2MA1036-3441	L6.0V	49	···	···	15.62(0.05)	35	14.45(0.04)	35	13.80(0.04)	35
246	WIS1039-1600	T7.5V	78	···	···	···	···	···	···	···	···
247	WIS1042-3842	T8.5V	78	···	···	···	···	···	···	···	···
248	2MA1043+1213	L7.0V	49	···	···	15.997(0.088)	35	14.969(0.077)	35	14.258(0.066)	35
249	2MA1044+0429	L7.0V	49	···	···	15.881(0.077)	35	14.95(0.07)	35	14.259(0.086)	35
250	2MA1045-0149	L1.0V	112	···	···	13.160(0.024)	35	12.352(0.025)	35	11.780(0.023)	35
251	2MA1047-1815	L2.5V	112	···	···	14.199(0.029)	35	13.423(0.030)	35	12.891(0.030)	35
252	2MA1047+2124	T6.5V	154	···	···	15.82(0.06)	35	15.797(0.120)	35	16.41(~)	7
253	GJ 3622	M7.0V	112	15.60(~)	69	8.857(0.021)	35	8.263(0.036)	35	7.93(0.03)	35
254	DEN1048-3956	M8.5V	65	···	···	9.538(0.022)	35	8.90(0.04)	35	8.447(0.023)	35
255	2MA1048+0111	L1.0V	112	···	···	12.924(0.023)	35	12.140(0.022)	35	11.623(0.024)	35
256	GJ 3624	M6.0V	124	19.11(~)	150	12.535(0.024)	35	11.970(0.024)	35	11.596(0.019)	35
257	WIS1051-2138	T9.0±1V	78	···	···	···	···	···	···	···	···
258	GJ 406	M6.0V	69	13.507(0.006)	83	7.085(0.024)	35	6.482(0.042)	35	6.084(0.017)	35
259	2MA1058-1548	L3.0V	38	···	···	14.155(0.035)	35	13.226(0.025)	35	12.532(0.029)	35

Table 2.2 (continued)

Line	Primary Name	Sp. Type	Ref.	V	Ref.	J	Ref.	H	Ref.	K	Ref.
260	GJ 412 A	M2.0V	69	8.780(0.009)	117	5.54(~)	35	5.00(~)	35	4.77(~)	35
261	GJ 412 B	M6.0V	156	14.45(~)	69	8.742(0.026)	35	8.177(0.024)	35	7.839(0.026)	35
262	2MA1106+0428	M7.0V	110	···	···	12.329(0.022)	35	11.716(0.027)	35	11.332(0.023)	35
263	2MA1110+0116	T5.5±0.5V	16	···	···	16.343(0.115)	35	15.924(0.144)	35	15.13	113
264	GJ 417 A	G0.0V	114	6.54(~)	153	5.265(0.024)	35	5.021(0.018)	35	4.959(0.017)	35
265	GJ 417 B	L4.5±1V	44	···	···	((15.23(0.16)))	44	((14.10(0.07)))	44	((13.31(0.03)))	44
266	GJ 417 C	L6.0±1V	44	···	···	((15.46(0.20)))	44	((14.42(0.09)))	44	((13.66(0.03)))	44
267	2MA1114-2618	T7.5V	49	···	···	15.858(0.083)	35	15.734(0.123)	35	>16.109	77
268	GJ 423 Aa	F9.0V	147	4.264(0.009)	67	2.46(0.294)	35	2.23(0.204)	35	2.14(0.230)	35
269	GJ 423 Ab	M3.0V	6	(Aa+Ab)	···	(Aa+Ab)	···	(Aa+Ab)	···	(Aa+Ab)	···
270	GJ 423 Ba	G2.0V	6	4.729(0.009)	67	···	···	···	···	···	···
271	GJ 423 Bb	K(late)V	···	(Ba+Bb)	···	···	···	···	···	···	···
272	GJ 423 C	T8.5V	158	···	···	17.792(0.053)	158	18.146(0.060)	158	18.746(0.150)	158
273	GJ 3655 A	M8.0±0.5V	43	19.57(~)	150	11.93(~)	112	11.26(0.02)	43	10.74(~)	112
274	GJ 3655 B	L7.0±1V	43	···	···	15.23(0.08)	43	14.22(0.05)	43	13.64(0.04)	43
275	WIS1122+2550	T6.0V	78	···	···	···	···	···	···	···	···
276	2MA1124+3808	M8.5V	112	···	···	12.713(0.023)	35	12.017(0.027)	35	11.570(0.025)	35
277	WIS1124-0421	T7.0V	78	···	···	···	···	···	···	···	···
278	2MA1139-3159	M8.0V	15	···	···	12.686(0.026)	35	11.996(0.022)	35	11.503(0.023)	35
279	2MA1141-2232	M7.0V	112	···	···	12.633(0.023)	35	11.996(0.024)	35	11.569(0.023)	35
280	WIS1150+6302	T8.0V	78	···	···	···	···	···	···	···	···
281	GJ 3693	M8.0V	9	17.89(~)	150	11.256(0.022)	35	10.660(0.027)	35	10.262(0.022)	35
282	2MA1155-3727	L2.0V	49	···	···	12.811(0.024)	35	12.040(0.026)	35	11.462(0.021)	35
283	2MA1155-2224	M7.5V	112	···	···	10.930(0.023)	35	10.295(0.023)	35	9.881(0.019)	35
284	2MA1155+0559	L7.5V	49	···	···	15.660(0.077)	35	14.703(0.070)	35	14.118(0.075)	35
285	SDS1157+0611	T1.5V	49	···	···	16.926(0.200)	77	16.038(0.166)	77	>15.251	77
286	2MA1203+0015	L3.0V	112	···	···	14.006(0.026)	35	13.056(0.024)	35	12.476(0.024)	35
287	2MA1207+0244	L8.0V	49	···	···	15.58(0.07)	35	14.56(0.07)	35	13.99(0.06)	35
288	2MA1209-1004A	T3.0±0.5V	94	···	···	15.80(0.05)	94	15.32(0.04)	94	15.22(0.04)	94
289	2MA1209-1004B	T2.0±0.5V	94	···	···	17.27(0.17)	94	18.08(0.26)	94	18.48(0.52)	94
290	2MA1215-3420	T4.5V	49	···	···	16.24(0.13)	35	15.81(0.19)	35	···	···
291	2MA1217-0311	T7.5V	154	···	···	15.86(0.06)	35	15.748(0.119)	35	15.89(~)	7
292	WIS1217+1626	T9.0V	77	···	···	···	···	···	···	···	···
293	2MA1221+0257	L0.0V	112	···	···	13.169(0.023)	35	12.410(0.025)	35	11.953(0.026)	35
294	2MA1224-1238	M9.0V	69	···	···	12.571(0.024)	35	11.822(0.026)	35	11.353(0.025)	35
295	2MA1225-2739A	T5.5±0.5V	44	···	···	15.16(0.03)	44	15.42(0.03)	44	15.51(0.03)	44
296	2MA1225-2739B	T8.0±0.5V	44	···	···	16.48(0.03)	44	16.91(0.03)	44	17.09(0.03)	44

Table 2.2 (continued)

Line	Primary Name	Sp. Type	Ref.	V	Ref.	J	Ref.	H	Ref.	K	Ref.
297	WIS1225-1013	T6.0V	78	···	···	···	···	16.46(0.15)	103	···	···
298	2MA1228-1547A	L5.5±1V	44	···	···	14.378(0.030)	35	13.35(0.03)	35	12.767(0.030)	35
299	2MA1228-1547B	L5.5±1V	44	···	···	(A+B)	···	(A+B)	···	(A+B)	···
300	GJ 1159 A	M4.0V	124	···	···	9.98(∼)	35	9.50(∼)	35	9.22(∼)	35
301	GJ 1159 B	M6.0V	52	···	···	12.202(0.022)	35	11.697(0.021)	35	11.369(0.016)	35
302	GJ 473 A	M5.5V	63	12.467(0.004)	83	6.995(0.024)	35	6.397(0.034)	35	6.042(0.020)	35
303	GJ 473 B	(A+B)	···	(A+B)	···	(A+B)	···	(A+B)	···	(A+B)	···
304	2MA1236-1722	M6.0V	112	···	···	11.669(0.024)	35	11.093(0.029)	35	10.712(0.023)	35
305	2MA1237+6526	T6.5V	113	···	···	16.053(0.087)	35	15.74(0.14)	35	16.06(∼)	113
306	ULA1238+0953	T8.0V	78	···	···	18.78(0.06)	23	19.25(0.15)	23	···	···
307	2MA1239+5515A	L5.0±0.5V	75	···	···	14.711(0.032)	35	13.568(0.033)	35	12.792(0.029)	35
308	2MA1239+5515B	$L6.0^{+2.5}_{-1.5}$V	75	···	···	(A+B)	···	(A+B)	···	(A+B)	···
309	2MA1246+3148	M7.5V	112	···	···	12.227(0.022)	35	11.583(0.022)	35	11.209(0.019)	35
310	2MA1250-2121	M7.5V	112	···	···	11.160(0.023)	35	10.550(0.023)	35	10.128(0.021)	35
311	2MA1253+4034	M7.5V	112	···	···	12.185(0.019)	35	11.545(0.022)	35	11.162(0.019)	35
312	2MA1254-0122	T2.0V	12	···	···	14.89(0.04)	35	14.090(0.025)	35	13.84(0.05)	35
313	2MA1300+1912	L1.0V	7	···	···	12.717(0.022)	35	12.080(0.023)	35	11.624(0.020)	35
314	GJ 494 A	M0.5V	21	9.76(∼)	153	6.437(0.021)	35	5.786(0.017)	35	5.578(0.016)	35
315	GJ 494 B	M7.0V	87	>13.2	64	(A+B)	···	(A+B)	···	(A+B)	···
316	GJ 494 C	T8.0±0.5Vp	26	···	···	16.69(0.02)	138	17.01(0.04)	138	16.90(0.06)	138
317	ULA1302+1308	T8.0V	78	···	···	18.11(0.04)	25	18.60(0.06)	25	···	···
318	2MA1305-2541A	L2.0±1V	53	···	···	13.414(0.026)	35	12.99(0.15)	53	12.37(0.16)	53
319	2MA1305-2541B	L3.0p±1.5V	143	···	···	(A+B)	···	13.49(0.15)	53	12.76(0.16)	53
320	2MA1309-2330	M8.0V	112	···	···	11.785(0.022)	35	11.082(0.022)	35	10.669(0.024)	35
321	WIS1311+0122	T9.0±1V	78	···	···	···	···	···	···	···	···
322	2MA1314+1320A	M7.0V	111	···	···	9.75(∼)	35	9.18(∼)	35	8.79(∼)	35
323	2MA1314+1320B	(A+B)	···	···	···	(A+B)	···	(A+B)	···	(A+B)	···
324	ULA1315+0826	T7.5V	104	···	···	18.86(0.04)	121	19.50(0.10)	121	19.60(0.12)	121
325	WIS1318-1758	T9.0±1V	78	···	···	···	···	···	···	···	···
326	WIS1320+6034	T6.5V	78	···	···	···	···	···	···	···	···
327	WIS1322-2340	T8.0V	78	···	···	···	···	···	···	···	···
328	2MA1326-0038	L5.5V	47	···	···	16.10(0.07)	35	15.050(0.060)	35	14.208(0.067)	35
329	2MA1332-0441	M7.5V	112	···	···	12.369(0.027)	35	11.730(0.022)	35	11.283(0.019)	35
330	WIS1335+1130	T9.0V	23	···	···	···	···	18.250(0.010)	77	···	···
331	2MA1346-3149	M6.0V	112	···	···	10.975(0.024)	35	10.436(0.026)	35	10.038(0.019)	35
332	2MA1346-0031	T6.0V	154	···	···	16.00(0.10)	35	15.459(0.118)	35	15.77(0.27)	113
333	2MA1348-1344A	M4.5±0.5V	40	15.098(∼)	28	10.413(0.026)	35	9.937(0.023)	35	9.664(0.024)	35

Table 2.2 (continued)

Line	Primary Name	Sp. Type	Ref.	V	Ref.	J	Ref.	H	Ref.	K	Ref.
334	2MA1348-1344B	T5.5±0.5V	40	···	···	16.39(0.02)	40	16.57(0.04)	40	16.90(0.08)	40
335	2MA1354+0846	M7.0V	112	···	···	12.193(0.024)	35	11.605(0.024)	35	11.156(0.025)	35
336	2MA1356+4342	M7.0V	112	···	···	11.709(0.023)	35	11.043(0.021)	35	10.650(0.018)	35
337	2MA1359-4034	L1.0V	49	···	···	13.645(0.026)	35	13.034(0.028)	35	12.566(0.029)	35
338	2MA1403+3007	M8.5V	112	···	···	12.684(0.023)	35	12.000(0.023)	35	11.602(0.021)	35
339	2MA1404-3159A	L9.0±1V	44	···	···	15.58(0.06)	35	14.955(0.067)	35	14.538(0.095)	35
340	2MA1404-3159B	T5.0±0.5V	44	···	···	(A+B)	···	(A+B)	···	(A+B)	···
341	WIS1405+5534	Y0.0Vp	34	···	···	20.09(0.12)	78	>20.5	78	···	···
342	2MA1411-2119	M9.0V	112	···	···	12.437(0.022)	35	11.826(0.027)	35	11.330(0.021)	35
343	2MA1411-4132A	M5.0V	66	15.63(∼)	66	9.670(0.022)	35	9.041(0.024)	35	8.620(0.020)	35
344	2MA1411-4132B	L1.0V	66	···	···	(A+B)	···	(A+B)	···	(A+B)	···
345	2MA1412+1633	L0.5V	112	···	···	13.888(0.029)	35	13.150(0.036)	35	12.521(0.030)	35
346	2MA1416+1348A	L6.0V	11	···	···	13.148(0.025)	35	12.456(0.028)	35	12.114(0.023)	35
347	ULA1416+1348(B)	T7.5V	20	···	···	17.26(0.02)	25	17.58(0.03)	25	18.93(0.24)	25
348	2MA1421+1827	L0.0V	119	···	···	13.231(0.021)	35	12.428(0.021)	35	11.943(0.020)	35
349	GJ 547 A	G1.0V	86	6.26(∼)	35	5.053(0.037)	35	4.814(0.067)	35	4.644(0.017)	35
350	GJ 547 B	T8.0Vp	122	···	···	19.69(0.05)	122	19.14(0.20)	122	19.89(0.33)	122
351	2MA1428+1356	M8.0V	112	···	···	11.014(0.021)	35	10.390(0.015)	35	10.026(0.020)	35
352	GJ 3849	M9.0V	112	19.74(∼)	150	11.990(0.021)	35	11.225(0.029)	35	10.744(0.024)	35
353	GJ 3855	M6.5V	69	17.88(∼)	129	10.790(0.018)	35	10.140(0.020)	35	9.788(0.020)	35
354	2MA1432+0811	M6.0V	112	···	···	10.11(∼)	35	9.53(∼)	35	9.17(∼)	35
355	WIS1436-1814	T8.0Vp	78	···	···	···	···	···	···	···	···
356	2MA1438+6408	M9.5V	112	···	···	12.985(0.024)	35	12.161(0.031)	35	11.650(0.021)	35
357	2MA1439+1929	L1.0V	112	···	···	12.759(0.019)	35	12.041(0.019)	35	11.546(0.022)	35
358	GJ 551/559 A	G2.0V	149	-0.008(0.013)	71	-1.453(0.133)	71	-1.886(0.219)	71	-2.007(0.259)	71
359	GJ 551/559 B	K1.0V	149	1.348(0.012)	71	(A+B)	···	(A+B)	···	(A+B)	···
360	GJ 551/559 C	M6.0Ve	149	11.12(∼)	42	5.357(0.023)	35	4.835(0.057)	35	4.384(0.033)	35
361	2MA1440+1339	M8.0V	112	···	···	12.395(0.022)	35	11.710(0.020)	35	11.337(0.020)	35
362	GJ 9492 A	M3.0V	60	10.83(0.07)	67	7.306(0.024)	35	6.733(0.026)	35	6.491(0.024)	35
363	GJ 9492 B	L0.0V	47	···	···	(A+B)	···	(A+B)	···	(A+B)	···
364	2MA1444+3002	M8.0V	112	···	···	11.671(0.020)	35	11.017(0.021)	35	10.616(0.018)	35
365	2MA1444-2019	M9.0VI	49	···	···	12.55(0.03)	35	12.142(0.026)	35	11.94(0.15)	17
366	SDS1446+0024	L5.0V	154	···	···	15.686(∼)	142	14.536(∼)	142	13.832(∼)	142
367	GJ 564 A	G1.0V	30	5.99(∼)	153	5.00(0.22)	35	4.69(0.23)	35	4.458(0.02)	35
368	GJ 564 B	L4.0V	47	···	···	13.900(∼)	47	13.200(∼)	47	12.300(∼)	47
369	GJ 564 C	L4.0V	47	···	···	14.200(∼)	47	13.600(∼)	47	12.600(∼)	47
370	GJ 569 A	M2.0V	79	10.150(∼)	79	6.633(0.023)	35	5.990(0.021)	35	5.770(0.018)	35

Table 2.2 (continued)

Line	Primary Name	Sp. Type	Ref.	V	Ref.	J	Ref.	H	Ref.	K	Ref.
371	GJ 569 Ba	M8.5V	85	···	···	11.14(0.07)	85	10.43(0.04)	141	9.86(0.10)	141
372	GJ 569 Bb	M9.0V	85	···	···	11.65(0.07)	85	11.04(0.05)	141	10.39(0.06)	141
373	GJ 3877	M7.0V	69	17.05(~)	150	9.965(0.026)	35	9.315(0.022)	35	8.928(0.027)	35
374	WIS1457+5815	T7.0V	78	···	···	···	···	···	···	···	···
375	GJ 570 A	K4.0V	61	5.88(~)	153	3.663(0.258)	35	3.085(0.196)	35	3.048(0.224)	35
376	GJ 570 B	M1.5V	61	8.065(~)	79	4.55(0.26)	35	3.91(0.20)	35	3.80(0.23)	35
377	GJ 570 C	M3.0V	50	8.00(~)	129	12.680(0.023)	35	12.360(0.027)	35	12.297(0.029)	35
378	GJ 570 D	T7.5V	89	···	···	15.32(0.05)	35	15.27(0.09)	35	15.24(0.16)	35
379	2MA1501+2250	M9.0V	69	···	···	11.866(0.022)	35	11.181(0.03)	35	10.706(0.024)	35
380	2MA1503+2525	T5.5V	12	···	···	13.937(0.024)	35	13.856(0.031)	35	13.963(0.059)	35
381	SDS1504+1027	T7.0V	49	···	···	16.49(0.03)	31	16.92(0.03)	31	17.02(0.03)	31
382	GJ 576 A	K8.0V	79	9.91(~)	153	7.264(0.019)	35	6.655(0.02)	35	6.468(0.02)	35
383	GJ 576 B	T6.5±1V	138	···	···	16.59(0.02)	138	17.05(0.04)	138	17.41(0.09)	138
384	WIS1506+7027	T6.0V	105	···	···	···	···	···	···	···	···
385	2MA1506+1321	L3.0V	112	···	···	13.365(0.023)	35	12.380(0.021)	35	11.741(0.019)	35
386	2MA1507-2000	M7.5V	112	···	···	11.713(0.023)	35	11.045(0.022)	35	10.661(0.021)	35
387	2MA1507-1627	L5.0V	32	···	···	12.830(0.027)	35	11.895(0.024)	35	11.312(0.026)	35
388	2MA1510-0241	M9.0V	69	···	···	12.614(0.023)	35	11.842(0.022)	35	11.347(0.021)	35
389	2MA1511+0607	T0.0V	49	···	···	16.016(0.079)	35	14.955(0.075)	35	14.544(0.100)	35
390	2MA1515+4847	L6.0V	7	···	···	14.111(0.029)	35	13.099(0.031)	35	12.500(0.024)	35
391	2MA1516+3910	M6.5V	112	···	···	10.796(0.021)	35	10.188(0.016)	35	9.813(0.018)	35
392	WIS1517+0529	T8.0V	78	···	···	···	···	···	···	···	···
393	WIS1519+7009	T8.0V	78	···	···	···	···	···	···	···	···
394	2MA1521+5053	M7.5V	7	···	···	12.014(0.024)	35	11.327(0.015)	35	10.922(0.019)	35
395	2MA1521+0131	T2.0V	49	···	···	16.399(0.102)	35	15.576(0.099)	35	15.347(0.171)	35
396	GJ 584 A	G2.0V	71	5.125(0.004)	71	4.052(0.225)	71	3.700(0.236)	71	3.713(0.216)	71
397	GJ 584 B	G0.0V	71	5.882(0.008)	71	4.052(0.225)	71	3.700(0.236)	71	3.713(0.216)	71
398	GJ 584 C	L8.0V	154	···	···	16.06(0.10)	35	14.928(0.081)	35	14.348(0.067)	35
399	2MA1526+2043	L7.0V	49	···	···	15.586(0.055)	35	14.497(0.044)	35	13.922(0.052)	35
400	2MA1534-2952A	T5.0±0.5V	94	···	···	14.90(0.05)	35	14.866(0.102)	35	14.843(0.114)	35
401	2MA1534-2952B	T5.0±0.5V	94	···	···	(A+B)	···	(A+B)	···	(A+B)	···
402	2MA1534-1418	M7.0V	112	···	···	11.380(0.023)	35	10.732(0.022)	35	10.305(0.023)	35
403	2MA1539-0520	L3.5V	135	···	···	13.922(0.029)	35	13.060(0.026)	35	12.575(0.029)	35
404	WIS15412250	Y0.5V	78	···	···	20.74(0.31)	78	>20.2	78	···	···
405	WIS1542+2230	T9.5V	78	···	···	···	···	···	···	···	···
406	WIS1544+5842	T7.5V	78	···	···	···	···	···	···	···	···
407	2MA1546+3749	M7.5V	112	···	···	12.435(0.024)	35	11.791(0.029)	35	11.407(0.020)	35

Table 2.2 (continued)

Line	Primary Name	Sp. Type	Ref.	V	Ref.	J	Ref.	H	Ref.	K	Ref.
408	2MA1546-3325	T5.5V	16	···	···	15.63(0.05)	35	15.446(0.092)	35	15.485(0.181)	35
409	2MA1552-2623	M6.0V	112	···	···	10.258(0.021)	35	9.676(0.022)	35	9.315(0.021)	35
410	2MA1553+1532A	T6.5±0.5V	44	···	···	(16.42(0.07))	44	(16.52(0.16))	44	(16.07(0.18))	44
411	2MA1553+1532B	T7.5±0.5V	44	···	···	(16.77(0.07))	44	(16.90(0.16))	44	(16.50(0.18))	44
412	2MA1555-0956	L1.0V	112	···	···	12.557(0.024)	35	11.984(0.024)	35	11.443(0.019)	35
413	2MA1606+4054	M6.5V	112	···	···	11.05(∼)	35	10.42(∼)	35	10.07(∼)	35
414	WIS1612-3420	T6.5V	78	···	···	···	···	···	···	···	···
415	2MA1614-0251	M6.0V	112	···	···	11.303(0.024)	35	10.683(0.025)	35	10.280(0.023)	35
416	WIS1614+1739	T9.0V	78	···	···	···	···	···	···	···	···
417	2MA1615+1340	T6.0V	49	···	···	16.35(0.09)	35	16.49(0.25)	35	>15.859	77
418	2MA1615+3559	L3.0V	112	···	···	14.539(0.033)	35	13.515(0.029)	35	12.935(0.029)	35
419	WIS1617+1807	T8.0V	78	···	···	···	···	···	···	···	···
420	GJ 618.1 A	M2.0V	45	10.673(0.012)	71	7.950(0.020)	35	7.267(0.047)	35	7.081(0.021)	35
421	GJ 618.1 B	L2.5±0.5V	132	···	···	15.283(0.049)	35	14.348(0.040)	35	13.598(0.038)	35
422	WIS1622-0959	T6.0V	78	···	···	16.398(0.118)	36	16.615(∼)	36	15.737(0.257)	36
423	2MA1624+0029	T6.0V	38	···	···	15.49(0.05)	35	15.524(0.100)	35	15.52(∼)	7
424	WIS1627+3255	T6.0V	78	···	···	···	···	···	···	···	···
425	2MA1627+8105	M9.0V	119	···	···	13.027(0.024)	35	12.329(0.023)	35	11.880(0.022)	35
426	SDS1628+2308	T7.0V	31	···	···	16.25(0.03)	31	16.63(0.04)	31	16.72(0.03)	31
427	2MA1630+0818	T5.5V	49	···	···	16.18(0.03)	31	16.35(0.03)	31	16.41(0.03)	31
428	2MA1632+1904	L8.0V	38	···	···	15.87(0.07)	35	14.612(0.038)	35	14.003(0.047)	35
429	2MA1645-1319	L1.5V	49	···	···	12.451(0.028)	35	11.685(0.025	35	11.145(0.026)	35
430	2MA1646+3434	M6.5V	128	···	···	10.533(0.018)	35	9.968(0.017)	35	9.606(0.020)	35
431	WIS1647+5632	L9.0Vp	77	···	···	16.911(0.180)	77	15.259(0.084)	77	14.611(0.087)	77
432	WIS1653+4444	T8.0V	78	···	···	···	···	···	···	···	···
433	GJ 643/644 A	M3.0V	156	9.023(∼)	79	5.270(0.037)	35	4.775(0.017)	35	4.403(0.036)	35
434	GJ 643/644 Ba	M2.0V	41	···	···	···	···	···	···	···	···
435	GJ 643/644 Bb	M5.0V	41	···	···	···	···	···	···	···	···
436	GJ 643/644 C	M3.5V	52	11.759(0.004)	83	7.555(0.024)	35	7.056(0.061)	35	6.724(0.017)	35
437	GJ 643/644 D	M7.0V	81	16.70(∼)	69	9.776(0.029)	35	9.201(0.024)	35	8.816(0.023)	35
438	2MA1658+7027	L1.0V	38	···	···	13.288(0.024)	35	12.470(0.032)	35	11.915(0.023)	35
439	2MA1705-0516	L4.0V	47	···	···	13.309(0.030)	35	12.552(0.024)	35	12.032(0.0210)	35
440	2MA1707+6439	M9.0V	119	···	···	12.539(0.024)	35	11.793(0.028)	35	11.375(0.023)	35
441	2MA1707-0558A	M9.0V	132	···	···	12.25(∼)	130	11.46(∼)	130	10.90(∼)	130
442	2MA1707-0558B	L3.0V	132	···	···	14.00(∼)	130	12.90(∼)	130	12.4(∼)	130
443	WIS1711+3500	T8.0V	78	···	···	···	···	···	···	···	···
444	2MA1711+4029A	M4.5V	128	···	···	11.074(0.020)	35	10.562(0.022)	35	10.271(0.019)	35

Table 2.2 (continued)

Line	Primary Name	Sp. Type	Ref.	V	Ref.	J	Ref.	H	Ref.	K	Ref.
445	2MA1711+4028(B)	L5.0±2V	123	···	···	15.00(0.06)	35	14.30(0.07)	35	13.80(0.05)	35
446	GJ 660.1 A	M1.0V	79	11.73(∼)	153	8.661(0.026)	35	8.069(0.044)	35	7.937(0.024)	35
447	GJ 660.1 B	M9.0±2V	136	···	···	13.05(0.04)	35	12.565(0.023)	35	12.227(0.027)	35
448	WIS1717+6128	T8.0V	78	···	···	···	···	···	···	···	···
449	2MA1721+3344	L3.0V	7	···	···	13.625(0.023)	35	12.952(0.026)	35	12.489(0.020)	35
450	WIS1721+1117	T6.0V	78	···	···	16.456(0.148)	37	16.240(∼)	37	16.121(∼)	37
451	2MA1728+3948A	L5V	22	···	···	17.36(0.05)	22	15.63(0.05)	22	···	···
452	2MA1728+3948B	L6.5V	22	···	···	17.68(0.05)	22	16.09(0.05)	22	···	···
453	2MA1731+2721	L0.0V	112	···	···	12.094(0.027)	35	11.391(0.030)	35	10.914(0.021)	35
454	2MA1735+2634A	M7.5±0.5V	44	···	···	11.70(0.03)	44	11.14(0.03)	44	10.67(0.02)	44
455	2MA1735+2634B	L0.0±1V	44	···	···	12.27(0.03)	44	11.69(0.03)	44	11.15(0.02)	44
456	WIS1738+2732	Y0.0V	34	···	···	19.51(0.08)	78	20.39(0.33)	78	···	···
457	WIS1741+2553	T9.0V	77	···	···	16.451(0.099)	77	16.356(0.216)	77	>16.785	77
458	GJ 4029	M6.0V	125	20.1(∼)	150	12.171(0.027)	35	11.670(0.032)	35	11.287(0.022)	35
459	2MA1750-0016	L5.5V	47	···	···	13.294(0.023)	35	12.411(0.022)	35	11.849(0.021)	35
460	2MA1754+1649	T5.5V	49	···	···	15.81(0.07)	35	15.65(0.13)	35	15.56(0.16)	35
461	GJ 4037	M6.0V	129	17.98(∼)	129	11.819(0.023)	35	11.227(0.023)	35	10.875(0.016)	35
462	2MA1757+7042	M7.5V	112	···	···	11.452(0.021)	35	10.835(0.019)	35	10.397(0.021)	35
463	GJ 4040 A	M3.0V	48	11.79(∼)	···	7.847(0.020)	35	7.254(0.023)	35	7.000(0.017)	35
464	GJ 4040 B	T6.5V	48	···	···	16.15(0.09)	35	16.25(0.22)	35	15.46(0.19)	35
465	WIS1800+0134	L7.5±0.5V	57	···	···	14.30(0.04)	57	13.12(0.04)	57	12.42(0.03)	57
466	WIS1804+3117	T9.5±1V	78	···	···	···	···	···	···	···	···
467	2MA1807+5015	L1.5V	112	···	···	12.934(0.024)	35	12.127(0.031)	35	11.602(0.025)	35
468	WIS1809+3838	T8.0V	78	···	···	···	···	···	···	···	···
469	WIS1812+2721	T8.5±1V	78	···	···	···	···	···	···	···	···
470	GJ 4052 A	G6.0V	61	6.92(∼)	120	···	···	···	···	···	···
471	GJ 4052 C	···	···	···	···	···	···	···	···	···	···
472	WIS1828+2650	≥Y2.0V	78	···	···	23.57(0.35)	78	22.85(0.24)	78	···	···
473	2MA1828-4849	T5.5V	49	···	···	15.175(0.056)	35	14.908(0.067)	35	15.181(0.144)	35
474	2MA1835+3259	M8.5V	127	···	···	10.270(0.022)	35	9.617(0.021)	35	9.171(0.018)	35
475	2MA1839+2952	M6.5V	128	···	···	11.011(0.023)	35	10.383(0.028)	35	10.005(0.021)	35
476	2MA1840+7240	M6.5V	129	···	···	10.974(0.020)	35	10.379(0.017)	35	10.006(0.020)	35
477	CE 507	M6.0V	32	16.282(0.006)	32	10.732(0.032)	32	10.140(0.030)	32	9.829(0.024)	32
478	GJ 4073	M8.0V	112	18.23(∼)	150	11.313(0.022)	35	10.688(0.021)	35	10.308(0.018)	35
479	2MA1845-6357A	M8.5V	66	···	···	9.544(0.023)	66	8.967(0.027)	66	8.508(0.02)	66
480	2MA1845-6357B	T6.0V	66	···	···	15.552(0.057)	66	15.275(0.106)	66	15.111(0.136)	66
481	WIS1852+3537	T7.0V	78	···	···	···	···	···	···	···	···

Table 2.2 (continued)

Line	Primary Name	Sp. Type	Ref.	V	Ref.	J	Ref.	H	Ref.	K	Ref.
482	2MA1854+8429	L0.0V	112	···	···	13.663(0.028)	35	13.01(0.03)	35	12.472(0.026)	35
483	WIS1906+4508	T6.0V	78	···	···	···	···	···	···	···	···
484	WIS1906+4011	L1.0V	58	···	···	13.08(∼)	58	12.26(∼)	58	11.77(∼)	58
485	GJ 748.1 A	A7.0V	152	5.124(∼)	72	4.338(0.222)	35	4.264(0.144)	35	4.313(0.018)	35
486	GJ 748.1 B	···	···	···	···	(A+B)	···	(A+B)	···	(A+B)	···
487	GJ 752 A	M3.5V	69	9.115(∼)	79	5.583(0.030)	35	4.929(0.027)	35	4.673(0.020)	35
488	GJ 752 B	M8.0V	81	···	···	···	···	···	···	8.77(∼)	146
489	GJ 758 A	G8.0V	118	6.51(∼)	153	5.369(0.218)	35	4.743(0.096)	35	4.493(0.036)	35
490	GJ 758 B	T8.5-T9	33	···	···	18.57(0.20)	99	19.15(0.20)	99	···	···
491	WIS1928+2356	T6.0V	103	···	···	···	···	···	···	···	···
492	2MA1936-5502	L5.0V	49	···	···	14.486(0.039)	35	13.628(0.035)	35	13.05(0.03)	35
493	GJ 1245 Aa	M6.0V	134	13.41(∼)	151	7.791(0.023)	35	7.194(0.016)	35	6.854(0.016)	35
494	GJ 1245 Ab	(Aa+Ab)	···	(Aa+Ab)	···	(Aa+Ab)	···	(Aa+Ab)	···	(Aa+Ab)	···
495	GJ 1245 B	M6.0V	52	13.99(∼)	126	8.275(0.026)	35	7.728(0.031)	35	7.387(0.018)	35
496	WIS1959-3338	T8.0V	78	···	···	16.866(0.145)	36	16.077(∼)	36	16.227(∼)	36
497	GJ 779 A	G0.0V	61	11.36(∼)	150	4.689(0.206)	35	4.43(0.204)	35	4.388(0.027)	35
498	GJ 779 B	L6.0V	93	···	···	7.465(0.020)	35	6.994(0.036)	35	6.838(0.016)	35
499	WIS2018-7423	T7.0V	78	···	···	···	···	···	···	···	···
500	WIS2019-1148	T8.5±1V	78	···	···	···	···	···	···	···	···
501	GJ 791.2 A	M6.0V	69	13.04(∼)	69	8.228(0.020)	35	7.666(0.036)	35	7.307(0.024)	35
502	GJ 791.2 B	(A+B)	···	(A+B)	···	(A+B)	···	(A+B)	···	(A+B)	···
503	2MA2037-1137	M8.0V	7	···	···	12.272(0.028)	35	11.629(0.022)	35	11.257(0.019)	35
504	GJ 802 Aa	M5.0V	69	14.67(∼)	150	9.563(0.023)	35	9.058(0.019)	35	8.753(0.014)	35
505	GJ 802 Ab	(Aa+Ab)	···	(Aa+Ab)	···	(Aa+Ab)	···	(Aa+Ab)	···	(Aa+Ab)	···
506	GJ 802 B	L5.0-L7.0	68	···	···	14.75(0.27)	68	14.13(0.09)	68	13.61(0.08)	68
507	SDS2047-0718	T0.0V	49	···	···	···	···	···	···	···	···
508	2MA2049-1716	M6.0V	112	···	···	11.814(0.027)	35	11.210(0.023)	35	10.807(0.021)	35
509	WIS2056+1459	Y0.0V	34	···	···	19.23(0.13)	78	19.62(0.31)	78	···	···
510	2MA2057-0252	L1.5V	49	···	···	13.121(0.024)	35	12.268(0.024)	35	11.724(0.025)	35
511	WIS2102-4429	T9.0V	78	···	···	···	···	···	···	···	···
512	2MA2104-1037	L3.0V	7	···	···	13.841(0.029)	35	12.975(0.025)	35	12.369(0.024)	35
513	2MA2116+2238	M6.0V	128	···	···	11.78(0.02)	35	11.30(0.02)	35	10.83(0.02)	35
514	HB88 M18	M8.5V	77	···	···	13.425(0.022)	77	12.768(0.025)	77	12.368(0.029)	77
515	2MA2124+4003	M6.5±0.5V	91	···	···	10.34(0.02)	35	9.74(0.03)	35	9.43(0.03)	35
516	WIS2134-7137	T9.0Vp	78	···	···	···	···	···	···	···	···
517	GJ 836.7 A	G0.0V	114	6.08(∼)	153	4.793(0.035)	35	4.598(0.036)	35	4.559(0.038)	35
518	GJ 836.7 B	T2.5±0.5V	101	···	···	16.70(0.16)	35	15.55(0.11)	35	15.63(0.25)	35

Table 2.2 (continued)

Line	Primary Name	Sp. Type	Ref.	V	Ref.	J	Ref.	H	Ref.	K	Ref.
519	GJ 1263 A	M4.0V	24	12.70(∼)	124	8.36(0.02)	35	7.83(0.03)	35	7.49(0.03)	35
520	GJ 1263 B	T8.5V	88	···	···	18.16(0.02)	24	18.77(0.03)	24	18.85(0.05)	24
521	2MA2151-4853	T4.0V	49	···	···	15.730(0.075)	35	15.168(0.096)	35	15.431(0.184)	35
522	2MA2154+5942	T6.0V	78	···	···	15.66(0.07)	35	15.77(0.17)	35	···	···
523	WIS2157+2659	T7.0V	78	···	···	···	···	···	···	···	···
524	2MA2158+6117	M6.0±0.5V	91	···	···	11.29(0.03)	35	10.78(0.03)	35	10.45(0.02)	35
525	GJ 845 A	K5.0V	149	4.83(∼)	153	2.894(0.292)	35	2.349(0.214)	35	2.237(0.24)	35
526	GJ 845 B	T1.0V	109	···	···	12.29(0.03)	70	11.52(0.03)	70	11.36(0.03)	70
527	GJ 845 C	T6.0V	109	···	···	13.23(0.03)	70	13.21(0.03)	70	13.47(0.03)	70
528	WIS2209-2734	T7.0V	78	···	···	···	···	···	···	···	···
529	WIS2213+0911	T7.0V	78	···	···	···	···	···	···	···	···
530	WIS2220-3628	Y0.0V	78	···	···	20.38(0.17)	78	20.81(0.30)	78	···	···
531	2MA2224-0158	L4.5V	38	···	···	14.073(0.027)	35	12.818(0.026)	35	12.022(0.023)	35
532	WIS2226+0440	T8.0V	78	···	···	···	···	···	···	···	···
533	2MA2228-4310	T6.0V	49	···	···	15.662(0.073)	35	15.363(0.117)	35	15.296(0.206)	35
534	GJ 4281	M6.5V	69	17.14(∼)	150	10.768(0.023)	35	10.217(0.025)	35	9.843(0.021)	35
535	2MA2235+1840	M7.0V	55	···	···	12.39(0.02)	35	11.77(0.02)	35	11.36(0.02)	35
536	WIS2237+7228	T6.0V	78	···	···	15.764(0.073)	37	15.937(0.206)	37	15.990(∼)	37
537	GJ 4287 Aa	K7.0V	108	9.48(∼)	153	6.639(0.02)	35	6.046(0.033)	35	5.872(0.027)	35
538	GJ 4287 Ab	M3.0V	5	···	···	(Aa+Ab)	···	(Aa+Ab)	···	(Aa+Ab)	···
539	GJ 4287 B	M9.5V	135	···	···	13.343(0.022)	35	12.691(0.021)	35	12.178(0.019)	35
540	GJ 866 Aa	M6.0V	129	12.361(0.0027)	84	6.553(0.019)	35	5.954(0.031)	35	5.537(0.020)	35
541	GJ 866 Ab	M6.5±1V	78	15.00(∼)	129	(Aa+Ab+B)	···	(Aa+Ab+B)	···	(Aa+Ab+B)	···
542	GJ 866 B	M5.5±1V	78	13.24(∼)	129	···	···	···	···	···	···
543	2MA2252-1730A	L4.5±1.5V	44	···	···	14.66(0.04)	44	13.73(0.04)	44	13.10(0.03)	44
544	2MA2252-1730B	T3.5±1V	44	···	···	15.36(0.06)	44	14.90(0.07)	44	14.82(0.07)	44
545	WIS2255-3118	T8.0V	78	···	···	···	···	···	···	···	···
546	WIS2301+0216	T6.0V	78	···	···	···	···	···	···	···	···
547	2MA2306-0502	M7.5±0.5V	55	···	···	11.35(0.02)	35	10.72(0.02)	35	10.30(0.02)	35
548	WIS2313-8037	T8.0V	78	···	···	···	···	···	···	···	···
549	WIS2319-1844	T7.5V	78	···	···	···	···	···	···	···	···
550	ULA2321+1354	T7.5V	78	···	···	16.72(0.03)	25	17.15(0.03)	25	17.16(0.03)	25
551	2MA2322-3133	L0.0Vβ	49	···	···	13.577(0.027)	35	12.789(0.023)	35	12.324(0.024)	35
552	WIS2325-4105	T9.0Vp	78	···	···	···	···	···	···	···	···
553	2MA2330-4736	M8.5±0.5V	95	···	···	11.23(0.02)	35	10.64(0.03)	35	10.28(0.02)	35
554	GJ 9829 A	F8.0V	27	6.49(∼)	···	5.488(0.019)	35	5.264(0.038)	35	5.150(0.017)	35
555	GJ 9829 B	M8.0V	27	···	···	12.938(0.024)	35	12.294(0.026)	35	11.954(0.030)	35

Table 2.2 (continued)

Line	Primary Name	Sp. Type	Ref.	V	Ref.	J	Ref.	H	Ref.	K	Ref.
556	GJ 9829 C	L3.0V	27	···	···	(B+C)	···	(B+C)	···	(B+C)	···
557	2MA2331-2749	M7.5V	112	···	···	11.646(0.023)	35	11.055(0.026)	35	10.651(0.026)	35
558	WIS2332-4325	T9.0±1V	78	···	···	···	···	···	···	···	···
559	2MA2337-1250	M7.0V	112	···	···	11.462(0.023)	35	10.830(0.022)	35	10.452(0.021)	35
560	WIS2340-0745	T7.0V	78	···	···	···	···	···	···	···	···
561	GJ 905	M6.0V	69	12.28(∼)	69	6.884(0.026)	35	6.247(0.027)	35	5.929(0.020)	35
562	WIS2342+0856	T6.5V	78	···	···	···	···	···	···	···	···
563	WIS2343-7418	T6.0V	78	···	···	···	···	···	···	···	···
564	WIS2344+1034	T9.0V	78	···	···	···	···	···	···	···	···
565	WIS2348-1028	T7.0V	78	···	···	···	···	···	···	···	···
566	2MA2349+1224	M8.0V	112	···	···	12.601(0.022)	35	11.965(0.020)	35	11.557(0.018)	35
567	2MA2351-2537A	M8.0V	112	···	···	12.471(0.026)	35	11.725(0.022)	35	11.269(0.026)	35
568	2MA2351-2537B	L0.5V	112	···	···	(A+B)	···	(A+B)	···	(A+B)	···
569	2MA2353-0833	M8.5V	112	···	···	13.033(0.026)	35	12.369(0.024)	35	11.932(0.027)	35
570	2MA2354-3316A	M4.0V	51	12.80(∼)	51	9.477(0.024)	35	8.912(0.023)	35	8.612(0.021)	35
571	2MA2354-3316(B)	DAVII	54	···	···	13.985(0.106)	35	13.855(0.249)	35	13.725(0.113)	35
572	2MA2354-3316(C)	M9.0V	132	···	···	13.05(2)	35	12.36(3)	35	11.88(2)	35
573	2MA2356-1553	T6.0V	154	···	···	15.82(0.06)	35	15.630(0.100)	35	15.771(0.183)	35
574	WIS2357+1227	T6.0V	78	···	···	···	···	···	···	···	···

Table 2.2 (continued)

Line	Primary Name	Sp. Type	Ref.	V	Ref.	J	Ref.	H	Ref.	K	Ref.
575	2MA2358-6245	M6.0V	137	···	···	11.39(0.03)	35	10.83(0.02)	35	10.52(0.02)	35
576	WIS2359-7335	T5.5V	49	···	···	···	···	···	···	···	···

$^{(A+B) or (B+C)}$Photometry is a combination of two components.

Note. — Here is the VJHK magnitude data.

References. — (1) Abt [2009]; (2) Allen et al. [2007]; (3) Artigau et al. [2006]; (4) Artigau et al. [2010]; (5) Balega et al. [2005]; (6) Ball et al. [2005]; (7) Berger [2006]; (8) Bergeron et al. [2001]; (9) Bochanski et al. [2011]; (10) Bouy et al. [2004]; (11) Bowler et al. [2010]; (12) Burgasser et al. [2004]; (13) Burgasser et al. [2005a]; (14) Burgasser et al. [2005b]; (15) Burgasser & Putman [2005]; (16) Burgasser et al. [2006a]; (17) Burgasser et al. [2007a]; (18) Burgasser [2007b]; (19) Burgasser [2007a]; (20) Burgasser et al. [2010a]; (21) Burgasser et al. [2010b]; (22) Burgasser et al. [2011a]; (23) Burningham et al. [2008]; (24) Burningham et al. [2009]; (25) Burningham et al. [2010]; (26) Burningham et al. [2011]; (27) Caballero [2007]; (28) Casagrande et al. [2008]; (29) Castro & Gizis [2012]; (30) Chen et al. [2000]; (31) Chiu et al. [2006]; (32) Costa et al. [2006]; (33) Currie et al. [2010]; (34) Cushing et al. [2011]; (35) Cutri et al. [2003]; (36) Cutri & et al. [2012b]; (37) Cutri & et al. [2012a]; (38) Dahn et al. [2002]; (39) Deacon et al. [2011]; (40) Deacon et al. [2012]; (41) Docobo & Andrade [2006]; (42) Doyle & Butler [1990]; (43) Dupuy et al. [2009b]; (44) Dupuy & Liu [2012]; (45) Endl et al. [2006]; (46) Fabricius et al. [2002]; (47) Faherty et al. [2009]; (48) Faherty et al. [2010]; (49) Faherty et al. [2012]; (50) Forveille et al. [1999]; (51) Garcés et al. [2011]; (52) Geballe et al. [2002]; (53) Gelino et al. [2006]; (54) Giammichele et al. [2012]; (55) Gizis et al. [2000]; (56) Gizis et al. [2001]; (57) Gizis et al. [2011a]; (58) Gizis et al. [2011b]; (59) Golimowski et al. [2000]; (60) Golimowski et al. [2004]; (61) Gray et al. [2006]; (62) Hawley et al. [1996]; (63) Henry et al. [1992]; (64) Henry et al. [1999]; (65) Henry et al. [2004]; (66) Henry et al. [2006]; (67) Høg et al. [2000]; (68) Ireland et al. [2008]; (69) Jenkins et al. [2009]; (70) Kasper et al. [2009]; (71) Kharchenko & Roeser [2009]; (72) King et al. [2003]; (73) Kirkpatrick et al. [1991]; (74) Kirkpatrick et al. [1999b]; (75) Kirkpatrick et al. [2000]; (76) Kirkpatrick [2005]; (77) Kirkpatrick et al. [2011]; (78) Kirkpatrick et al. [2012]; (79) Koen et al. [2010]; (80) Konopacky et al. [2010]; (81) Krishnamurthi et al. [1999]; (82) Kürster et al. [2008]; (83) Landolt [1992]; (84) Landolt [2009]; (85) Lane et al. [2001]; (86) Lawler et al. [2009]; (87) Leggett et al. [2002]; (88) Leggett et al. [2010b]; (89) Leggett et al. [2012]; (90) Leinert et al. [2000]; (91) Lépine et al. [2003]; (92) Lépine et al. [2009]; (93) Liu et al. [2002]; (94) Liu et al. [2010]; (95) Lodieu et al. [2005]; (96) Lodieu et al. [2007a]; (97) Lodieu et al. [2007b]; (98) Loutrel et al. [2011]; (99) Lowrance et al. [2000]; (100) Lucas et al. [2010]; (101) Luhman et al. [2007]; (102) Luhman et al. [2012]; (103) Mace et al. [2012]; (104) Marocco et al. [2010]; (105) Marsh & Jarrett [2012]; (106) Martinache et al. [2009]; (107) Mason et al. [1996]; (108) Mason et al. [2001]; (109) McCaughrean et al. [2004]; (110) McLean et al. [2003]; (111) McLean et al. [2011]; (112) McLean et al. [2012]; (113) Metchev et al. [2008]; (114) Montes et al. [2001]; (115) Muzic et al. [2012]; (116) Nakajima et al. [1995]; (117) Oja [1991]; (118) Perryman et al. [1997]; (119) Phan-Bao et al. [2007]; (120) Pilyavsky et al. [2011]; (121) Pinfield et al. [2008]; (122) Pinfield et al. [2012]; (123) Radigan et al. [2008]; (124) Reid et al. [1995]; (125) Reid et al. [1996]; (126) Reid et al. [1997]; (127) Reid et al. [2003a]; (128) Reid et al. [2003b]; (129) Reid et al. [2004]; (130) Reid et al. [2006]; (131) Reid et al. [2007]; (132) Reid et al. [2008]; (133) Rodriguez et al. [2011]; (134) Rojas-Ayala et al. [2012]; (135) Schmidt et al. [2007]; (136) Schneider et al. [2011]; (137) Scholz et al. [2002]; (138) Scholz [2010a]; (139) Shkolnik et al. [2009]; (140) Siegler et al. [2005]; (141) Simon et al. [2006]; (142) Stephens & Leggett [2004]; (143) Stumpf et al. [2009]; (144) Subasavage et al. [2007]; (145) Subasavage et al. [2009]; (146) Tanner et al. [2012]; (147) ten Brummelaar et al. [2000]; (148) Tomkin & Pettersen [1986]; (149) Torres et al. [2006]; (150) van Altena et al. [1995]; (151) van Altena et al. [2001]; (152) van Belle & von Braun [2009]; (153) van Leeuwen [2007]; (154) Vrba et al. [2004]; (155) Warren et al. [2007]; (156) White et al. [1989]; (157) Winters et al. [2011]; (158) Wright et al. [2012]

Table 2.3 Objects Comprising Gliese-Jahreiß Ultracool Systems

Line	Primary Name	α [h]	δ [deg.]	Ref.	Sp. Type	Ref.	d [pc]	meth.	Ref.
1	GJ 1001 A	00 04 36.46	−40 44 02.48	77	M3.5V	10	12.52(0.588)	t	34
2	GJ 1001 B	00 04 34.84	−40 44 05.8x	69	L5.0±0.5V	17	12.52(0.588)	t	[A]
3	GJ 1001 C	00 04 34.84	−40 44 05.8x	[B]	L5.0±0.5V	17	12.52(0.588)	t	[A]
4	GJ 2005 A	00 24 44.19	−27 08 24.24	77	M6.0V	56	7.7095(0.144)	t	34
5	GJ 2005 B	00 24 44.17	−27 08 24.0x	48	M8.5V	48	7.7095(0.144)	t	34
6	GJ 2005 C	00 24 44.19	−27 08 23.6x	48	L0.0V	73	7.7095(0.144)	t	34
7	GJ 27 A	00 39 21.81	+21 15 01.69	77	K0.0V	84	11.06(0.039)	t	85
8	GJ 27 B	00 39 18.91	+21 15 16.8x	19	T7.5±0.5V	51	11.06(0.039)	t	[A]
9	GJ 65 A	01 39 01.53	−17 57 01.86	77	M5.5V	36	2.676(~)	t	60
10	GJ 65 B	01 39 01.53	−17 57 01.86	77	M6.0V	36	2.62(0.04)	t	30
11	GJ 3128	02 02 16.24	+10 20 13.90	77	M6.0V	36	8.93(0.15)	t	26
12	GJ 3146	02 16 29.86	+13 35 12.72	77	M6.0V	64	8.460(0.49)	t	26
13	GJ 1046 A	02 19 10.08	−36 46 41.10	77	M2.5V	29	14.07(0.640)	t	85
14	GJ 1046 B	02 19 10.08	−36 46 41.10	[A]	NOTHING	···	14.07(0.640)	t	[A]
15	GJ 3158	02 28 09.88	+03 10 58.13	77	M6.0V	66	22.2(3.9)	t	26
16	GJ 1048 A	02 36 00.78	−23 31 00.77	77	K3.5Vk	29	21.27(0.43)	t	85
17	GJ 1048 B	02 35 59.93	−23 31 20.5x	13	L1.0V	56	21.27(0.43)	t	[A]
18	GJ 105 Aa	02 36 04.89	+06 53 12.73	77	K3.0V	29	7.1803(0.023)	t	85
19	GJ 105 Ab	02 35 58.8x	+06 52 01.xx	[A]	M7.0V	27	7.2088(~)	t	60
20	GJ 105 B	02 36 15.27	+06 52 18.04	77	M4.5V	36	7.728(0.26)	t	36
21	GJ 3180	02 46 14.92	−04 59 20.56	77	M6.0V	31	16(2.2)	t	26
22	GJ 3181	02 46 34.73	+16 25 10.34	77	M6.0V	36	14.6(0.75)	t	36
23	GJ 3208	03 14 12.47	+28 40 39.51	77	M6.0V	66	15(1.9)	t	26
24	GJ 3252	03 51 00.05	−00 52 00.87	77	M7.5V	56	14.7(0.39)	t	26
25	GJ 164 A	04 12 58.80	+52 36 41.93	77	M4.5V	64	12(1)	t	63
26	GJ 164 B	04 12 58.80	+52 36 41.93	[A]	>M8.5V	52	12(1)	t	63
27	GJ 3276	04 22 14.14	+15 30 52.45	77	M6.0V	70	40.3(5.0)	t	21
28	GJ 3289	04 26 19.92	+03 36 35.98	77	M6.5V	38	17.0(0.52)	t	26
29	GJ 3311	04 46 18.50	+48 44 51.90	77	M6.0V	36	19.2(0.3)	t	36
30	GJ 3351	05 38 12.45	+79 31 19.40	77	M6.0V	64	22.1(0.69)	t	26
31	GJ 229 A	06 10 34.62	−21 51 52.27	77	M1.0V	59	5.7534(0.033)	t	85
32	GJ 229 B	06 10 34.80	−21 52 00.0x	19	T7.0Vp	6	5.7534(0.033)	t	[A]
33	GJ 234 A	06 29 23.40	−02 48 50.32	77	M4.5V	56	4.1268(0.0531)	t	85
34	GJ 234 B	06 29 23.40	−02 48 50.32	77	M8.0V	56	4.1268(0.0531)	t	85
35	GJ 240.1 A	06 46 14.15	+79 33 53.32	77	F7.0V	1	17.87(0.086)	t	85
36	GJ 240.1 B	06 46 14.15	+79 33 53.32	[A]	L9.0±1V	50	17.87(0.086)	t	[A]
37	GJ 268 A	07 10 01.83	+38 31 46.06	77	M4.5V (A+B)	38	6.2945(0.133)	t	85

Table 2.3 (continued)

Line	Primary Name	α [h]	δ [deg.]	Ref.	Sp. Type	Ref.	d [pc]	meth.	Ref.
38	GJ 268 B	07 10 01.83	+38 31 46.06	A	M5.0±1V	81	6.3597(~)	t	60
39	GJ 3444	07 32 01.74	+57 55 43.96	77	M6.0V	36	18(1)	t	36
40	GJ 283 A	07 40 20.78	−17 24 49.19	77	DZAVII	25	9.1083(0.067)	t	79
41	GJ 283 B	07 40 19.36	−17 24 45.96	77	M6.5V	33	9.1017(0.068)	t	79
42	GJ 293.2 A	07 58 04.37	−25 37 35.87	77	K4.0Vk	41	18.51(0.380)	t	85
43	GJ 293.2 B	07 58 04.37	−25 37 35.87	A	T4.5V	14	18.51(0.380)	t	85
44	GJ 3483 A	08 06 53.74	−66 18 16.74	77	DQVII	78	19.17(0.614)	t	79
45	GJ 3483 B	08 06 53.74	−66 18 16.74	A	Y?V	71	19.17(0.614)	t	A
46	GJ 1111	08 29 49.34	+26 46 33.67	77	M6.5V	36	3.626(0.04)	t	83
47	GJ 3504	08 32 30.48	−01 34 38.58	77	M6.0V	33	19.7(0.2)	t	26
48	GJ 316.1	08 40 29.68	+18 24 08.64	77	M6.0V	76	14.1(0.2)	t	83
49	GJ 3517	08 53 36.16	−03 29 32.31	77	M9.0V	36	8.562(0.11)	t	26
50	GJ 1116 A	08 58 15.12	+19 45 47.04	77	M6.0V	72	5.26(0.08)	t	30
51	GJ 1116 B	08 58 15.12	+19 45 47.04	77	M5.5V	64	5.26(0.1)	t	30
52	GJ 337 A	09 12 17.55	+14 59 45.73	77	G8.0V	53	20.32(0.19)	t	34
53	GJ 337 B	09 12 17.55	+14 59 45.73	77	K1.0V	53	20.32(0.19)	t	34
54	GJ 337 C	09 12 14.69	+14 59 39.6x	13	L8.5±1V	17	20.32(0.19)	t	AB
55	GJ 337 D	09 12 14.69	+14 59 39.6x	C	L7.5±2V	17	20.32(0.19)	t	AB
56	GJ 9326 A	10 22 10.56	+41 13 46.31	77	F7.0V	58	39.43(0.48)	t	85
57	GJ 9326 B	10 22 10.56	+41 13 46.31	A	L0.0V	39	39.43(0.48)	t	A
58	GJ 3622	10 48 12.62	−11 20 09.65	77	M7.0V	56	4.52(0.074)	t	26
59	GJ 3624	10 49 03.39	+05 02 22.78	77	M6.0V	64	24.4(1.4)	t	26
60	GJ 406	10 56 28.91	+07 00 53.20	77	M6.0V	36	2.391(0.014)	t	36
61	GJ 412 A	11 05 28.58	+43 31 36.39	77	M2.0V	36	4.8480(0.0235)	t	85
62	GJ 412 B	11 05 30.90	+43 31 18.04	77	M6.0V	87	4.8323(~)	t	60
63	GJ 417 A	11 12 32.35	+35 48 50.69	77	G0.0V	58	21.93(0.21)	t	85
64	GJ 417 B	11 12 25.67	+35 48 13.17	13	L4.5±1V	17	21.93(0.21)	t	A
65	GJ 417 C	11 12 25.68	+35 48 13.19	13	L6.0±1V	17	21.93(0.21)	t	A
66	GJ 423 Aa	11 18 10.94	+31 31 45.39	77	F9.0V	80	8.3675(0.055)	t	34
67	GJ 423 Ab	11 18 10.94	+31 31 45.39	A	M3.0V	4	8.3675(0.055)	t	34
68	GJ 423 Ba	11 18 10.94	+31 31 45.39	77	G2.0V	4	8.3675(0.055)	t	34
69	GJ 423 Bb	11 18 10.94	+31 31 45.39	B	K(late)V	···	8.3675(0.055)	t	34
70	GJ 423 C	11 18 10.94	+31 31 45.39	AB	T8.5V	88	8.3675(0.055)	t	AB
71	GJ 3655 A	11 21 49.19	−13 13 08.54	77	M8.0±0.5V	16	14.59(0.372)	t	34
72	GJ 3655 B	11 21 49.19	−13 13 08.54	A	L7.0±1V	16	14.59(0.372)	t	A
73	GJ 3693	11 53 52.67	+06 59 56.26	77	M8.0V	5	14.2(0.55)	t	57
74	GJ 1159 A	12 29 14.41	+53 32 44.90	77	M4.0V	64	25.1(0.63)	t	67

Table 2.3 (continued)

Line	Primary Name	α [h]	δ [deg.]	Ref.	Sp. Type	Ref.	d [pc]	meth.	Ref.
75	GJ 1159 B	12 29 14.15	+53 33 06.15	77	M6.0V	24	25.1(0.63)	t	A
76	GJ 473 A	12 33 17.41	+09 01 15.72	77	M5.5V	32	4.388(~)	t	60
77	GJ 473 B	12 33 17.41	+09 01 15.72	77	(A+B)	···	4.388(~)	t	60
78	GJ 494 A	13 00 46.58	+12 22 32.61	77	M0.5V	7	11.62(0.200)	t	34
79	GJ 494 B	13 00 46.58	+12 22 32.61	A	M7.0V	45	11.62(0.200)	t	34
80	GJ 494 C	13 00 41.93	+12 21 14.72	2	T8.0±0.5Vp	9	11.62(0.200)	t	34
81	GJ 547 A	14 23 15.29	+01 14 29.65	77	G1.0V	44	17.19(0.16)	t	85
82	GJ 547 B	14 23 15.29	+01 14 29.65	A	T8.0Vp	62	17.19(0.16)	t	85
83	GJ 3849	14 28 43.24	+33 10 39.28	77	M9.0V	56	11(0.16)	t	36
84	GJ 3855	14 30 37.79	+59 43 25.08	77	M6.5V	36	9.681(0.12)	t	26
85	GJ 551/559 A	14 39 36.50	−60 50 02.30	77	G2.0V	82	1.3248(0.00721)	t	85
86	GJ 551/559 B	14 39 35.08	−60 50 13.76	77	K1.0V	82	1.2548(0.04078)	t	85
87	GJ 551/559 C	14 29 42.95	−62 40 46.15	77	M6.0Ve	82	1.2959(0.00437)	t	85
88	GJ 9492 A	14 42 21.57	+66 03 20.66	77	M3.0V	28	10.73(0.150)	t	85
89	GJ 9492 B	14 42 21.75	+66 03 19.8x	19	L0.0V	19	10.73(0.150)	t	A
90	GJ 564 A	14 50 15.81	+23 54 42.64	77	G1.0V	11	18.17(0.11)	t	85
91	GJ 564 B	14 50 16.00	+23 54 41.8x	19	L4.0V	19	18.17(0.11)	t	A
92	GJ 564 C	14 50 16.00	+23 54 41.8x	B	L4.0V	19	18.17(0.11)	t	A
93	GJ 569 A	14 54 29.24	+16 06 03.83	77	M2.0V	41	9.9384(0.126)	t	34
94	GJ 569 Ba	14 54 29.24	+16 06 03.83	77	M8.5V	43	9.9384(0.126)	t	34
95	GJ 569 Bb	14 54 29.24	+16 06 03.83	A	M9.0V	43	9.9384(0.126)	t	34
96	GJ 3877	14 56 38.26	−28 09 48.63	77	M7.0V	36	6.337(0.20)	t	67
97	GJ 570 A	14 57 28.00	−21 24 55.71	77	K4.0V	29	5.8610(0.023)	t	34
98	GJ 570 B	14 57 26.54	−21 24 41.47	77	M1.5V	29	5.8610(0.023)	t	34
99	GJ 570 C	14 57 26.54	−21 24 41.47	B	M3.0V	22	5.8610(0.023)	t	34
100	GJ 570 D	14 57 14.96	−21 21 47.8x	13	T7.5V	47	5.8610(0.023)	t	34
101	GJ 576 A	15 04 53.52	+05 38 17.15	77	K8.0V	41	18.50(0.921)	t	34
102	GJ 576 B	15 04 53.52	+05 38 17.15	A	T6.5±1V	75	18.50(0.921)	t	34
103	GJ 584 A	15 23 12.31	+30 17 16.12	77	G2.0V	37	18.6(0.30)	t	34
104	GJ 584 B	15 23 12.38	+30 17 16.77	77	G0.0V	37	18.6(0.30)	t	34
105	GJ 584 C	15 23 22.63	+30 14 56.2x	13	L8.0V	86	18.6(0.30)	t	AB
106	GJ 618.1 A	16 20 24.78	−04 16 02.31	77	M2.0V	18	33.42(3.00)	t	85
107	GJ 618.1 B	16 20 26.14	−04 16 31.55	13	L2.5±0.5V	70	33.42(3.00)	t	A
108	GJ 643/644 A	16 55 28.76	−08 20 10.92	77	M3.0V	87	6.1954(0.216)	t	85
109	GJ 643/644 Ba	16 55 28.75	−08 20 10.75	77	M2.0V	15	6.1954(0.216)	t	85
110	GJ 643/644 Bb	16 55 28.75	−08 20 10.75	B	M5.0V	15	6.1954(0.216)	t	85
111	GJ 643/644 C	16 55 25.22	−08 19 21.27	77	M3.5V	24	6.7150(0.180)	t	85

Table 2.3 (continued)

Line	Primary Name	α [h]	δ [deg.]	Ref.	Sp. Type	Ref.	d [pc]	meth.	Ref.
112	GJ 643/644 D	16 55 35.25	−08 23 40.7x	77	M7.0V	42	6.4952(~)	t	60
113	GJ 660.1 A	17 12 51.27	−05 07 31.34	77	M1.0V	41	20.00(1.36)	t	34
114	GJ 660.1 B	17 12 51.27	−05 07 31.34	A	M9.0±2V	74	20.00(1.36)	t	A
115	GJ 4029	17 49 59.50	+22 41 06.99	77	M6.0V	65	14.9(1.4)	t	26
116	GJ 4037	17 55 33.43	+58 24 27.53	77	M6.0V	68	21.5(0.46)	t	26
117	GJ 4040 A	17 57 50.96	+46 35 19.11	77	M3.0V	20	14.09(0.369)	t	85
118	GJ 4040 B	17 57 50.96	+46 35 19.11	A	T6.5V	20	14.09(0.369)	t	A
119	GJ 4052 A	18 20 03.93	−09 35 44.60	77	G6.0V	29	37.43(0.97)	t	85
120	GJ 4052 C	18 20 03.93	−09 35 44.60	A	NOTHING	···	37.43(0.97)	t	A
121	GJ 4073	18 43 22.13	+40 40 21.40	77	M8.0V	56	14.1(0.2)	t	26
122	GJ 748.1 A	19 09 09.88	+76 33 37.80	77	A7.0V	84	27.30(0.14)	t	85
123	GJ 748.1 B	19 09 09.88	+76 33 37.80	A	···	···	27.30(0.14)	t	A
124	GJ 752 A	19 16 55.25	+05 10 08.05	77	M3.5V	36	5.8699(0.0345)	t	85
125	GJ 752 B	19 16 55.25	+05 10 08.05	77	M8.0V	42	5.8699(0.0345)	t	A
126	GJ 758 A	19 23 34.01	+33 13 19.08	77	G8.0V	61	15.76(0.087)	t	85
127	GJ 758 B	19 23 34.01	+33 13 19.08	A	T8.5-T9	12	15.76(0.087)	t	85
128	GJ 1245 Aa	19 53 54.49	+44 24 53.25	77	M6.0V	72	4.55(0.02)	t	36
129	GJ 1245 Ab	19 53 54.49	+44 24 53.25	77	(Aa+Ab)	···	4.55(0.02)	t	36
130	GJ 1245 B	19 53 55.15	+44 24 54.13	77	M6.0V	24	4.55(0.02)	t	36
131	GJ 779 A	20 04 06.23	+17 04 12.62	77	G0.0V	29	17.77(0.11)	t	85
132	GJ 779 B	20 04 06.23	+17 04 12.62	A	L6.0V	49	17.77(0.11)	t	A
133	GJ 791.2 A	20 29 48.33	+09 41 20.19	77	M6.0V	36	9.09(0.16)	t	36
134	GJ 791.2 B	20 29 48.33	+09 41 20.19	A	(A+B)	···	9.09(0.16)	t	A
135	GJ 802 Aa	20 43 19.26	+55 20 53.03	77	M5.0V	36	16(1.4)	t	34
136	GJ 802 Ab	20 43 19.26	+55 20 53.03	A	(Aa+Ab)	···	16(1.4)	t	34
137	GJ 802 B	20 43 19.26	+55 20 53.03	AaAb	L5.0-L7.0	35	16(1.4)	t	34
138	GJ 836.7 A	21 44 31.33	+14 46 18.98	77	G0.0V	58	17.89(0.14)	t	85
139	GJ 836.7 B	21 44 28.47	+14 46 07.79	13	T2.5±0.5V	51	17.89(0.14)	t	85
140	GJ 1263 A	21 46 40.44	−00 10 23.69	77	M4.0V	8	12.0(0.56)	t	83
141	GJ 1263 B	21 46 40.44	−00 10 23.69	A	T8.5V	46	12.0(0.56)	t	83
142	GJ 845 A	22 03 21.66	−56 47 09.52	77	K5.0V	82	3.6224(0.0037)	t	85
143	GJ 845 B	22 04 10.52	−56 46 57.7x	13	T1.0V	55	3.6224(0.0037)	t	A
144	GJ 845 C	22 04 10.52	−56 46 57.7x	B	T6.0V	55	3.6224(0.0037)	t	A
145	GJ 4281	22 28 54.37	−13 25 19.44	77	M6.5V	36	11(0.60)	t	36
146	GJ 4287 Aa	22 37 29.90	+39 22 51.59	77	K7.0V	54	19.54(0.619)	t	85
147	GJ 4287 Ab	22 37 29.90	+39 22 51.59	A	M3.0V	3	19.54(0.619)	t	85
148	GJ 4287 B	22 37 32.55	+39 22 39.81	13	M9.5V	73	19.54(0.619)	t	A

Table 2.3 (continued)

Line	Primary Name	α [h]	δ [deg.]	Ref.	Sp. Type	Ref.	d [pc]	meth.	Ref.
149	GJ 866 Aa	22 38 33.59	−15 17 59.26	77	M6.0V	68	3.454(0.052)	t	83
150	GJ 866 Ab	22 38 33.59	−15 17 59.26	77	M6.5±1V	40	3.454(0.052)	t	$\mathrm{A}aAb$
151	GJ 866 B	22 38 33.59	−15 17 59.26	77	M5.5±1V	40	3.454(~)	t	60
152	GJ 9829 A	23 31 31.50	−04 05 14.66	77	F8.0V	10	26.12(0.37)	t	10
153	GJ 9829 B	23 31 01.61	−04 06 19.39	13	M8.0V	10	26.12(0.37)	t	10
154	GJ 9829 C	23 31 01.61	−04 06 19.39	13	L3.0V	10	26.12(0.37)	t	10
155	GJ 905	23 41 55.00	+44 10 38.88	77	M6.0V	36	3.158(0.007)	t	23

^{A}Value of component A or parent adopted.

^{B}Value of component B or parent adopted.

^{C}Value of component C or parent adopted.

Note. — Lines of data are arranged according to a two-level hierarchy: right ascension followed by designation, both in ascending order. Coordinates are predominantly taken from Stauffer et al. [2010]. Coordinates are provided in sexagesimal form and were truncated to two decimal places. For coordinates of lesser precision, an "x" serves as a placeholder.

References. — (1) Abt [2009]; (2) Adelman-McCarthy & et al. [2009]; (3) Balega et al. [2005]; (4) Ball et al. [2005]; (5) Bochanski et al. [2011]; (6) Burgasser et al. [2006a]; (7) Burgasser et al. [2010b]; (8) Burningham et al. [2009]; (9) Burningham et al. [2011]; (10) Caballero [2007]; (11) Chen et al. [2000]; (12) Currie et al. [2010]; (13) Cutri et al. [2003]; (14) Deacon et al. [2011]; (15) Docobo & Andrade [2006]; (16) Dupuy et al. [2009b]; (17) Dupuy & Liu [2012]; (18) Endl et al. [2006]; (19) Faherty et al. [2009]; (20) Faherty et al. [2010]; (21) Faherty et al. [2012]; (22) Forveille et al. [1999]; (23) Gatewood [2008]; (24) Geballe et al. [2002]; (25) Giammichele et al. [2012]; (26) Gliese & Jahreiß [1991]; (27) Golimowski et al. [2000]; (28) Golimowski et al. [2004]; (29) Gray et al. [2006]; (30) Harrington & Dahn [1980]; (31) Hawley et al. [1996]; (32) Henry et al. [1992]; (33) Henry et al. [2004]; (34) Henry [2012]; (35) Ireland et al. [2008]; (36) Jenkins et al. [2009]; (37) Kharchenko & Roeser [2009]; (38) Kirkpatrick et al. [1991]; (39) Kirkpatrick [2005]; (40) Kirkpatrick et al. [2012]; (41) Koen et al. [2010]; (42) Krishnamurthi et al. [1999]; (43) Lane et al. [2001]; (44) Lawler et al. [2009]; (45) Leggett et al. [2002]; (46) Leggett et al. [2010b]; (47) Leggett et al. [2012]; (48) Leinert et al. [2000]; (49) Liu et al. [2002]; (50) Loutrel et al. [2011]; (51) Luhman et al. [2007]; (52) Martinache et al. [2009]; (53) Mason et al. [1996]; (54) Mason et al. [2001]; (55) McCaughrean et al. [2004]; (56) McLean et al. [2012]; (57) Monet et al. [1992]; (58) Montes et al. [2001]; (59) Nakajima et al. [1995]; (60) Oppenheimer et al. [2001]; (61) Perryman et al. [1997]; (62) Pinfield et al. [2012]; (63) Pravdo et al. [2004]; (64) Reid et al. [1995]; (65) Reid et al. [1996]; (66) Reid et al. [1997]; (67) Reid & Cruz [2002]; (68) Reid et al. [2004]; (69) Reid et al. [2006]; (70) Reid et al. [2008]; (71) Rodriguez et al. [2011]; (72) Rojas-Ayala et al. [2012]; (73) Schmidt et al. [2007]; (74) Schneider et al. [2011]; (75) Scholz [2010a]; (76) Shkolnik et al. [2009]; (77) Stauffer et al. [2010]; (78) Subasavage et al. [2007]; (79) Subasavage et al. [2009]; (80) ten Brummelaar et al. [2000]; (81) Tomkin & Pettersen [1986]; (82) Torres et al. [2006]; (83) van Altena et al. [1995]; (84) van Belle & von Braun [2009]; (85) van Leeuwen [2007]; (86) Vrba et al. [2004]; (87) White et al. [1989]; (88) Wright et al. [2012]

Table 2.4 Objects Comprising Nearby non Gliese-Jahreiß Ultracool Systems

Line	Primary Name	α [h]	δ [deg.]	Ref.	Sp. Type	Ref.	d [pc]	meth.	Ref.
1	2MA0000+2554	00 00 13.54	+25 54 18.1x	28	T4.5V	35	14.1(0.38)	t	34
2	WIS0005+3737	00 05 17.48	+37 37 20.53	30	T9.0V	65	7.09(~)	t	53
3	2MA0011+5908	00 11 31.83	+59 08 40.0x	28	M6.5±0.5V	59	9.234(0.119)	t	59
4	2MA0013-0457	00 13 46.59	−04 57 37.2x	28	M6.0V	71	17(~)	ph	71
5	WIS0015-4615	00 15 05.87	−46 15 17.68	30	T8.0V	53	14.9(~)	ph	53
6	2MA0019+4614	00 19 26.26	+46 14 07.81	28	M8.0V	9	19(~)	ph	9
7	2MA0019+5213	00 19 45.79	+52 13 17.95	28	M9.0V	9	19(~)	ph	9
8	2MA0024-0158	00 24 24.63	−01 58 20.14	28	M9.5V	71	13(0.53)	t	49
9	2MA0027+2219A	00 27 55.92	+22 19 32.84	28	M7.0±1V	34	14.4(0.2)	t	34
10	2MA0027+2219B	00 27 55.92	+22 19 32.84	28	M8.0±1V	34	14.4(0.2)	t	34
11	WIS0032-4946	00 32 31.09	−49 46 51.47	30	T8.5V	53	19.3(~)	ph	53
12	2MA0032-4405	00 32 55.84	−44 05 05.87	28	L0.0Vγ	36	26.0(3.3)	t	36
13	ULA0034-0052	00 34 02.77	−00 52 06.78	98	T8.5V	27	12.6(0.60)	t	90
14	2MA0034+0523	00 34 51.57	+05 23 05.10	28	T6.5V	36	9.488(0.68)	t	36
15	2MA0036+1821	00 36 16.17	+18 21 10.47	28	L3.5V	31	8.757(0.061)	t	31
16	WIS0038+2758	00 38 29.05	+27 58 52.15	30	T9.0V	53	11.3(~)	ph	53
17	WIS0040+0900	00 40 24.88	+09 00 54.86	30	T7.0V	53	14.6(~)	ph	53
18	2MA0045+1634	00 45 21.43	+16 34 44.70	28	L3.5V	9	10(~)	ph	9
19	WIS0049+2151	00 49 45.61	+21 51 20.04	30	T8.5V	65	7.41(~)	t	53
20	2MA0050-3322	00 50 19.94	−33 22 40.27	28	T7.0V	53	10.7(~)	ph	53
21	2MA0052-2705	00 52 54.68	−27 05 59.70	28	M8.0V	49	24(2.38)	t	47
22	CFB0059-0114	00 59 10.90	−01 14 01.3x	33	T8.5V	27	9.891(0.24)	t	34
23	2MA0103+1935	01 03 32.04	+19 35 36.2x	28	L6.0Vβ	36	21.3(3.5)	t	36
24	2MA0107+0041	01 07 52.42	+00 41 56.40	28	L5.5V	97	15.59(1.10)	t	47
25	2MA0109-5100	01 09 01.50	−51 00 49.49	28	L2.0V	15	10(~)	ph	15
26	2MA0109+2949	01 09 21.70	+29 49 25.56	28	M9.5V	74	19(~)	ph	74
27	2MA0109-0343	01 09 51.17	−03 43 26.43	28	M9.0V	9	11(~)	ph	9
28	WIS0123+4142	01 23 33.21	+41 42 03.9x	29	T7.0V	53	20.6(~)	ph	53
29	CFB0133+0231	01 33 02.27	+02 31 28.4x	3	T8.5V	53	16.9(~)	ph	53
30	WIS0135+1715	01 35 25.64	+17 15 03.49	30	T6.0V	53	23.7(~)	ph	53
31	2MA0136+0933	01 36 56.62	+09 33 47.3x	28	T2.5V	6	6.41(~)	t	6
32	2MA0140+2701	01 40 02.64	+27 01 50.6x	28	M8.5V	74	19(~)	ph	74
33	2MA0141+1804	01 41 03.21	+18 04 50.2x	28	L4.5V	9	13(~)	ph	9
34	2MA0144-0716	01 44 35.36	−07 16 14.24	28	L5.0V	9	13(~)	ph	9
35	WIS0146+4234	01 46 56.66	+42 34 10.05	30	Y0.0V	53	6.29(~)	t	53
36	WIS0148-7202	01 48 07.25	−72 02 58.8x	29	T9.5V	27	9.2(~)	ph	53
37	2MA0148-3024	01 48 38.64	−30 24 39.64	28	M7.5V	9	18(~)	ph	9

Table 2.4 (continued)

Line	Primary Name	α [h]	δ [deg.]	Ref.	Sp. Type	Ref.	d [pc]	meth.	Ref.
38	2MA0149+2956	01 49 08.95	+29 56 13.19	28	M9.5V	50	22.5(0.36)	t	31
39	ULA0150+1359	01 50 24.37	+13 59 24.0x	55	T7.5V	53	23.0(∼)	ph	53
40	2MA0151+1244	01 51 41.55	+12 44 30.08	28	T1.0V	97	21.40(1.54)	t	47
41	2MA0205-1159A	02 05 29.40	−11 59 29.6x	80	L6.0V	80	19.8(0.586)	t	31
42	2MA0205-1159B	02 05 29.40	−11 59 29.6x	80	L6.0V	80	19.8(0.586)	t	31
43	2MA0213+4444	02 13 28.80	+44 44 45.36	28	L1.5V	9	19(∼)	ph	9
44	WIS0221+3842	02 21 05.94	+38 42 02.9x	29	T6.5V	53	22.4(∼)	ph	53
45	WIS0223-2932	02 23 22.39	−29 32 58.1x	29	T7.5V	53	14.4(∼)	ph	53
46	WIS0241-3653	02 41 24.73	−36 53 28.09	30	T7.0V	53	16.5(∼)	ph	53
47	2MA0243-2453	02 43 13.72	−24 53 29.8x	28	T6.0V	97	10.68(0.414)	t	47
48	WIS0245-3450	02 45 12.62	−34 50 47.84	30	T8.0V	53	17.2(∼)	ph	53
49	WIS0247+3725	02 47 14.52	+37 25 23.57	30	T8.0V	53	17.5(∼)	ph	53
50	2MA0248-1651	02 48 41.00	−16 51 21.68	28	M8.0V	71	16.2(1.42)	t	95
51	2MA0251-0352	02 51 14.90	−03 52 45.94	28	L3.0V	9	12(∼)	ph	9
52	2MA0253+1652	02 53 00.84	+16 52 53.28	28	M6.5V	46	3.8549(0.0578)	t	47
53	WIS0254+0223	02 54 09.45	+02 23 59.1x	29	T8.0V	52	6.06(1.7)	t	52
54	2MA0255-4700	02 55 03.57	−47 00 50.99	28	L7.5V	26	4.9660(0.0959)	t	47
55	WIS0313+7807	03 13 25.96	+78 07 44.3x	29	T8.5V	53	8.6(∼)	ph	53
56	2MA0314+1603	03 14 03.44	+16 03 05.63	28	L0.0V	71	14(∼)	ph	71
57	2MA0318-3421	03 18 54.03	−34 21 29.22	28	L7.0V	36	13.7(1.4)	t	36
58	2MA0320+1854	03 20 59.65	+18 54 23.31	28	M8.0V	49	14.6(0.1)	t	31
59	WIS0323-6025	03 23 37.53	−60 25 54.9x	29	T8.5V	53	13.9(∼)	ph	53
60	WIS0325-3854	03 25 17.69	−38 54 54.11	30	T9.0V	53	15.7(∼)	ph	53
61	WIS0325+0831	03 25 47.72	+08 31 18.22	30	T7.0V	53	11.2(∼)	ph	53
62	2MA0325+0425	03 25 53.22	+04 25 40.7x	28	T5.5V	36	18.0(3.53)	t	36
63	2MA0331-3042	03 31 30.25	−30 42 38.30	28	M7.5V	9	12(∼)	ph	9
64	2MA0334-4953	03 34 12.18	−49 53 32.28	28	M9.0V	36	8.292(0.25)	t	36
65	2MA0335+2342	03 35 02.08	+23 42 35.61	28	M8.5V	9	19(∼)	ph	9
66	WIS0335+4310	03 35 15.01	+43 10 45.14	30	T9.0±2V	53	14.0(∼)	ph	53
67	WIS0336-0143	03 36 05.05	−01 43 50.48	30	T8.0±2V	53	17.0(∼)	ph	53
68	2MA0339-3525	03 39 35.22	−35 25 44.09	28	M9.0V	50	4.965(0.104)	t	95
69	2MA0348-6022	03 48 07.72	−60 22 27.06	28	T7.0V	16	7.81(∼)	t	53
70	WIS0350-5658	03 50 00.32	−56 58 30.23	30	Y1.0V	67	4.20(0.67)	t	67
71	2MA0350+1818	03 50 57.37	+18 18 06.91	28	M8.0V	9	23(∼)	ph	9
72	WIS0359-5401	03 59 34.06	−54 01 54.64	30	Y0.0V	53	13.5(∼)	ph	53
73	WIS0410+1502	04 10 22.72	+15 02 48.6x	29	Y0.0V	27	6.10(0.89)	t	67
74	WIS0413-4750	04 13 58.14	−47 50 39.30	30	T9.0V	53	20.3(∼)	ph	53

Table 2.4 (continued)

Line	Primary Name	α [h]	δ [deg.]	Ref.	Sp. Type	Ref.	d [pc]	meth.	Ref.
75	2MA0415-0935	04 15 19.54	−09 35 06.7x	28	T8.0V	13	5.7359(0.0908)	t	47
76	2MA0417-0800	04 17 37.45	−08 00 00.74	28	M7.5V	9	17(∼)	ph	9
77	2MA0423-0414A	04 23 48.58	−04 14 03.5x	80	L6.0±1V	14	15.17(0.391)	t	47
78	2MA0423-0414B	04 23 48.58	−04 14 03.5x	80	T2.0±1V	14	15.17(0.391)	t	47
79	2MA0429-3123A	04 29 18.42	−31 23 56.8x	80	M7.5±1.5V	88	10(∼)	ph	9
80	2MA0429-3123B	04 29 18.42	−31 23 56.8x	80	L1.0±1.5V	88	10(∼)	ph	A
81	2MA0435-1606	04 35 16.13	−16 06 57.50	28	M7.0V	9	9(∼)	ph	9
82	2MA0439-2353	04 39 01.01	−23 53 08.33	28	L6.5V	36	9.058(0.33)	t	36
83	2MA0440-0530	04 40 23.25	−05 30 08.27	28	M7.0V	9	10(∼)	ph	9
84	2MA0443+0002	04 43 37.61	+00 02 05.18	28	M9.0V	71	16(∼)	ph	71
85	2MA0445-3048	04 45 53.87	−30 48 20.46	28	L2.0V	36	12.7(0.80)	t	36
86	WIS0458+6434A	04 58 53.90	+64 34 52.9x	29	T8.5V	53	11(∼)	ph	22
87	WIS0458+6434B	04 58 53.90	+64 34 52.9x	29	T9.5V	53	11(∼)	ph	22
88	WIS0500-1223	05 00 03.05	−12 23 43.2x	29	T8.0V	53	14.4(∼)	ph	53
89	2MA0501-0010	05 01 24.07	−00 10 45.26	28	L4.0Vγ	36	13.1(0.82)	t	36
90	2MA0510+2714	05 10 20.12	+27 14 03.2x	28	M8.0Ve	59	9.930(0.16)	t	47
91	WIS0513+0608	05 13 17.28	+06 08 14.7x	29	T6.5V	53	13.7(∼)	ph	53
92	2MA0515+5911	05 15 30.94	+59 11 18.5x	28	M7.0V	58	15.2(0.30)	t	47
93	2MA0516-0445	05 16 09.45	−04 45 49.94	28	T5.5V	36	22.5(3.3)	t	36
94	2MA0517-3349	05 17 37.66	−33 49 02.80	28	M8.0V	9	15(∼)	ph	9
95	2MA0518-3101	05 18 11.32	−31 01 53.0x	28	M6.5V	71	20(∼)	ph	71
96	2MA0518-2828A	05 18 59.95	−28 28 37.27	28	L6.0±1V	34	21.1(3.0)	t	36
97	2MA0518-2828B	05 18 59.95	−28 28 37.27	28	T4.0±0.5V	34	21.1(3.0)	t	A
98	2MA0523-1403	05 23 38.22	−14 03 02.29	28	L2.5V	9	13(∼)	ph	9
99	WIS0528-3308	05 28 44.51	−33 08 23.99	30	T7.0Vp	53	17.6(∼)	ph	53
100	2MA0532+8246	05 32 53.46	+82 46 46.5x	28	L7.0VI	35	23.65(0.985)	t	47
101	WIS0535-7500	05 35 16.80	−75 00 24.92	30	≥Y1.0V	53	5.88(1.5)	t	67
102	2MA0539-0059	05 39 52.00	−00 59 01.9x	28	L5.0V	97	13.14(0.375)	t	47
103	WIS0542-1628	05 42 31.27	−16 28 29.14	30	T6.5V	53	15.5(∼)	ph	53
104	2MA0544-2433	05 44 11.50	−24 33 01.83	28	M8.0V	71	19(∼)	ph	71
105	2MA0559-1404	05 59 19.14	−14 04 48.88	28	T5.0V	31	10.34(0.10)	t	47
106	2MA0602+3910	06 02 30.46	+39 10 59.22	28	L1.0V	9	11(∼)	ph	9
107	WIS0607+2429	06 07 38.65	+24 29 53.5x	29	L8.0V	24	7.800(∼)	t	53
108	WIS0612-3036	06 12 13.94	−30 36 12.8x	29	T6.0V	53	19.9(∼)	ph	53
109	WIS0614+3912	06 14 07.49	+39 12 36.4x	29	T6.0V	53	15.4(∼)	ph	53
110	WIS0614+0951	06 14 37.73	+09 51 35.08	30	T7.0V	53	15.8(∼)	ph	53
111	2MA0614+3950	06 14 38.18	+39 50 35.7x	28	L9.0±1V	73	26.1(1.3)	ph	73

Table 2.4 (continued)

Line	Primary Name	α [h]	δ [deg.]	Ref.	Sp. Type	Ref.	d [pc]	meth.	Ref.
112	WIS0623-0456	06 23 09.94	−04 56 24.62	30	T8.0V	53	11.5(∼)	ph	53
113	2MA0624-4521	06 24 45.95	−45 21 54.89	28	L5.0V	36	11.9(0.64)	t	36
114	WIS0625+5646	06 25 42.21	+56 46 25.5x	29	T6.0V	53	20.6(∼)	ph	53
115	WIS0627-1114	06 27 20.07	−11 14 28.9x	29	T6.0V	53	11.4(∼)	ph	53
116	2MA0630-7643A	06 30 46.61	−76 43 09.45	28	M6.0V	81	8.7596(0.142)	t	46
117	2MA0630-7643B	06 30 46.61	−76 43 09.45	A	(A+B)	···	8.7596(0.142)	t	46
118	2MA0641-4322	06 41 18.40	−43 22 32.93	28	L1.5V	82	18.0(1.8)	t	5
119	2MA0652+4710A	06 52 30.73	+47 10 34.83	28	L3.5V	54	11(∼)	ph	9
120	2MA0652+4710B	06 52 30.73	+47 10 34.83	A	L6.5V	54	11(∼)	ph	A
121	UGP0722-0540	072227.87	−054031.1x	64	T9.0V	27	4.119(0.0407)	t	57
122	2MA0700+3157A	07 00 36.64	+31 57 26.69	28	L3.0±1V	34	12(0.297)	t	93
123	2MA0700+3157B	07 00 36.64	+31 57 26.69	28	L6.5±1.5V	34	12(0.297)	t	93
124	2MA0707-4900	07 07 53.27	−49 00 50.36	28	M8.0V	49	16.41(0.813)	t	47
125	2MA0711+4329A	07 11 11.38	+43 29 59.0x	28	M7.0±1V	34	12.9(0.5)	t	47
126	2MA0711+4329B	07 11 11.38	+43 29 59.0x	A	M7.0±1V	34	12.9(0.5)	t	47
127	WIS0713-2917	07 13 22.55	−29 17 51.96	30	Y0.0V	53	7.09(∼)	t	53
128	WIS0723+3403	07 23 12.44	+34 03 13.58	30	T9.0±1V	53	14.0(∼)	ph	53
129	2MA0727+1710	07 27 18.25	+17 10 01.2x	28	T7.0V	97	9.0794(0.193)	t	47
130	2MA0729-3954	07 29 00.02	−39 54 04.40	28	T8.0V	36	7.918(0.52)	t	36
131	WIS0733+7544	07 33 47.94	+75 44 39.25	30	T6.0V	53	24.0(∼)	ph	53
132	WIS0734-7157	07 34 44.02	−71 57 44.05	30	Y0.0V	53	10.7(∼)	ph	53
133	2MA0741+1738	07 41 06.81	+17 38 45.99	28	M7.0V	71	18(∼)	ph	71
134	2MA0742+2055	07 42 01.30	+20 55 19.9x	28	T5.0V	36	15.0(1.9)	t	36
135	WIS0744+5628	07 44 57.15	+56 28 21.9x	29	T8.0V	53	14.5(∼)	ph	53
136	2MA0746+2000A	07 46 42.56	+20 00 32.18	28	L0.5±0.5V	11	12.2(0.045)	t	31
137	2MA0746+2000B	07 46 42.56	+20 00 32.18	28	L1.5±0.5V	11	12.2(0.045)	t	31
138	WIS0750+2725	07 50 03.84	+27 25 44.8x	29	T8.5V	53	15.8(∼)	ph	53
139	WIS0751-7634	07 51 08.79	−76 34 49.7x	29	T9.0V	53	12.0(∼)	ph	53
140	2MA0752+1612	07 52 23.90	+16 12 15.71	28	M7.0V	9	11(∼)	ph	9
141	WIS0759-4904	07 59 46.98	−49 04 54.08	30	T8.0V	53	11.9(∼)	ph	53
142	2MA0805+4812A	08 05 31.90	+48 12 33.1x	28	L4.5V	17	22.9(0.58)	t	34
143	2MA0805+4812B	08 05 31.90	+48 12 33.1x	28	T5.0±0.6V	17	22.9(0.58)	t	34
144	2MA0810+1420	08 10 58.65	+14 20 39.08	28	M9.0V	74	20(∼)	ph	74
145	WIS0811-8051	08 11 17.81	−80 51 41.39	30	T9.5±1V	53	9.8(∼)	ph	53
146	WIS0812+4021	08 12 20.04	+40 21 06.26	30	T8.0V	53	19.5(∼)	ph	53
147	2MA0817-6155	08 17 30.01	−615515.82	28	T6.0V	7	4.93(0.32)	t	7
148	2MA0818+2333	08 18 58.04	+23 33 52.21	28	M7.0V	71	19(∼)	ph	71

Table 2.4 (continued)

Line	Primary Name	α [h]	δ [deg.]	Ref.	Sp. Type	Ref.	d [pc]	meth.	Ref.
149	2MA0825+2115	08 25 19.68	+21 15 52.12	28	L7.5V	31	10.61(0.099)	t	47
150	2MA0828-1309	08 28 34.19	−13 09 19.9x	28	L2.0V	71	14(~)	ph	71
151	2MA0830+4828	08 30 08.25	+48 28 48.29	28	L8.0V	97	13.09(0.587)	t	47
152	2MA0830+0947	08 30 32.56	+09 47 15.40	28	M8.0V	85	15.76(0.276)	t	47
153	2MA0830+0128	08 30 48.78	+01 28 31.15	28	T4.5V	36	23.2(3.3)	t	36
154	2MA0835-0819	08 35 42.56	−08 19 23.75	28	L5.0V	85	8.525(0.814)	t	5
155	WIS0836-1859	08 36 41.12	−18 59 47.2x	29	T8.0Vp	53	22.2(~)	ph	53
156	2MA0838-5855	08 38 02.24	−58 55 58.37	28	M6.0V	99	8.00(~)	t	99
157	2MA0847-1532	08 47 28.73	−15 32 37.22	28	L2.0V	36	13.1(0.60)	t	36
158	WIS0857+5604	08 57 16.25	+56 04 07.6x	29	T8.0V	53	12.9(~)	ph	53
159	2MA0859-1949	08 59 25.47	−19 49 26.89	28	L7.0V	36	15.3(1.4)	t	36
160	2MA0900+2150	09 00 23.59	+21 50 05.43	28	M6.5V	49	6.3747(0.109)	t	46
161	ULA0901-0306	09 01 16.23	−03 06 35.0x	63	T7.5V	62	16.0(0.66)	t	66
162	WIS0906+4735	09 06 49.36	+47 35 38.7x	29	T8.0V	53	15.8(~)	ph	53
163	2MA0909-0658	09 09 57.49	−06 58 18.64	28	L0.0V	4	23.5(2.3)	t	5
164	2MA0920+3517A	09 20 12.24	+35 17 43.0x	28	L6.5V	54	18(3)	ph	60
165	2MA0920+3517B	09 20 12.24	+35 17 43.0x	^{A}	T2.0V	54	18(3)	ph	60
166	2MA0921-2104	09 21 14.10	−21 04 44.60	28	L2.0V	71	12(~)	ph	71
167	2MA0926+5847A	09 26 15.37	+58 47 21.23	28	T3.5±1V	34	21.3(0.73)	t	34
168	2MA0926+5847B	09 26 15.37	+58 47 21.23	^{A}	T5.0±1V	34	21.3(0.73)	t	34
169	WIS0929+0409	09 29 06.77	+04 09 57.93	30	T6.5V	53	19.9(~)	ph	53
170	2MA0929+3429	09 29 33.65	+34 29 52.7x	28	L8.0V	9	22(~)	ph	9
171	2MA0931-1717	09 31 22.29	−17 17 42.5x	28	M6.5V	71	13(~)	ph	71
172	2MA0937+2931	09 37 34.88	+29 31 41.0x	28	T6.0Vp	16	6.124(0.0600)	t	47
173	2MA0939-2448	09 39 35.49	−24 48 27.94	28	T8.0V	16	5.339(0.131)	t	18
174	2MA0949-1545	09 49 08.60	−15 45 48.52	28	T2.0V	36	18.1(2.2)	t	36
175	WIS0952+1955	09 52 59.29	+19 55 07.3x	29	T6.0V	53	22.1(~)	ph	53
176	2MA1004-3335	10 04 39.29	−33 35 18.9x	28	L4.0V	35	18.2(1.9)	t	5
177	2MA1006-1653	10 06 31.97	−16 53 26.64	28	M7.5V	71	16(~)	ph	71
178	2MA1007-4555	10 07 33.69	−45 55 14.71	28	T5.0V	36	14(1.0)	t	36
179	2MA1010-0406	10 10 14.80	−04 06 49.93	28	L7.0V	36	16.7(2.3)	t	36
180	2MA1016+2751	10 16 34.70	+27 51 49.79	28	M8.0V	71	14(~)	ph	71
181	ULA1017+0118	10 17 21.40	+01 18 17.9x	23	T8.0Vp	53	24.4(~)	ph	53
182	WIS1018-2445	10 18 08.05	−24 45 57.7x	29	T8.0V	53	14.6(~)	ph	53
183	WIS1019+6529	10 19 05.63	+65 29 54.2x	29	T6.0V	53	17.4(~)	ph	53
184	2MA1021-0304A	10 21 09.69	−03 04 19.8x	28	T0.0±1V	34	32.6(1.4)	t	34
185	2MA1021-0304B	10 21 09.69	−03 04 19.8x	^{A}	T5.0±0.5V	34	32.6(1.4)	t	34

Table 2.4 (continued)

Line	Primary Name	α [h]	δ [deg.]	Ref.	Sp. Type	Ref.	d [pc]	meth.	Ref.
186	2MA1024+1815	10 24 09.97	+18 15 53.35	28	M8.0V	71	16(∼)	ph	71
187	CFB1028+5654	10 28 41.0x	+56 54 01.xx	83	T8.0V	53	17.8(∼)	ph	53
188	2MA1036-3441	10 36 53.05	−34 41 38.09	28	L6.0V	36	16.3(2.4)	t	36
189	WIS1039-1600	10 39 07.73	−16 00 02.93	30	T7.5V	53	14.5(∼)	ph	53
190	WIS1042-3842	10 42 45.23	−38 42 38.33	30	T8.5V	53	16.3(∼)	ph	53
191	2MA1043+1213	10 43 35.08	+12 13 14.97	28	L7.0V	36	14.6(2.26)	t	36
192	2MA1044+0429	10 44 09.42	+04 29 37.70	28	L7.0V	36	19.5(3.84)	t	36
193	2MA1045-0149	10 45 24.00	−01 49 57.68	28	L1.0V	71	17(∼)	ph	71
194	2MA1047-1815	10 47 31.09	−18 15 57.43	28	L2.5V	71	22(∼)	ph	71
195	2MA1047+2124	10 47 53.85	+21 24 23.5x	28	T6.5V	97	10.56(0.425)	t	47
196	DEN1048-3956	10 48 14.64	−39 56 06.24	28	M8.5V	45	4.0370(0.0253)	t	48
197	2MA1048+0111	10 48 42.81	+01 11 58.07	28	L1.0V	71	15(∼)	ph	71
198	WIS1051-2138	10 51 30.01	−21 38 59.71	30	T9.0±1V	53	12.5(∼)	ph	53
199	2MA1058-1548	10 58 47.87	−15 48 17.23	28	L3.0V	31	17.3(0.300)	t	31
200	2MA1106+0428	11 06 18.97	+04 28 32.71	28	M7.0V	69	20.8(1.3)	t	95
201	2MA1110+0116	11 10 10.01	+01 16 13.09	28	T5.5±0.5V	16	19.2(0.44)	t	34
202	2MA1114-2618	11 14 51.33	−26 18 23.56	28	T7.5V	36	5.656(0.22)	t	36
203	WIS1122+2550	11 22 54.73	+25 50 21.5x	29	T6.0V	53	17.7(∼)	ph	53
204	2MA1124+3808	11 24 04.87	+38 08 05.47	28	M8.5V	71	19(∼)	ph	71
205	WIS1124-0421	11 24 38.12	−04 21 49.76	30	T7.0V	53	15.5(∼)	ph	53
206	2MA1139-3159	11 39 51.14	−31 59 21.50	28	M8.0V	15	20(∼)	ph	15
207	2MA1141-2232	11 41 44.06	−22 32 15.69	28	M7.0V	71	22(∼)	ph	71
208	WIS1150+6302	11 50 13.88	+63 02 40.7x	29	T8.0V	53	10.1(∼)	ph	53
209	2MA1155-3727	11 55 39.52	−37 27 35.06	28	L2.0V	36	9.579(0.43)	t	36
210	2MA1155-2224	11 55 42.86	−22 24 58.60	28	M7.5V	71	10(∼)	ph	71
211	2MA1155+0559	11 55 53.89	+05 59 57.7x	28	L7.5V	36	17.3(3.04)	t	36
212	SDS1157+0611	11 57 00.49	+06 11 05.11	2	T1.5V	36	29.6(12.4)	t	36
213	2MA1203+0015	12 03 58.12	+00 15 50.09	28	L3.0V	71	19(∼)	ph	71
214	2MA1207+0244	12 07 47.17	+02 44 24.93	28	L8.0V	36	22.5(6.16)	t	36
215	2MA1209-1004A	12 09 56.13	−10 04 00.81	28	T3.0±0.5V	60	21.1(4.96)	t	36
216	2MA1209-1004B	12 09 56.13	−10 04 00.81	A	T2.0±0.5V	60	21.1(4.96)	t	A
217	2MA1215-3420	12 15 44.31	−34 20 59.5x	28	T4.5V	36	25.1(5.6)	t	36
218	2MA1217-0311	12 17 11.10	−03 11 13.17	28	T7.5V	97	9.0613(0.483)	t	47
219	WIS1217+1626	12 17 56.91	+16 26 40.2x	29	T9.0V	52	7.09(∼)	t	53
220	2MA1221+0257	12 21 27.70	+02 57 19.86	28	L0.0V	71	19(∼)	ph	71
221	2MA1224-1238	12 24 52.22	−12 38 35.24	28	M9.0V	49	17.1(1.11)	t	95
222	2MA1225-2739A	12 25 54.32	−27 39 46.68	28	T5.5±0.5V	34	13.5(0.630)	t	47

Table 2.4 (continued)

Line	Primary Name	α [h]	δ [deg.]	Ref.	Sp. Type	Ref.	d [pc]	meth.	Ref.
223	2MA1225-2739B	12 25 54.32	−27 39 46.68	A	T8.0±0.5V	34	13.5(0.630)	t	47
224	WIS1225-1013	12 25 58.86	−10 13 45.07	30	T6.0V	53	17.0(~)	ph	53
225	2MA1228-1547A	12 28 15.23	−15 47 34.23	28	L5.5±1V	34	22.3(0.90)	t	34
226	2MA1228-1547B	12 28 15.23	−15 47 34.23	A	L5.5±1V	34	22.3(0.90)	t	34
227	2MA1236-1722	12 36 39.60	−17 22 17.1x	28	M6.0V	71	19(~)	ph	71
228	2MA1237+6526	12 37 39.19	+65 26 14.81	28	T6.5V	72	11.51(0.510)	t	47
229	ULA1238+0953	12 38 28.51	+09 53 51.3x	23	T8.0V	53	24.6(~)	ph	53
230	2MA1239+5515A	12 39 27.27	+55 15 37.2x	28	L5.0±0.5V	51	23.6(1.2)	t	34
231	2MA1239+5515B	12 39 27.27	+55 15 37.2x	A	L6.0$^{+2.5}_{-1.5}$V	51	23.6(1.2)	t	34
232	2MA1246+3148	12 46 51.76	+31 48 10.45	28	M7.5V	71	18(~)	ph	71
233	2MA1250-2121	12 50 52.65	−21 21 13.7x	28	M7.5V	71	11(~)	ph	71
234	2MA1253+4034	12 53 12.40	+40 34 03.84	28	M7.5V	71	17(~)	ph	71
235	2MA1254-0122	12 54 53.93	−01 22 47.49	28	T2.0V	13	12.18(0.236)	t	47
236	2MA1300+1912	13 00 42.55	+19 12 35.47	28	L1.0V	9	14(~)	ph	9
237	ULA1302+1308	13 02 17.21	+13 08 51.2x	56	T8.0V	53	20.1(~)	ph	53
238	2MA1305-2541A	13 05 40.19	−25 41 05.99	28	L2.0±1V	39	18.7(0.696)	t	31
239	2MA1305-2541B	13 05 40.19	−25 41 05.99	28	L3.0p±1.5V	91	18.7(0.696)	t	31
240	2MA1309-2330	13 09 21.85	−23 30 35.05	28	M8.0V	71	13(~)	ph	71
241	WIS1311+0122	13 11 06.24	+01 22 52.4x	29	T9.0±1V	53	13.6(~)	ph	53
242	2MA1314+1320A	13 14 20.39	+13 20 01.2x	28	M7.0V	70	16.7(0.78)	t	59
243	2MA1314+1320B	13 14 20.39	+13 20 01.2x	A	(A+B)	···	16.7(0.78)	t	A
244	ULA1315+0826	13 15 08.42	+08 26 27.4x	75	T7.5V	66	23.4(4.2)	t	66
245	WIS1318-1758	13 18 33.98	−17 58 26.54	30	T9.0±1V	53	10.1(~)	ph	53
246	WIS1320+6034	13 20 04.16	+60 34 26.2x	29	T6.5V	53	17.2(~)	ph	53
247	WIS1322-2340	13 22 33.66	−23 40 17.2x	29	T8.0V	53	10.4(~)	ph	53
248	2MA1326-0038	13 26 29.81	−00 38 31.49	28	L5.5V	35	20.01(2.53)	t	47
249	2MA1332-0441	13 32 24.42	−04 41 12.69	28	M7.5V	71	21(~)	ph	71
250	WIS1335+1130	13 35 53.41	+11 30 04.7x	29	T9.0V	23	10.3(0.34)	t	66
251	2MA1346-3149	13 46 46.08	−31 49 25.8x	28	M6.0V	71	14(~)	ph	71
252	2MA1346-0031	13 46 46.34	−00 31 50.13	28	T6.0V	97	13.75(0.949)	t	47
253	2MA1348-1344A	13 48 07.21	−13 44 32.13	28	M4.5±0.5V	32	21(3)	ph	78
254	2MA1348-1344B	13 48 02.90	−13 44 07.1x	89	T5.5±0.5V	32	24(5)	ph	32
255	2MA1354+0846	13 54 08.76	+08 46 08.35	28	M7.0V	71	17(~)	ph	71
256	2MA1356+4342	13 56 41.48	+43 42 58.77	28	M7.0V	71	16(~)	ph	71
257	2MA1359-4034	13 59 55.10	−40 34 58.26	28	L1.0V	36	15.6(1.3)	t	36
258	2MA1403+3007	14 03 22.32	+30 07 54.75	28	M8.5V	71	19(~)	ph	71
259	2MA1404-3159A	14 04 49.48	−31 59 33.06	28	L9.0±1V	34	25(3.9)	t	36

Table 2.4 (continued)

Line	Primary Name	α [h]	δ [deg.]	Ref.	Sp. Type	Ref.	d [pc]	meth.	Ref.
260	2MA1404-3159B	14 04 49.48	−31 59 33.06	A	T5.0±0.5V	34	25(3.9)	t	A
261	WIS1405+5534	14 05 18.40	+55 34 21.5x	29	Y0.0Vp	27	4.83(0.91)	t	67
262	2MA1411-2119	14 11 21.31	−21 19 50.33	28	M9.0V	71	16(∼)	ph	71
263	2MA1411-4132A	14 11 59.98	−41 32 21.2x	28	M5.0V	46	9.3101(0.132)	t	46
264	2MA1411-4132B	14 11 59.98	−41 32 21.2x	28	L1.0V	46	9.3101(0.132)	t	46
265	2MA1412+1633	14 12 24.49	+16 33 11.53	28	L0.5V	71	25(∼)	ph	71
266	2MA1416+1348A	14 16 24.08	+13 48 26.3x	28	L6.0V	12	8.4(1.9)	ph	12
267	ULA1416+1348(B)	14 16 23.94	+13 48 36.29	87	T7.5V	19	9.099(0.15)	t	34
268	2MA1421+1827	14 21 31.45	+18 27 40.78	28	L0.0V	74	20(∼)	ph	74
269	2MA1428+1356	14 28 04.20	+13 56 13.7x	28	M8.0V	71	10(∼)	ph	71
270	2MA1432+0811	14 32 08.50	+08 11 31.3x	28	M6.0V	71	9(∼)	ph	71
271	WIS1436-1814	14 36 02.19	−18 14 21.8x	29	T8.0Vp	53	18.4(∼)	ph	53
272	2MA1438+6408	14 38 08.29	+64 08 36.38	28	M9.5V	71	18(∼)	ph	71
273	2MA1439+1929	14 39 28.36	+19 29 14.98	28	L1.0V	71	14.4(0.10)	t	31
274	2MA1440+1339	14 40 22.93	+13 39 23.01	28	M8.0V	71	18(∼)	ph	71
275	2MA1444+3002	14 44 17.18	+30 02 14.5x	28	M8.0V	71	13(∼)	ph	71
276	2MA1444-2019	14 44 20.67	−20 19 22.3x	28	M9.0VI	36	16.3(1.4)	t	36
277	SDS1446+0024	14 46 00.59	+00 24 51.91	2	L5.0V	97	21.53(1.51)	t	47
278	WIS1457+5815	14 57 15.03	+58 15 10.27	30	T7.0V	53	16.0(∼)	ph	53
279	2MA1501+2250	15 01 08.18	+22 50 02.04	28	M9.0V	49	10.6(0.067)	t	31
280	2MA1503+2525	15 03 19.61	+25 25 19.68	28	T5.5V	13	6.361(0.089)	t	34
281	SDS1504+1027	15 04 11.64	+10 27 18.4x	1	T7.0V	36	19.0(2.6)	t	36
282	WIS1506+7027	15 06 49.97	+70 27 36.0x	29	T6.0V	67	5.18(0.70)	t	52
283	2MA1506+1321	15 06 54.41	+13 21 06.08	28	L3.0V	71	14(∼)	ph	71
284	2MA1507-2000	15 07 27.79	−20 00 43.18	28	M7.5V	71	14(∼)	ph	71
285	2MA1507-1627	15 07 47.69	−16 27 38.62	28	L5.0V	26	7.2987(0.031)	t	47
286	2MA1510-0241	15 10 16.85	−02 41 07.85	28	M9.0V	49	16.3(1.25)	t	94
287	2MA1511+0607	15 11 14.66	+06 07 43.17	28	T0.0V	36	27.2(4.8)	t	36
288	2MA1515+4847	15 15 00.83	+48 47 41.69	28	L6.0V	9	6(∼)	ph	9
289	2MA1516+3910	15 16 40.73	+39 10 48.7x	28	M6.5V	71	12(∼)	ph	71
290	WIS1517+0529	15 17 21.13	+05 29 29.31	30	T8.0V	53	22.2(∼)	ph	53
291	WIS1519+7009	15 19 06.64	+70 09 31.5x	29	T8.0V	53	15.6(∼)	ph	53
292	2MA1521+5053	15 21 01.03	+50 53 23.02	28	M7.5V	9	16(∼)	ph	9
293	2MA1521+0131	15 21 03.27	+01 31 42.7x	28	T2.0V	36	24.2(4.2)	t	36
294	2MA1526+2043	15 26 14.05	+20 43 41.5x	28	L7.0V	36	20.6(3.7)	t	36
295	2MA1534-2952A	15 34 49.84	−29 52 27.41	28	T5.0±0.5V	60	16.0(0.33)	t	34
296	2MA1534-2952B	15 34 49.84	−29 52 27.41	A	T5.0±0.5V	60	16.0(0.33)	t	34

Table 2.4 (continued)

Line	Primary Name	α [h]	δ [deg.]	Ref.	Sp. Type	Ref.	d [pc]	meth.	Ref.
297	2MA1534-1418	15 34 57.04	−14 18 48.66	28	M7.0V	71	11(~)	ph	71
298	2MA1539-0520	15 39 41.90	−05 20 42.82	28	L3.5V	85	15.5(0.82)	t	5
299	WIS15412250	15 41 51.66	−22 50 25.2x	29	Y0.5V	53	2.85(0.877)	t	52
300	WIS1542+2230	15 42 14.00	+22 30 05.24	30	T9.5V	53	12.6(~)	ph	53
301	WIS1544+5842	15 44 59.27	+58 42 04.56	30	T7.5V	53	23.0(~)	ph	53
302	2MA1546+3749	15 46 05.41	+37 49 45.82	28	M7.5V	71	20(~)	ph	71
303	2MA1546-3325	15 46 27.19	−33 25 11.2x	28	T5.5V	16	11.4(0.25)	t	96
304	2MA1552-2623	15 52 44.60	−26 23 13.4x	28	M6.0V	71	11(~)	ph	71
305	2MA1553+1532A	15 53 02.28	+15 32 36.9x	28	T6.5±0.5V	34	13.3(0.2)	t	34
306	2MA1553+1532B	15 53 02.28	+15 32 36.9x	A	T7.5±0.5V	34	13.3(0.2)	t	34
307	2MA1555-0956	15 55 15.73	−09 56 05.5x	28	L1.0V	71	13(~)	ph	71
308	2MA1606+4054	16 06 33.90	+40 54 21.6x	28	M6.5V	71	12(~)	ph	71
309	WIS1612-3420	16 12 15.95	−34 20 27.1x	29	T6.5V	53	17.0(~)	ph	53
310	2MA1614-0251	16 14 25.20	−02 51 01.0x	28	M6.0V	71	18(~)	ph	71
311	WIS1614+1739	16 14 41.46	+17 39 36.8	29	T9.0V	53	10.0(~)	ph	53
312	2MA1615+1340	16 15 04.13	+13 40 07.93	28	T6.0V	36	14.6(1.4)	t	36
313	2MA1615+3559	16 15 44.17	+35 59 00.5x	28	L3.0V	71	24(~)	ph	71
314	WIS1617+1807	16 17 05.75	+18 07 14.3x	29	T8.0V	53	15.4(~)	ph	53
315	WIS1622-0959	16 22 08.94	−09 59 34.6x	29	T6.0V	53	16.2(~)	ph	53
316	2MA1624+0029	16 24 14.36	+00 29 15.82	28	T6.0V	31	11.08(0.242)	t	47
317	WIS1627+3255	16 27 25.65	+32 55 25.6x	29	T6.0V	53	15.4(~)	ph	53
318	2MA1627+8105	16 27 27.94	+81 05 07.59	28	M9.0V	74	21(~)	ph	74
319	SDS1628+2308	16 28 38.78	+23 08 21.1x	1	T7.0V	25	13.3(0.2)	t	34
320	2MA1630+0818	16 30 22.96	+08 18 22.2x	28	T5.5V	36	21.3(4.59)	t	36
321	2MA1632+1904	16 32 29.11	+19 04 40.71	28	L8.0V	31	15.38(0.419)	t	47
322	2MA1645-1319	16 45 22.11	−13 19 51.7x	28	L1.5V	36	9.099(0.51)	t	36
323	2MA1646+3434	16 46 31.55	+34 34 55.5x	28	M6.5V	78	11.9(0.11)	t	38
324	WIS1647+5632	16 47 15.59	+56 32 08.2x	30	L9.0Vp	52	8.62(2.2)	t	52
325	WIS1653+4444	16 53 11.05	+44 44 23.9x	29	T8.0V	53	12.1(~)	ph	53
326	2MA1658+7027	16 58 03.80	+70 27 01.56	28	L1.0V	31	18.6(0.24)	t	31
327	2MA1705-0516	17 05 48.34	−05 16 46.24	28	L4.0V	35	22.5(6.06)	t	5
328	2MA1707+6439	17 07 18.30	+64 39 33.13	28	M9.0V	74	17(~)	ph	74
329	2MA1707-0558A	17 07 23.43	−05 58 24.92	28	M9.0V	82	17(~)	ph	71
330	2MA1707-0558B	17 07 23.43	−05 58 24.92	A	L3.0V	82	17(~)	ph	71
331	WIS1711+3500	17 11 04.60	+35 00 36.81	30	T8.0V	53	18.5(~)	ph	53
332	2MA1711+4029A	17 11 46.05	+40 29 01.5x	28	M4.5V	78	22.2(4.5)	ph	76
333	2MA1711+4028(B)	17 11 45.59	+40 28 57.8x	28	L5.0±2V	76	20.0(6.3)	ph	76

Table 2.4 (continued)

Line	Primary Name	α [h]	δ [deg.]	Ref.	Sp. Type	Ref.	d [pc]	meth.	Ref.
334	WIS1717+6128	17 17 17.02	+61 28 59.39	30	T8.0V	53	22.3(~)	ph	53
335	2MA1721+3344	17 21 03.90	+33 44 16.04	28	L3.0V	9	15(~)	ph	9
336	WIS1721+1117	17 21 34.46	+11 17 39.49	30	T6.0V	53	19.1(~)	ph	53
337	2MA1728+3948A	17 28 11.50	+39 48 59.31	28	L5V	20	24.10(1.89)	t	47
338	2MA1728+3948B	17 28 11.01	+39 49 34.96	68	L6.5V	20	24.10(1.89)	t	A
339	2MA1731+2721	17 31 29.75	+27 21 23.35	28	L0.0V	71	12(~)	ph	71
340	2MA1735+2634A	17 35 12.96	+26 34 47.54	28	M7.5±0.5V	34	15.0(0.31)	t	34
341	2MA1735+2634B	17 35 12.96	+26 34 47.54	A	L0.0±1V	34	15.0(0.31)	t	34
342	WIS1738+2732	17 38 35.53	+27 32 58.9x	29	Y0.0V	27	9.01(2.9)	t	67
343	WIS1741+2553	17 41 24.26	+25 53 19.5x	29	T9.0V	52	5.68(0.71)	t	67
344	2MA1750-0016	17 50 24.84	−00 16 15.11	28	L5.5V	35	9.217(0.22)	t	5
345	2MA1754+1649	17 54 54.47	+16 49 19.67	28	T5.5V	36	11.4(1.33)	t	36
346	2MA1757+7042	17 57 15.39	+70 42 01.20	28	M7.5V	71	12(~)	ph	71
347	WIS1800+0134	18 00 26.60	+01 34 53.1x	29	L7.5±0.5V	42	8.8(1.0)	ph	42
348	WIS1804+3117	18 04 35.40	+31 17 06.1x	29	T9.5±1V	53	9.2(~)	ph	53
349	2MA1807+5015	18 07 15.93	+50 15 31.68	28	L1.5V	71	15(~)	ph	71
350	WIS1809+3838	18 09 01.07	+38 38 05.42	30	T8.0V	53	22.8(~)	ph	53
351	WIS1812+2721	18 12 10.85	+27 21 44.35	30	T8.5±1V	53	14.4(~)	ph	53
352	WIS1828+2650	18 28 31.08	+26 50 37.8x	29	≥Y2.0V	53	8.20(0.87)	t	8
353	2MA1828-4849	18 28 35.72	−48 49 04.64	28	T5.5V	36	11.9(1.1)	t	36
354	2MA1835+3259	18 35 37.90	+32 59 54.59	28	M8.5V	77	5.666(0.02)	t	77
355	2MA1839+2952	18 39 33.08	+29 52 16.42	28	M6.5V	78	12.6(0.318)	t	59
356	2MA1840+7240	18 40 02.39	+72 40 54.0x	28	M6.5V	79	16.9(0.626)	t	59
357	CE 507	18 43 12.5x	−33 22 30.xx	84	M6.0V	26	15.26(0.585)	t	26
358	2MA1845-6357A	18 45 05.41	−63 57 47.55	28	M8.5V	46	3.854(0.0165)	t	46
359	2MA1845-6357B	18 45 05.47	−63 57 46.3x	10	T6.0V	46	3.8543(0.0165)	t	46
360	WIS1852+3537	18 52 15.78	+35 37 16.3x	29	T7.0V	53	17.0(~)	ph	53
361	2MA1854+8429	18 54 45.97	+84 29 47.09	28	L0.0V	71	23(~)	ph	71
362	WIS1906+4508	19 06 24.75	+45 08 08.2x	29	T6.0V	53	15.8(~)	ph	53
363	WIS1906+4011	19 06 48.48	+40 11 06.9x	29	L1.0V	43	13(~)	ph	43
364	WIS1928+2356	19 28 41.35	+23 56 04.96	30	T6.0V	65	6.99(~)	t	53
365	2MA1936-5502	19 36 01.87	−55 02 32.22	28	L5.0V	36	15.1(1.2)	t	36
366	WIS1959-3338	19 59 05.66	−33 38 33.8x	29	T8.0V	53	11.4(~)	ph	53
367	WIS2018-7423	20 18 24.96	−74 23 25.9x	29	T7.0V	53	14.7(~)	ph	53
368	WIS2019-1148	20 19 20.76	−11 48 07.60	30	T8.5±1V	53	13.0(~)	ph	53
369	2MA2037-1137	20 37 07.15	−11 37 56.98	28	M8.0V	9	17(~)	ph	9
370	SDS2047-0718	20 47 49.59	−07 18 18.26	2	T0.0V	36	20.0(3.2)	t	36

Table 2.4 (continued)

Line	Primary Name	α [h]	δ [deg.]	Ref.	Sp. Type	Ref.	d [pc]	meth.	Ref.
371	2MA2049-1716	20 49 52.72	−17 16 08.4x	28	M6.0V	71	19(~)	ph	71
372	WIS2056+1459	20 56 28.90	+14 59 53.3x	29	Y0.0V	27	5.21(~)	t	53
373	2MA2057-0252	20 57 54.09	−02 52 30.26	28	L1.5V	36	14.3(0.75)	t	36
374	WIS2102-4429	21 02 00.15	−44 29 19.53	30	T9.0V	53	9.5(~)	ph	53
375	2MA2104-1037	21 04 14.91	−10 37 36.99	28	L3.0V	9	17(~)	ph	9
376	2MA2116+2238	21 16 06.30	+22 38 46.3x	28	M6.0V	78	20.65(0.456)	t	38
377	HB88 M18	21 18 30.8x	−45 05 45.xx	44	M8.5V	52	21.4(3.62)	t	95
378	2MA2124+4003	21 24 32.34	+40 04 00.0x	28	M6.5±0.5V	58	14.99(0.297)	t	38
379	WIS2134-7137	21 34 56.73	−71 37 43.6x	29	T9.0Vp	53	13.1(~)	ph	53
380	2MA2151-4853	21 51 38.39	−48 53 54.25	28	T4.0V	36	19.8(2.6)	t	36
381	2MA2154+5942	21 54 33.18	+59 42 18.77	28	T6.0V	53	13.0(~)	ph	53
382	WIS2157+2659	21 57 51.38	+26 59 31.4x	29	T7.0V	53	18.9(~)	ph	53
383	2MA2158+6117	21 58 34.58	+61 17 06.0x	28	M6.0±0.5V	58	16.90(0.617)	t	38
384	WIS2209-2734	22 09 22.10	−27 34 39.5x	29	T7.0V	53	14.1(~)	ph	53
385	WIS2213+0911	22 13 54.69	+09 11 39.4x	29	T7.0V	53	18.0(~)	ph	53
386	WIS2220-3628	22 20 55.32	−36 28 17.50	30	Y0.0V	53	8.13(~)	t	53
387	2MA2224-0158	22 24 43.81	−01 58 52.14	28	L4.5V	31	11.6(0.15)	t	34
388	WIS2226+0440	22 26 23.05	+04 40 03.9x	29	T8.0V	53	13.8(~)	ph	53
389	2MA2228-4310	22 28 28.89	−43 10 26.27	28	T6.0V	36	11(0.79)	t	36
390	2MA2235+1840	22 35 49.06	+18 40 29.88	28	M7.0V	41	22.97(1.87)	t	38
391	WIS2237+7228	22 37 20.39	+72 28 33.88	30	T6.0V	53	14.1(~)	ph	53
392	2MA2252-1730A	22 52 10.73	−17 30 13.46	28	L4.5±1.5V	34	15.8(0.40)	t	34
393	2MA2252-1730B	22 52 10.73	−17 30 13.46	A	T3.5±1V	34	15.8(0.40)	t	34
394	WIS2255-3118	22 55 40.74	−31 18 41.8x	29	T8.0V	53	13.7(~)	ph	53
395	WIS2301+0216	23 01 33.32	+02 16 35.07	30	T6.0V	53	18.6(~)	ph	53
396	2MA2306-0502	23 06 29.28	−05 02 28.59	28	M7.5±0.5V	41	12.11(0.378)	t	26
397	WIS2313-8037	23 13 36.41	−80 37 00.3x	29	T8.0V	53	11.0(~)	ph	53
398	WIS2319-1844	23 19 39.13	−18 44 04.3x	29	T7.5V	53	16.0(~)	ph	53
399	ULA2321+1354	23 21 23.79	+13 54 54.9x	55	T7.5V	53	14.1(~)	ph	53
400	2MA2322-3133	23 22 46.84	−31 33 23.17	28	L0.0Vβ	36	17.1(1.6)	t	36
401	WIS2325-4105	23 25 19.54	−41 05 34.9x	29	T9.0Vp	53	11.5(~)	ph	53
402	2MA2330-4736	23 30 16.12	−47 36 45.93	28	M8.5±0.5V	61	13.75(0.630)	t	26
403	2MA2331-2749	23 31 21.74	−27 49 50.03	28	M7.5V	71	15(~)	ph	71
404	WIS2332-4325	23 32 26.49	−43 25 10.64	30	T9.0±1V	53	14.6(~)	ph	53
405	2MA2337-1250	23 37 38.31	−12 50 27.7x	28	M7.0V	71	19(~)	ph	71
406	WIS2340-0745	23 40 26.62	−07 45 07.2x	29	T7.0V	53	11.6(~)	ph	53
407	WIS2342+0856	23 42 28.98	+08 56 20.21	30	T6.5V	53	15.7(~)	ph	53

Table 2.4 (continued)

Line	Primary Name	α [h]	δ [deg.]	Ref.	Sp. Type	Ref.	d [pc]	meth.	Ref.
408	WIS2343-7418	23 43 51.20	−74 18 47.0x	29	T6.0V	53	14.9(~)	ph	53
409	WIS2344+1034	23 44 46.25	+10 34 15.8x	29	T9.0V	53	14.1(~)	ph	53
410	WIS2348-1028	23 48 41.10	−10 28 44.4x	29	T7.0V	53	16.6(~)	ph	53
411	2MA2349+1224	23 49 48.99	+12 24 38.63	28	M8.0V	71	20(~)	ph	71
412	2MA2351-2537A	23 51 50.44	−25 37 36.71	28	M8.0V	71	18(~)	ph	71
413	2MA2351-2537B	23 51 50.44	−25 37 36.71	^{A}	L0.5V	71	18(~)	ph	71
414	2MA2353-0833	23 53 59.46	−08 33 31.15	28	M8.5V	71	22(~)	ph	71
415	2MA2354-3316A	23 54 01.09	−33 16 24.2x	28	M4.0V	37	22.60(0.909)	t	92
416	2MA2354-3316(B)	23 54 01.07	−33 16 30.8x	28	DAVII	40	23.35(1.31)	t	92
417	2MA2354-3316(C)	23 54 09.28	−33 16 26.63	28	M9.0V	82	22.60(0.909)	t	92
418	2MA2356-1553	23 56 54.77	−15 53 11.1x	28	T6.0V	97	14.50(0.719)	t	47
419	WIS2357+1227	23 57 16.49	+12 27 41.86	30	T6.0V	53	16.8(~)	ph	53
420	2MA2358-6245	23 58 42.86	−62 45 42.4x	28	M6.0V	86	20.84(0.964)	t	26
421	WIS2359-7335	23 59 41.07	−73 35 04.8x	21	T5.5V	36	11.5(0.76)	t	36

^{A}Value of component A or parent adopted.

Note. — Lines of data are arranged according to a two-level hierarchy: right ascension followed by designation, both in ascending order. The majority of these coordinates were sourced from CDS's Simbad service, while the coordinates for WISE objects were obtained from CDS's VizieR service. Coordinates are provided in sexagesimal form and were truncated to two decimal places.

References. — (1) Adelman-McCarthy & et al. [2007]; (2) Adelman-McCarthy et al. [2008]; (3) Albert et al. [2011]; (4) Allen et al. [2007]; (5) Andrei et al. [2011]; (6) Artigau et al. [2006]; (7) Artigau et al. [2010]; (8) Beichman [2012]; (9) Berger [2006]; (10) Biller et al. [2006]; (11) Bouy et al. [2004]; (12) Bowler et al. [2010]; (13) Burgasser et al. [2004]; (14) Burgasser et al. [2005b]; (15) Burgasser & Putman [2005]; (16) Burgasser et al. [2006a]; (17) Burgasser [2007b]; (18) Burgasser et al. [2008]; (19) Burgasser et al. [2010a]; (20) Burgasser et al. [2011a]; (21) Burgasser et al. [2011b]; (22) Burgasser et al. [2012]; (23) Burningham et al. [2008]; (24) Castro & Gizis [2012]; (25) Chiu et al. [2006]; (26) Costa et al. [2006]; (27) Cushing et al. [2011]; (28) Cutri et al. [2003]; (29) Cutri & et al. [2012b]; (30) Cutri & et al. [2012a]; (31) Dahn et al. [2002]; (32) Deacon et al. [2012]; (33) Delorme et al. [2008]; (34) Dupuy & Liu [2012]; (35) Faherty et al. [2009]; (36) Faherty et al. [2012]; (37) Garcés et al. [2011]; (38) Gatewood & Coban [2009]; (39) Gelino et al. [2006]; (40) Giammichele et al. [2012]; (41) Gizis et al. [2000]; (42) Gizis et al. [2011a]; (43) Gizis et al. [2011b]; (44) Hawkins & Bessell [1988]; (45) Henry et al. [2004]; (46) Henry et al. [2006]; (47) Henry [2012]; (48) Jao et al. [2005]; (49) Jenkins et al. [2009]; (50) Kirkpatrick et al. [1999b]; (51) Kirkpatrick et al. [2000]; (52) Kirkpatrick et al. [2011]; (53) Kirkpatrick et al. [2012]; (54) Konopacky et al. [2010]; (55) Leggett et al. [2010b]; (56) Leggett et al. [2010a]; (57) Leggett et al. [2012]; (58) Lépine et al. [2003]; (59) Lépine et al. [2009]; (60) Liu et al. [2010]; (61) Lodieu et al. [2005]; (62) Lodieu et al. [2007a]; (63) Lodieu et al. [2007b]; (64) Lucas et al. [2010]; (65) Mace et al. [2012]; (66) Marocco et al. [2010]; (67) Marsh & Jarrett [2012]; (68) Mason et al. [2001]; (69) McLean et al. [2003]; (70) McLean et al. [2011]; (71) McLean et al. [2012]; (72) Metchev et al. [2008]; (73) Muzic et al. [2012]; (74) Phan-Bao et al. [2007]; (75) Pinfield et al. [2008]; (76) Radigan et al. [2008]; (77) Reid et al. [2003a]; (78) Reid et al. [2003b]; (79) Reid et al. [2004]; (80) Reid et al. [2006]; (81) Reid et al. [2007]; (82) Reid et al. [2008]; (83) Reylé et al. [2010]; (84) Ruiz et al. [2001]; (85) Schmidt et al. [2007]; (86) Scholz et al. [2002]; (87) Scholz [2010b]; (88) Siegler et al. [2005]; (89) Skrutskie et al. [2006]; (90) Smart et al. [2010]; (91) Stumpf et al. [2009]; (92) Subasavage et al. [2009]; (93) Thorstensen & Kirkpatrick [2003]; (94) Tinney et al. [1995]; (95) Tinney [1996]; (96) Tinney et al. [2003]; (97) Vrba et al. [2004]; (98) Warren et al. [2007]; (99) Winters et al. [2011]

Table 2.5 Component Masses and Orbital Elements of Nearby Ultracool Systems

Line	Primary Name	Mass [M$_{Jup}$]	Ref.	M$_{sum}$ [M$_{Jup}$]	Ref.	a$_1$ [au]	Ref.	a$_2$ [au]	Ref.	P$_1$ [yr]	Ref.	P$_2$ [yr]	Ref.
1	GJ 1001 A	270(M)	98	···	···	180(P)	43	1(P)	44	5850	98	3.45	98
2	GJ 1001 B	60(M)	98	···	···	(A,(B,C))	···	(B,C)	···	(A,(B,C))	···	(B,C)	···
3	GJ 1001 C	60(M)	98	···	···	···	···	···	···	···	···	···	···
4	GJ 2005 A	180(10)(D)	54	···	···	8.58(0.17)(T)	54	3.53(0.07)(T)	54	$44.4^{+11.9}_{-2.4}$	54	17.24(0.01)	54
5	GJ 2005 B	81(5)(D)	54	···	···	(A,(B,C))	···	(B,C)	···	(A,(B,C))	A,	(B,C)	···
6	GJ 2005 C	74(4)(D)	54	···	···	···	···	···	···	···	···	···	···
7	2MA0027+2219A	67^{+5}_{-4}(M)	29	127(9)(D)	55	1.94(0.04)(T)	29	···	···	7.31(0.37)	55	···	···
8	2MA0027+2219B	59(4)(M)	29	(A+B)	···	(A,B)	···	···	···	(A,B)	···	···	···
9	GJ 27 A	830(M)	35	···	···	476(6)(P)	67	···	···	···	···	···	···
10	GJ 27 B	53(15)(M)	67	···	···	(A,B)	···	···	···	···	···	···	···
11	GJ 65 A	···	···	···	···	···	···	···	···	···	···	···	···
12	GJ 65 B	···	···	···	···	···	···	···	···	···	···	···	···
13	2MA0205-1159A	···	···	100(D)	8	···	···	···	···	···	···	···	···
14	2MA0205-1159B	···	···	(A+B)	···	···	···	···	···	···	···	···	···
15	GJ 1046 A	417(7)(M)	56	···	···	0.421(0.010)(T)	56	···	···	0.5	56	···	···
16	GJ 1046 B	$47.2^{+64.8}_{-31.6}$(D)	56	···	···	(A,B)	···	···	···	(A,B)	···	···	···
17	GJ 1048 A	880(M)	32	···	···	250(P)	42	···	···	···	···	···	···
18	GJ 1048 B	58-79(M)	42	···	···	(A,B)	···	···	···	···	···	···	···
19	GJ 105 Aa	···	···	···	···	···	···	···	···	36900	98	61.3	98
20	GJ 105 Ab	···	···	···	···	···	···	···	···	((Aa,Ab),C)	···	(Aa,Ab)	···
21	GJ 105 B	···	···	···	···	···	···	···	···	···	···	···	···
22	GJ 164 A	269(21)(D)	69	359(27)(D)	69	1.03(0.03)(P)	85	···	···	2.04(0.03)	85	···	···
23	GJ 164 B	90(7)(D)	69	(A+B)	···	(A,B)	···	···	···	(A,B)	···	···	···
24	2MA0423-0414A	41-65(M)	12	···	···	2.49(0.07)(P)	12	···	···	19	12	···	···

Table 2.5 (continued)

Line	Primary Name	Mass [M_{Jup}]	Ref.	M_{sum} [M_{Jup}]	Ref.	a_1 [au]	Ref.	a_2 [au]	Ref.	P_1 [yr]	Ref.	P_2 [yr]	Ref.
25	2MA0423-0414B	30-53(M)	12	···	···	(A,B)	···	···	···	(A,B)	···	···	···
26	2MA0429-3123A	98^{+10}_{-12}(M)	92	···	···	6(P)	92	···	···	50	92	···	···
27	2MA0429-3123B	83^{+5}_{-19}(M)	92	···	···	(A,B)	···	···	···	(A,B)	···	···	···
28	WIS0458+6434A	···	···	···	···	···	···	···	···	···	···	···	···
29	WIS0458+6434B	···	···	···	···	···	···	···	···	···	···	···	···
30	2MA0518-2828A	4481(M)	12	···	···	1.8(0.5)(P)	12	···	···	10	12	···	···
31	2MA0518-2828B	3278(M)	12	···	···	(A,B)	···	···	···	(A,B)	···	···	···
32	GJ 229 A	···	···	···	···	44(P)	79	···	···	···	···	···	···
33	GJ 229 B	7(M)	59	···	···	(A,B)	···	···	···	···	···	···	···
34	GJ 234 A	···	···	···	···	···	···	···	···	···	···	···	···
35	GJ 234 B	···	···	···	···	···	···	···	···	···	···	···	···
36	2MA0630-7643A	100(M)	49	···	···	7.9(P)	49	···	···	50	49	···	···
37	2MA0630-7643B	100(M)	49	···	···	(A,B)	···	···	···	(A,B)	···	···	···
38	GJ 240.1 A	···	···	···	···	1420(P)	66	···	···	···	···	···	···
39	GJ 240.1 B	67^{+8}_{-20}(M)	66	···	···	(A,B)	···	···	···	···	···	···	···
40	2MA0652+4710A	79(M)	14	···	···	2(P)	14	···	···	10	14	···	···
41	2MA0652+4710B	74(M)	14	···	···	(A,B)	···	···	···	(A,B)	···	···	···
42	2MA0700+3157A	···	···	···	···	···	···	···	···	···	···	···	···
43	2MA0700+3157B	···	···	···	···	···	···	···	···	···	···	···	···
44	GJ 268 A	···	···	···	···	···	···	···	···	···	···	···	···
45	GJ 268 B	···	···	···	···	···	···	···	···	···	···	···	···
46	2MA0711+4329A	100^{+8}_{-12}(M)	29	203^{+26}_{-22}(D)	29	3.70(0.16)(T)	29	···	···	···	···	···	···
47	2MA0711+4329B	98(10)(M)	29	(A+B)	···	(A,B)	···	···	···	···	···	···	···
48	GJ 283 A	···	···	···	···	···	···	···	···	···	···	···	···

Table 2.5 (continued)

Line	Primary Name	Mass [M$_{Jup}$]	Ref.	M$_{sum}$ [M$_{Jup}$]	Ref.	a$_1$ [au]	Ref.	a$_2$ [au]	Ref.	P$_1$ [yr]	Ref.	P$_2$ [yr]	Ref.
49	GJ 283 B	···	···	···	···	···	···	···	···	···	···	···	···
50	2MA0746+2000A	···	···	153^{+17}_{-6}(D)	7	$2.53^{+0.37}_{-0.28}$(T)	7	···	···	$10.543^{2.48}_{-2.10}$	7	···	···
51	2MA0746+2000B	···	···	(A+B)	···	(A,B)	···	···	···	(A,B)	···	···	···
52	GJ 293.2 A	···	···	···	···	1630(P)	23	···	···	···	···	···	···
53	GJ 293.2 B	38(20)(M)	23	···	···	(A,B)	···	···	···	···	···	···	···
54	2MA0805+4812A	69-82(M)	13	···	···	···	···	···	···	···	···	···	···
55	2MA0805+4812B	38-72(M)	13	···	···	···	···	···	···	···	···	···	···
56	GJ 3483 A	610(30)(M)	41	···	···	2500(P)	88	···	···	···	···	···	···
57	GJ 3483 B	6-9(M)	68	···	···	(A,B)	···	···	···	···	···	···	···
58	GJ 1116 A	···	···	···	···	···	···	···	···	···	···	···	···
59	GJ 1116 B	···	···	···	···	···	···	···	···	···	···	···	···
60	GJ 337 A	930(M)	83	···	···	880(P)	11	2.4(T)	70	···	···	2.7	70
61	GJ 337 B	890(M)	83	···	···	((A,B),(C,D))	···	(A,B)	···	···	···	(A,B)	···
62	GJ 337 C	40-74(M)	101	···	···	···	···	11(P)	11	···	···	140-180	11
63	GJ 337 D	40-74(M)	101	···	···	···	···	(C,D)	···	···	···	(C,D)	···
64	2MA0920+3517A	40^{+40}_{-30}(M)	55	112(112)(D)	55	$1.67^{+0.06}_{-0.05}$(T)	28	···	···	6.6(3.3)	55	···	···
65	2MA0920+3517B	40^{+50}_{-30}(M)	55	(A+B)	···	(A,B)	···	···	···	(A,B)	···	···	···
66	2MA0926+5847A	3076(M)	12	···	···	2.6(0.5)(P)	12	···	···	18	12	···	···
67	2MA0926+5847B	3076(M)	12	···	···	(A,B)	···	···	···	(A,B)	···	···	···
68	2MA1021-0304A	2680(M)	12	···	···	5.0(0.7)(P)	12	···	···	50	12	···	···
69	2MA1021-0304B	2278(M)	12	···	···	(A,B)	···	···	···	(A,B)	···	···	···
70	GJ 9326 A	1500(200)(M)	1	···	···	2500(P)	101	···	···	···	···	···	···
71	GJ 9326 B	75-85(M)	76	···	···	(A,B)	···	···	···	···	···	···	···
72	GJ 412 A	···	···	···	···	···	···	···	···	···	···	···	···

Table 2.5 (continued)

Line	Primary Name	Mass [M$_{Jup}$]	Ref.	M$_{sum}$ [M$_{Jup}$]	Ref.	a$_1$ [au]	Ref.	a$_2$ [au]	Ref.	P$_1$ [yr]	Ref.	P$_2$ [yr]	Ref.
73	GJ 412 B	···	···	···	···	···	···	···	···	···	···	···	···
74	GJ 417 A	985(M)	33	···	···	2000(P)	53	1.5(P)	44	79000	98	5.99	98
75	GJ 417 B	···	···	37(16)(M)	53	(A,(B,C))	···	(B,C)	···	(A,(B,C))	···	(B,C)	···
76	GJ 417 C	···	···	(B+C)	···	···	···	···	···	···	···	···	···
77	GJ 423 Aa	1000(M)	38	···	···	4100(P)	103	···	···	1×10^5	103	1.832	46
78	GJ 423 Ab	400(M)	38	···	···	(((Aa,Ab),(Ba,Bb)),C)	···	···	···	(((Aa,Ab),(Ba,Bb)),C)	···	(Aa,Ab)	···
79	GJ 423 Ba	900(M)	38	950(M)	46	···	···	···	···	60	94	0.010898	46
80	GJ 423 Bb	150(M)	38	(Ba+Bb)	···	···	···	···	···	((Aa,Ab),(Ba,Bb))	···	(Ba,Bb)	···
81	GJ 423 C	28-58(M)	103	···	···	···	···	···	···	···	···	···	···
82	GJ 3655 A	$87.9^{+0.7}_{-1.6}$(M)	27	151(14)(D)	55	3.09(0.10)(T)	27	···	···	14.26(0.10)	55	···	···
83	GJ 3655 B	64^{+15}_{-12}(M)	27	(A+B)	···	(A,B)	···	···	···	(A,B)	···	···	···
84	2MA1209-1004A	···	···	···	···	···	···	···	···	···	···	···	···
85	2MA1209-1004B	···	···	···	···	···	···	···	···	···	···	···	···
86	2MA1225-2739A	···	···	···	···	···	···	···	···	···	···	···	···
87	2MA1225-2739B	···	···	···	···	···	···	···	···	···	···	···	···
88	2MA1228-1547A	···	···	141(D)	9	6.4(T)	9	···	···	44.2	9	···	···
89	2MA1228-1547B	···	···	(A+B)	···	(A,B)	···	···	···	(A,B)	···	···	···
90	GJ 1159 A	···	···	···	···	···	···	···	···	···	···	···	···
91	GJ 1159 B	···	···	···	···	···	···	···	···	···	···	···	···
92	GJ 473 A	···	···	···	···	···	···	···	···	···	···	···	···
93	GJ 473 B	···	···	···	···	···	···	···	···	···	···	···	···
94	2MA1239+5515A	···	···	···	···	···	···	···	···	···	···	···	···
95	2MA1239+5515B	···	···	···	···	···	···	···	···	···	···	···	···
96	GJ 494 A	600(M)	58	···	···	1100(P)	16	5.4(P)	5	···	···	14.5	47

Table 2.5 (continued)

Line	Primary Name	Mass [M$_{Jup}$]	Ref.	M$_{sum}$ [M$_{Jup}$]	Ref.	a$_1$ [au]	Ref.	a$_2$ [au]	Ref.	P$_1$ [yr]	Ref.	P$_2$ [yr]	Ref.
97	GJ 494 B	60-90(M)	3	···	···	((A,B),C)	···	(A,B)	···	···	···	(A,B)	···
98	GJ 494 C	5-20(M)	19	···	···	···	···	···	···	···	···	···	···
99	2MA1305-2541A	63(10)(M)	40	177^{+133}_{-55}(D)	95	5.4(P)	62	···	···	38^{+8}_{-6}	95	···	···
100	2MA1305-2541B	58(10)(M)	40	(A+B)	···	(A,B)	···	···	···	(A,B)	···	···	···
101	2MA1314+1320A	···	···	···	···	1.6(P)	74	···	···	···	···	···	···
102	2MA1314+1320B	···	···	···	···	(A,B)	···	···	···	···	···	···	···
103	2MA1348-1344A	···	···	···	···	1400(200)(P)	24	···	···	···	···	···	···
104	2MA1348-1344B	72^{+4}_{-7}(M)	24	···	···	(A,B)	···	···	···	···	···	···	···
105	2MA1404-3159A	···	···	50-80(M)	65	1.7(0.5)(T)	31	···	···	8(4)	31	···	···
106	2MA1404-3159B	···	···	(A+B)	···	(A,B)	···	···	···	(A,B)	···	···	···
107	2MA1411-4132A	130(40)(M)	75	···	···	6(T)	75	···	···	40	75	···	···
108	2MA1411-4132B	70-84(M)	75	···	···	(A,B)	···	···	···	(A,B)	···	···	···
109	2MA1416+1348A	···	···	···	···	89.3(1.5)(P)	31	···	···	···	···	···	···
110	ULA1416+1348(B)	22-47(M)	15	···	···	(A,B)	···	···	···	···	···	···	···
111	GJ 547 A	910(70)(M)	96	···	···	2630(P)	81	···	···	···	···	···	···
112	GJ 547 B	20-50(M)	81	···	···	(A,B)	···	···	···	···	···	···	···
113	GJ 551/559 A	1157(7)(D)	84	···	···	···	···	···	···	8.86×10^5	98	79.91(0.011)	84
114	GJ 551/559 B	978(6)(D)	84	···	···	···	···	···	···	((A,B),C)	···	(A,B)	···
115	GJ 551/559 C	129(6)(M)	91	···	···	···	···	···	···	···	···	···	···
116	2MA1440+1339	···	···	···	···	···	···	···	···	···	···	···	···
117	GJ 9492 A	340(160)(M)	44	···	···	31(P)	37	···	···	100	37	···	···
118	GJ 9492 B	···	···	···	···	(A,B)	···	···	···	(A,B)	···	···	···
119	GJ 564 A	1160(M)	57	···	···	46.5(P)	57	2.26(0.03)(T)	30	···	···	10.28(0.17)	30
120	GJ 564 B	<79(M)	82	114(2)(D)	26	(A,(B,C))	···	(B,C)	···	···	···	(B,C)	···

Table 2.5 (continued)

Line	Primary Name	Mass [M$_{Jup}$]	Ref.	M$_{sum}$ [M$_{Jup}$]	Ref.	a$_1$ [au]	Ref.	a$_2$ [au]	Ref.	P$_1$ [yr]	Ref.	P$_2$ [yr]	Ref.
121	GJ 564 C	<68(M)	82	(B+C)	···	···	···	···	···	···	···	···	···
122	GJ 569 A	370(30)(M)	45	···	···	50(P)	93	0.923(0.018)(T)	29	522	98	2.370(0.002)	55
123	GJ 569 Ba	85(10)(D)	34	121(7)(D)	34	(A,(Ba,Bb))	···	(Ba,Bb)	···	(A,(Ba,Bb)	···	(Ba,Bb)	···
124	GJ 569 Bb	62(7)(D)	34	(Ba+Bb)	···	···	···	···	···	···	···	···	···
125	GJ 570 A	700(M)	10	···	···	1525(15)(P)	10	···	···	40000	10	···	···
126	GJ 570 B	614(7)(D)	36	···	···	(A,D)	···	···	···	((A,(B,C)),D)	···	···	···
127	GJ 570 C	408(5)(D)	36	···	···	1385(15)(P)	10	···	···	···	···	···	···
128	GJ 570 D	31-47(M)	60	···	···	((B,C),D)	···	···	···	···	···	···	···
129	GJ 576 A	···	···	···	···	1230(P)	77	···	···	···	···	···	···
130	GJ 576 B	···	···	···	···	(A,B)	···	···	···	···	···	···	···
131	GJ 584 A	1302(57)(M)	78	···	···	3600(P)	53	···	···	2.13×10^5	98	41.6287	78
132	GJ 584 B	1152(41)(M)	78	···	···	((A,B),C)	···	···	···	((A,B),C)	···	(A,B)	···
133	GJ 584 C	63(16)(M)	53	···	···	···	···	···	···	···	···	···	···
134	2MA1534-2952A	30.1(1.7)(M)	63	63(4)(D)	55	$2.3^{+0.3}_{-0.2}$(T)	63	···	···	$15.1^{+3.1}_{-1.6}$	63	···	···
135	2MA1534-2952B	28.2(1.7)(M)	63	(A+B)	···	(A,B)	···	···	···	(A,B)	···	···	···
136	2MA1553+1532A	2068(M)	12	···	···	3.6(0.7)(P)	12	···	···	45	12	···	···
137	2MA1553+1532B	17-64(M)	12	···	···	(A,B)	···	···	···	(A,B)	···	···	···
138	GJ 618.1 A	700(M)	101	···	···	1000(P)	101	···	···	···	···	···	···
139	GJ 618.1 B	60-79(M)	101	···	···	(A,B)	···	···	···	···	···	···	···
140	GJ 643/644 A	429(29)(D)	71	···	···	···	···	···	···	1.7	100	0.0081191	71
141	GJ 643/644 Ba	352(17)(D)	71	···	···	···	···	···	···	(A,(Ba,Bb))	···	(Ba,Bb)	···
142	GJ 643/644 Bb	318(15)(D)	71	···	···	450(P)	71	···	···	···	···	···	···
143	GJ 643/644 C	200(M)	71	···	···	((A,(Ba,Bb)),C)	···	···	···	···	···	···	···
144	GJ 643/644 D	80(M)	71	···	···	···	···	···	···	···	···	···	···

Table 2.5 (continued)

Line	Primary Name	Mass [M_{Jup}]	Ref.	M_{sum} [M_{Jup}]	Ref.	a_1 [au]	Ref.	a_2 [au]	Ref.	P_1 [yr]	Ref.	P_2 [yr]	Ref.
145	2MA1707-0558A	75-87(M)	73	142-168(M)	73	15(3)(P)	73	···	···	150-300	73	···	···
146	2MA1707-0558B	67-81(M)	73	(A+B)	···	(A,B)	···	···	···	(A,B)	···	···	···
147	2MA1711+4029A	153(32)(M)	86	220(30)(M)	86	135(25)(P)	86	···	···	···	···	···	···
148	2MA1711+4028(B)	69^{+8}_{-16}(M)	86	(A+B)	···	(A,B)	···	···	···	···	···	···	···
149	GJ 660.1 A	···	···	···	···	120(P)	89	···	···	···	···	···	···
150	GJ 660.1 B	79-84(M)	89	···	···	(A,B)	···	···	···	···	···	···	···
151	2MA1728+3948A	79(7)(M)	17	160^{+260}_{-40}(D)	55	5.3(0.8)(T)	55	···	···	31(12)	55	···	···
152	2MA1728+3948B	69(8)(M)	17	(A+B)	···	(A,B)	···	···	···	(A,B)	···	···	···
153	2MA1735+2634A	···	···	···	···	···	···	···	···	···	···	···	···
154	2MA1735+2634B	···	···	···	···	···	···	···	···	···	···	···	···
155	GJ 4040 A	380(M)	32	···	···	2685(P)	32	···	···	···	···	···	···
156	GJ 4040 B	21-37(M)	32	···	···	(A,B)	···	···	···	···	···	···	···
157	GJ 4052 A	1040(20)(M)	80	···	···	2.8373(0.018)(T)	80	···	···	4.79077(0.0016)	80	···	···
158	GJ 4052 C	$30.3^{+9.4}_{-12.2}$(D)	87	···	···	(A,C)	···	···	···	(A,C)	···	···	···
159	2MA1845-6357A	···	···	···	···	4.5(P)	6	···	···	···	···	···	···
160	2MA1845-6357B	25-65(M)	99	···	···	(A,B)	···	···	···	···	···	···	···
161	GJ 748.1 A	1800(100)(M)	39	···	···	0.22(T)	39	···	···	0.07786(0.00003)	39	···	···
162	GJ 748.1 B	≥25(D)	39	···	···	(A,B)	···	···	···	(A,B)	···	···	···
163	GJ 752 A	···	···	···	···	···	···	···	···	···	···	···	···
164	GJ 752 B	···	···	···	···	···	···	···	···	···	···	···	···
165	GJ 758 A	1000(M)	97	···	···	44.8(T)	51	···	···	299	51	···	···
166	GJ 758 B	30-40(M)	51	···	···	(A,B)	···	···	···	(A,B)	···	···	···
167	GJ 1245 Aa	135(22)(D)	48	···	···	···	···	···	···	322	98	15.0	98
168	GJ 1245 Ab	78(14)(D)	48	···	···	···	···	···	···	((Aa,Ab),B)	···	(Aa,Ab)	···

Table 2.5 (continued)

Line	Primary Name	Mass [M$_{Jup}$]	Ref.	M$_{sum}$ [M$_{Jup}$]	Ref.	a$_1$ [au]	Ref.	a$_2$ [au]	Ref.	P$_1$ [yr]	Ref.	P$_2$ [yr]	Ref.
169	GJ 1245 B	···	···	···	···	···	···	···	···	···	···	···	···
170	GJ 779 A	1150(30)(M)	22	···	···	$18.3^{+0.4}_{-0.5}$(T)	22	···	···	73.3	22	···	···
171	GJ 779 B	$68.7^{+2.4}_{-3.1}$(D)	22	···	···	(A,B)	···	···	···	(A,B)	···	···	···
172	GJ 791.2 A	300(6)(D)	4	432(9)(D)	4	0.963(0.007)(T)	4	···	···	1.4731(0.0008)	4	···	···
173	GJ 791.2 B	132(3)(D)	4	(A+B)	···	(A,B)	···	···	···	(A,B)	···	···	···
174	GJ 802 Aa	140(M)	50	293(10)(D)	50	1.32(0.09)(T)	64	···	···	3.023(0.02)	50	0.00217752±8 × 10^{-9}	50
175	GJ 802 Ab	140(M)	50	(Aa+Ab)	···	((Aa,Ab),B)	···	···	···	((Aa,Ab),B)	···	(Aa,Ab)	···
176	GJ 802 B	66(5)(D)	50	···	···	···	···	···	···	···	···	···	···
177	GJ 836.7 A	1000(M)	88	···	···	795(15)(P)	67	···	···	···	···	···	···
178	GJ 836.7 B	22(9)(M)	67	···	···	(A,B)	···	···	···	···	···	···	···
179	GJ 1263 A	280(30)(M)	18	···	···	400(22)(P)	18	···	···	···	···	···	···
180	GJ 1263 B	24-45(M)	61	···	···	(A,B)	···	···	···	···	···	···	···
181	GJ 845 A	···	···	···	···	1459(P)	72	2.43(0.11)(T)	21	62700	98	11.2(0.5)	21
182	GJ 845 B	60-73(M)	52	121(1)(D)	21	(A,(B,C))	···	(B,C)	···	(A,(B,C))	···	(B,C)	···
183	GJ 845 C	47-60(M)	52	(B+C)	···	···	···	···	···	···	···	···	···
184	GJ 4287 Aa	560(M)	2	···	···	···	···	6(T)	2	1.44×10^4	98	16.9	98
185	GJ 4287 Ab	350(M)	2	···	···	···	···	(Aa,Ab)	···	((Aa,Ab),B)	···	(Aa,Ab)	···
186	GJ 4287 B	···	···	···	···	···	···	···	···	···	···	···	···
187	GJ 866 Aa	110(22)(M)	102	352(27)(D)	102	1.19(T)	102	0.03(T)	25	2.2506(0.0033)	102	0.01036691	90
188	GJ 866 Ab	110(22)(M)	102	(Aa+Ab+B)	···	((Aa,Ab),B)	···	(Aa,Ab)	···	((Aa,Ab),B)	···	(Aa,Ab)	···
189	GJ 866 B	115(19)(M)	102	···	···	···	···	···	···	···	···	···	···
190	2MA2252-1730A	···	···	···	···	$2.2^{+0.5}_{-0.2}$(T)	28	···	···	···	···	···	···
191	2MA2252-1730B	···	···	···	···	(A,B)	···	···	···	···	···	···	···
192	GJ 9829 A	1070^{+70}_{-60}(M)	20	···	···	11900(300)(P)	20	15(T)	20	1×10^6	20	146	20

Table 2.5 (continued)

Line	Primary Name	Mass [M$_{Jup}$]	Ref.	M$_{sum}$ [M$_{Jup}$]	Ref.	a$_1$ [au]	Ref.	a$_2$ [au]	Ref.	P$_1$ [yr]	Ref.	P$_2$ [yr]	Ref.
193	GJ 9829 B	92(2)(M)	20	···	···	(A,(B,C))	···	(B,C)	···	(A,(B,C))	···	(B,C)	···
194	GJ 9829 C	75(1)(M)	20	···	···	···	···	···	···	···	···	···	···
195	2MA2351-2537A	···	···	···	···	···	···	···	···	···	···	···	···
196	2MA2351-2537B	···	···	···	···	···	···	···	···	···	···	···	···
197	2MA2354-3316A	···	···	···	···	···	···	···	···	62700	98	1170	98
198	2MA2354-3316(B)	610(30)(M)	41	···	···	···	···	···	···	(A,(B,C))	···	(B,C)	···
199	2MA2354-3316(C)	···	···	···	···	···	···	···	···	···	···	···	···

Table 2.5 (continued)

Line	Primary Name	Mass [M_{Jup}]	Ref.	M_{sum} [M_{Jup}]	Ref.	a_1 [au]	Ref.	a_2 [au]	Ref.	P_1 [yr]	Ref.	P_2 [yr]	Ref.

[A] Value of component A or parent adopted.

[B] Value of component B or parent adopted.

Note. — Here is a list of all the multiple systems that we accounted. When an “(M)” follows an object’s listed mass, it indicates that the mass was derived from a model. When a “(D)” follows an object’s listed mass, it indicates that the mass was derived from orbital elements. When a “(P)” follows an object’s listed separation, it indicates that this is the *projected* separation from the indicated companion; when followed by a “(T)”, it indicates that this is the semi-major axis.

References. — (1) (1) Allende Prieto & Lambert [1999]; (2) Balega et al. [2005]; (3) Baraffe et al. [1998]; (4) Benedict et al. [2000]; (5) Beuzit et al. [2004]; (6) Biller et al. [2006]; (7) Bouy et al. [2004]; (8) Bouy et al. [2005]; (9) Brandner et al. [2004]; (10) Burgasser et al. [2000]; (11) Burgasser et al. [2005a]; (12) Burgasser et al. [2006b]; (13) Burgasser [2007b]; (14) Burgasser et al. [2007b]; (15) Burgasser et al. [2010a]; (16) Burgasser et al. [2010b]; (17) Burgasser et al. [2011a]; (18) Burningham et al. [2009]; (19) Burningham et al. [2011]; (20) Caballero [2007]; (21) Cardoso et al. [2009]; (22) Crepp et al. [2012]; (23) Deacon et al. [2011]; (24) Deacon et al. [2012]; (25) Delfosse et al. [1999]; (26) Dupuy et al. [2009a]; (27) Dupuy et al. [2009b]; (28) Dupuy [2010]; (29) Dupuy et al. [2010]; (30) Dupuy & Liu [2011]; (31) Dupuy & Liu [2012]; (32) Faherty et al. [2010]; (33) Faherty et al. [2011]; (34) Femenía et al. [2011]; (35) Fischer et al. [2003]; (36) Forveille et al. [1999]; (37) Forveille et al. [2004]; (38) Fuhrmann [2008]; (39) Galland et al. [2006]; (40) Gelino et al. [2006]; (41) Giammichele et al. [2012]; (42) Gizis et al. [2001]; (43) Goldman et al. [1999]; (44) Golimowski et al. [2004]; (45) Gorlova et al. [2003]; (46) Heintz [1967]; (47) Heintz [1994]; (48) Henry et al. [1999]; (49) Henry et al. [2006]; (50) Ireland et al. [2008]; (51) Janson et al. [2011]; (52) King et al. [2010]; (53) Kirkpatrick et al. [2001]; (54) Köhler et al. [2012]; (55) Konopacky et al. [2010]; (56) Kürster et al. [2008]; (57) Labadie et al. [2011]; (58) Leggett [1992]; (59) Leggett et al. [2002]; (60) Leggett et al. [2010b]; (61) Leggett et al. [2010a]; (62) Liu & Leggett [2005]; (63) Liu et al. [2008]; (64) Lloyd et al. [2006]; (65) Looper et al. [2008]; (66) Loutrel et al. [2011]; (67) Luhman et al. [2007]; (68) Luhman et al. [2012]; (69) Martinache et al. [2009]; (70) Mason et al. [1996]; (71) Mazeh et al. [2001]; (72) McCaughrean et al. [2004]; (73) McElwain & Burgasser [2006]; (74) McLean et al. [2011]; (75) Montagnier et al. [2006]; (76) Mugrauer et al. [2004]; (77) Murray et al. [2011]; (78) Muterspaugh et al. [2010]; (79) Nakajima et al. [1995]; (80) Pilyavsky et al. [2011]; (81) Pinfield et al. [2012]; (82) Potter et al. [2002]; (83) Pourbaix [2000]; (84) Pourbaix et al. [2002]; (85) Pravdo et al. [2004]; (86) Radigan et al. [2008]; (87) Reffert & Quirrenbach [2011]; (88) Rodriguez et al. [2011]; (89) Schneider et al. [2011]; (90) Ségransan et al. [2000]; (91) Ségransan et al. [2003]; (92) Siegler et al. [2005]; (93) Simon et al. [2006]; (94) Struve [1827]; (95) Stumpf et al. [2009]; (96) Takeda et al. [2007]; (97) Thalmann et al. [2009]; (98) Tokovinin [2008]; (99) Vigan et al. [2012]; (100) Voute [1946]; (101) Wilson et al. [2001]; (102) Woitas et al. [2000]; (103) Wright et al. [2012]

Table 2.6 Statistics

Line		Full	≤25 pc	GJ	Line		Full	≤25 pc	GJ
1	Objects:	576	555	155	18	Star + Brown Dwarf:	33	31	32
2	...With Trig. Distance:	357	337	155	19	Solar Star + Ultracool Dwarf:	20	16	20
3	...With Phot. Distance:	219	218	0	20	Solar Star + Brown Dwarf:	16	15	16
4	Systems:	464	451	79	21	Ultracool Field:	377	372	28
5	Multiple Systems (≥2):	87	79	51	22	Ultracool Field Unspecified:	201	199	28
6	Stars:	74	68	65	23	M Dwarfs (≥M6):	162	159	54
7	Solar Stars:	21	18	21	24	L Dwarfs:	126	121	19
8	Ultracool Dwarfs:	511	496	95	25	T Dwarfs:	200	195	14
9	...With Trig. Distance:	294	280	95	26	Y Dwarfs:	12	12	1
10	...With Phot. Distance:	217	216	0	27	Ultracool Binaries:	43	41	12
11	Ultracool Stars:	12	12	7	28	...M+M (≥M6):	4	4	2
12	Ultracool Unspecified:	229	225	40	29	...L+L:	12	12	4
13	Brown Dwarfs:	248	241	35	30	...T+T:	8	7	1
14	...With Trig. Distance:	133	126	35	31	Brown Dwarf Binaries:	21	20	6
15	...With Phot. Distance:	115	115	0	32	Ultracool Companions:	96	88	61
16	Brown Dwarf Candidates:	22	18	13	33	Brown Dwarf Companions:	57	54	35
17	Star + Ultracool Dwarf:	63	56	56	···	···	···	···	···

Note. — To be sure, these are not statistics of the local volume, per se; rather, these are statistics of the compilation catalog, which represents an attempt to account for all known ultracool dwarfs in the local volume. The "stars" statistic is a mix of stellar ultracool dwarfs and earlier types. The compilation catalog has the following meta-stats: row count of 576 rows; datum count of 12613 ; and reference count of 248 .

CHAPTER 3

THE DWARFS

3.1 Methodology

By conducting an intense literature search with the online tools provided by dwarfarchives.org, the Strasbourg Astronomical Data Center,[1] and NASA's Astrophysics Data System,[2] I was able to construct a tabular compilation of 464 ultracool systems and 576 individual objects. Motivated by the need for a clear picture of ultracool systems within a 25 pc radius, I constructed this compilation to aid those endeavoring to answer the remaining riddles of substellar formation and evolution. Because this compilation involves such a wide variety of sources with data recovered both manually and automatically, I had to be very careful not to include duplicate objects. As well, I also tried to include the most up-to-date data available. For each object, I included up to three designations; J2000 coordinates; JHK photometry where applicable; trigonometric parallaxes and distances[3]; dynamic and/or model masses; "maps;" first-order and, where applicable, second-order separations and periods; and all the associated references.

Inspired by the work of Evans [1968], Hartkopf & Mason [2004], Tokovinin [2006], and van den Berk et al. [2007], I developed a unique "address" and "profile" for each

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[1] Center de Donnes Astronomiques de Strasbourg (CDS): `http://cds.u-strasbg.fr`

[2] `http://adsabs.harvard.edu/abstract_service.html`

[3] For 219 of the accounted objects, there is no known trigonometric distance; a photometric distance is included.

object: both quantities served to aid in the calculation of statistics while simultaneously serving as short summaries of the object/system in question. The object address acts as a unique study-internal designation that conveys an object's system membership and orbital relationship. The object address is formatted as follows: a study-internal acronym, CRAT[4]; followed by system number (XXX), ranked by increasing right ascension; and ending with system hierarchy location (Y0.Y1.Y2.Y3). The basic form is as follows:

$$\mathrm{CRATXXX} :: \mathrm{Y0.Y1.Y2.Y3}$$

The system hierarchy location is four places long as the first place (Y0) marks the "root" of the tree and each subsequent place marks the membership within the hierarchical level in question. For example, the three-level hierarchical quintuple CRAT356, otherwise known as GJ 643/644, is the most complex system accounted for in this study (Table 3.1). This is visualized in the tree diagram of Figure 3.1.

The so-called profile of an object consists of a seven-symbol long place-value structure that encodes several characteristics about an object to facilitate the computation of project statistics. Let's consider the hierarchical triple system GJ 564. A cursory glance at Table 3.2 allows one to determine from the respective object profile that the primary, GJ 564 A, is a solar type star and that it is accompanied by a binary brown dwarf subsystem. The content of the profile was determined by answering a series of questions pertaining to the known or suspected nature of the object in question (see details in Appendix C).

Before these questions can be adequately addressed, one needs to be sure of their terms. Determining whether or not an object is an *ultracool dwarf* is simple enough: its spectral

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[4] The names **C**hristopher **R**amos and **A**ngelle **T**anner form the basis of the acronym.

type needs to be ≥ M6. Determining whether or not to label an object as a *brown dwarf* is not as clearcut; however, objects in the field with with spectral types ≥ T0 are assumed to be substellar in nature as theory indicates that no star can exist in this temperature regime [below ~1300 K; Kirkpatrick et al. 1999b; Kirkpatrick 2005]. Solitary M and L dwarfs suffer from the mass-age-luminosity degeneracy mentioned earlier (section 2.2), so it is problematic to derive the mass of these objects from models and impossible to determine the true mass; I generally labeled such objects as ultracool[5] with its stellar/substellar unspecified. Low mass components to binary systems with a median mass below the canonical substellar limit [~0.08 $M_{\odot}$; Burrows et al. 2001] were generally declared by the author as such. Low mass components with a median mass above the canonical limit, but an uncertainty range that overlaps this limit were generally labeled as *brown dwarf candidates*.

As stated earlier, my compilation consists of the following data types: object designations, equatorial coordinates in sexagesimal form (hhmmss.ss±ddmmss.ss), spectral type, VJHK photometry, trigonometric parallax or photometric distance, dynamic or model masses for objects and systems, and first order and/or second order separations and periods. I chose to include up to three designations for each object in order to limit confusion: often the set of designations ascribed to a newly discovered companion does not fully overlap that of the primary. Radial velocity measurements or angular separations may be used to determine a binary object's mass ratio; however, parallactic distances are required to determine the true masses of binary components. Thus, it is critical that theorists have on hand the most accurate and precise parallaxes available.

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[5] As this study focused on brown dwarfs

3.2 Statistics and Comparisons

In Table 2.6, several statistics generated during the development of this compilation are listed. I divided these statistics according to three[6] categories: pertaining to the full[7] sample;[8] pertaining to systems within 25 pc (96% of full sample); and pertaining to Gliese systems (27% of full sample). With a total of 576 objects comprising 464 nearby ultracool systems (555 objects comprising 451 systems within 25 pc), of greatest interest are the 87 multiple systems. To be clear, these statistics describe this compilation and not the local volume, per se; however, this compilation represents an attempt to account for all nearby ultracool dwarfs.

Burgasser et al. [2007b] reviewed the relevance of multiple systems to resolving the debate over very low mass (VLM) system formation and evolution. Their review finds that VLM binaries show the following distinct characteristics as compared to other systems: they are rarer than higher mass binaries, $f_{bin} \approx 10 - 30\%$; more closely separated, 93% have $\Delta < 20$ AU and peak at Δ ~3-10 AU; and more frequently with near equal mass, ~77% have $q \geq 0.8$. They were careful to mention that selection effects (e.g.: magnitude sensitivity limitations and undetected binarity) skew these statistics, though they can be "corrected" by making assumptions about the expected distributions.

In Figure 3.2, the colder end likely drops off due to difficulty in detecting such objects; Kirkpatrick et al. [2012] suggested that objects colder than ~200 K could not yet be detected;

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[6] Recall that not all Gliese systems are within 25 pc (the working definition of "nearby") of Sol and that the *GJ* sample [Stauffer et al. 2010] does not include all known nearby objects.

[7] That's Gliese systems and all other nearby ultracool systems.

[8] It's important to note here that the sub-samples used for Figure 3.2, Figure 3.3, Figure 3.4, and Figure 3.5 are sometimes smaller than the parent sample would suggest due to missing data.

objects earlier than M6 were not relevant to the study. The valley between M dwarfs and late-T dwarfs is not yet understood, though suggestive.

I found that about 17% (86/511) of the ultracool dwarfs and about 17% (42/248) of the brown dwarfs in this sample is a component of a binary system; both are consistent with Burgasser et al. [2007b]. I also found that the average separation between ultracool dwarf binary components in my sample is 2.99±3.51 AU; 2.80±1.93 AU is the average separation of brown dwarf binary components. Assuming a log-normal distribution, I found that both the separation between ultracool dwarf binary components and the separation between brown dwarf binary components in my sample peaks at ~3 AU; this is also consistent with Burgasser et al. [2007b] and Whitworth et al. [2007]. I found that 96.875% of ultracool binaries are separated by 20 AU or less (all of the brown dwarf binaries in my sample meet this condition), which is consistent with Burgasser et al. [2007b] (see Table 3.3). I also found that the shape of my binary ratio histogram qualitatively matches that found in Burgasser et al. [2007b]: the distribution of ultracool dwarfs and brown dwarf binaries peaks near unity (see Figure 3.4). There is a bias on the lower end of the mass ratio spectrum due in part to the difficulty of detecting low-mass companions. Figure 3.5 shows that the ultracool dwarf and brown dwarf binaries in my sample tend towards equal mass and small separations.

Kirkpatrick et al. [2012] compiled an 8 pc sample, including the newly classified "Y dwarfs". They were careful to mention that statistics for T and Y dwarfs are incomplete due in part to the sensitivity limitations of the Wide-field Infrared Survey Explorer (WISE). They concluded that there are 3 L dwarfs, ≥22 T dwarfs, and ≥8 Y dwarfs within 8 pc of Sol.

My compilation accounts for 5 L dwarfs, 22 T dwarfs, and the 8 newly discovered Y dwarfs. Kirkpatrick et al. [2012] listed GJ 2005 C as an M9V dwarf, citing Reiners et al. [2007]. GJ 2005 C is listed as a L0V dwarf in Schmidt et al. [2007]; they cited a 2006 private communication with C. Leinert. Kirkpatrick et al. [2012] did not include the L6V dwarf 2MASS J15150083+4847416 that was given a photometric distance of ~6 pc by Berger [2006].

Table 3.1 The Hierarchical Quintuple System GJ 643/644

Address	Name 1	Name 2
CRAT356::1.1.1.0	GJ 643/644 A	GJ 644 A
CRAT356::1.1.2.1	GJ 643/644 Ba	GJ 644 Ba
CRAT356::1.1.2.2	GJ 643/644 Bb	GJ 644 Bb
CRAT356::1.2.0.0	GJ 643/644 C	GJ 643 (C)
CRAT356::1.3.0.0	GJ 643/644 D	GJ 644 C (D)

Table 3.2 The Hierarchical Triple System GJ 564

Object	Profile
GJ 564 A	$$.ee.st.so.0.0.0
GJ 564 B	bi.co.uc.bd.1.1.1
GJ 564 C	ee.co.uc.bd.1.1.1

Table 3.3 Quick Ultracool Dwarf Separations Statistics

	a_{UCD}	a_{BD}
Δ ~20	96.875%	100%
Δ ~10	87.5%	94.11%
Δ ~5	68.75%	70.58%
Δ_{mean}	2.99±3.51 AU	2.80±1.93 AU

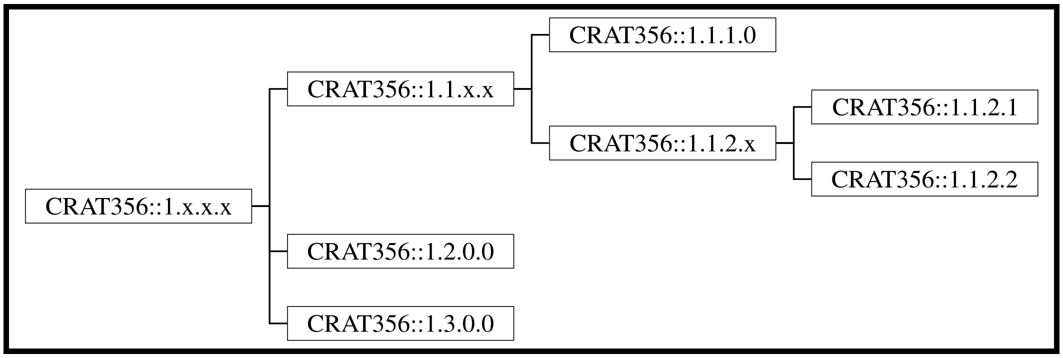

Figure 3.1 GJ 643/644 Tree Diagram

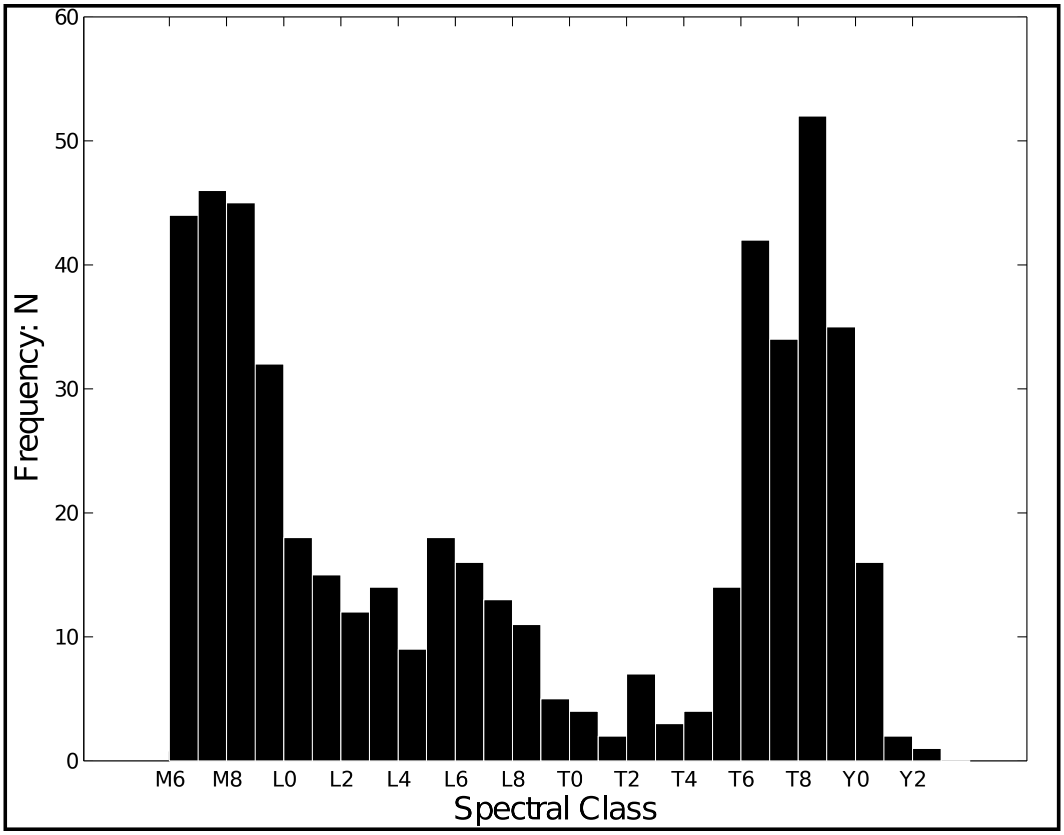

Figure 3.2 The Spectral Class Distribution of Ultracool Dwarfs: M6–Y2

Distribution of ultracool dwarfs from M6 to Y2 (warmer to colder). Spectral types are rounded to the nearest whole number.

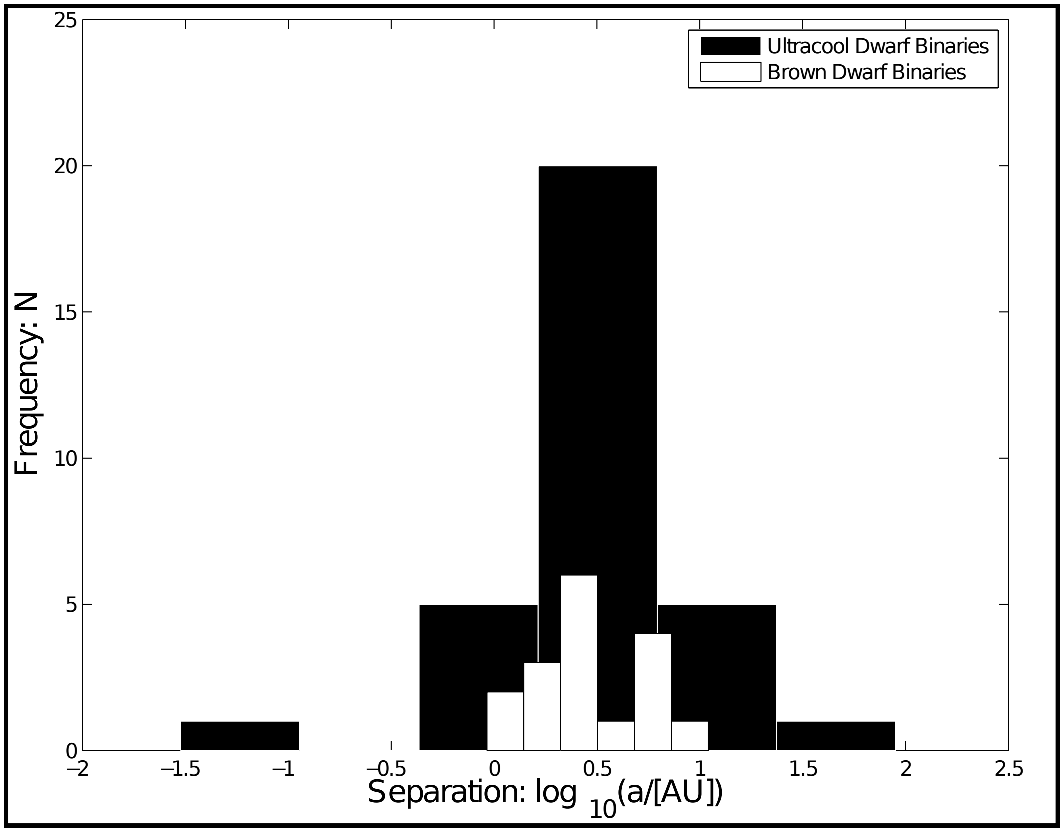

Figure 3.3 The Separation Distribution of Ultracool Dwarf Binaries

Distribution of binary ultracool dwarf separations with bin size determined by Sturges's Rule. The binary ultracool dwarf mean separation is 2.99±3.51 AU (N=32); the corresponding normal distribution peaks at ~3 AU. The binary brown dwarf mean separation is 2.80±1.93 AU (N=17); the corresponding normal distribution also peaks at ~3 AU. Note: some separations are the true semi-major axis, while others are the projected separation.

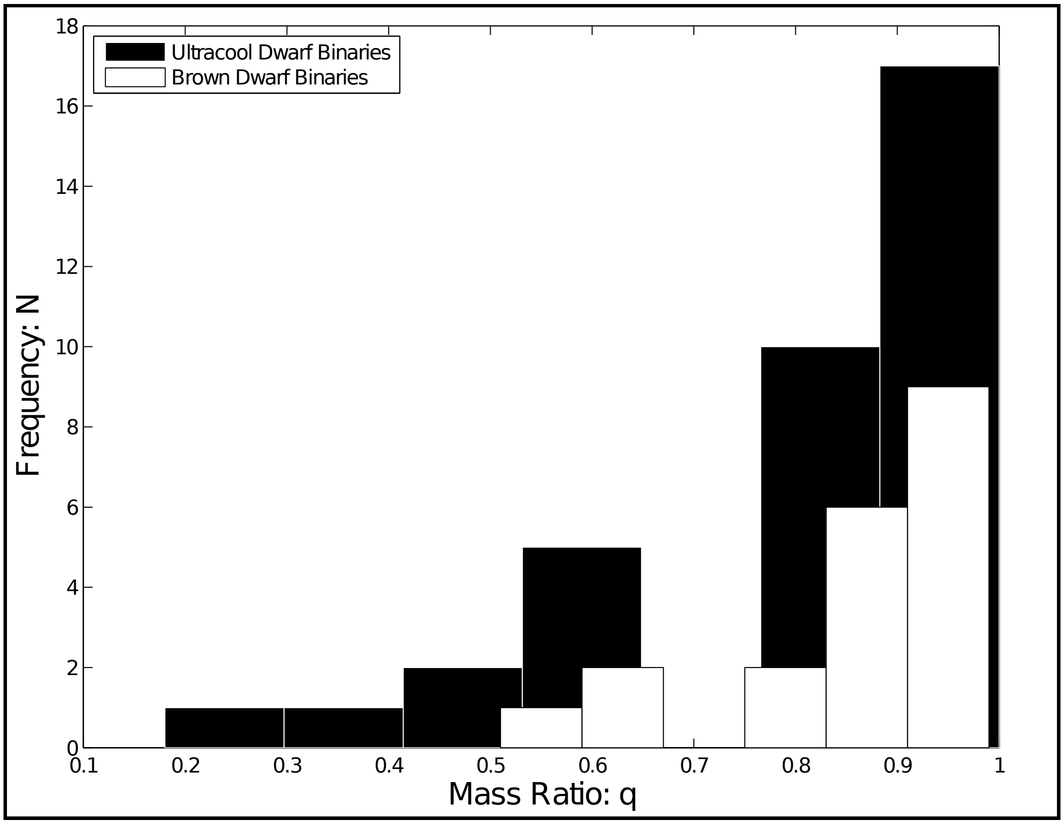

Figure 3.4 The Mass-Ratio Distribution of Ultracool Dwarf Binaries

Distribution of binary ultracool dwarf mass ratios with bin size determined by Sturges's Rule. The binary ultracool dwarf mean mass ratio is 0.805 (N=36). The binary brown dwarf mean mass ratio is 0.861 (N=20).

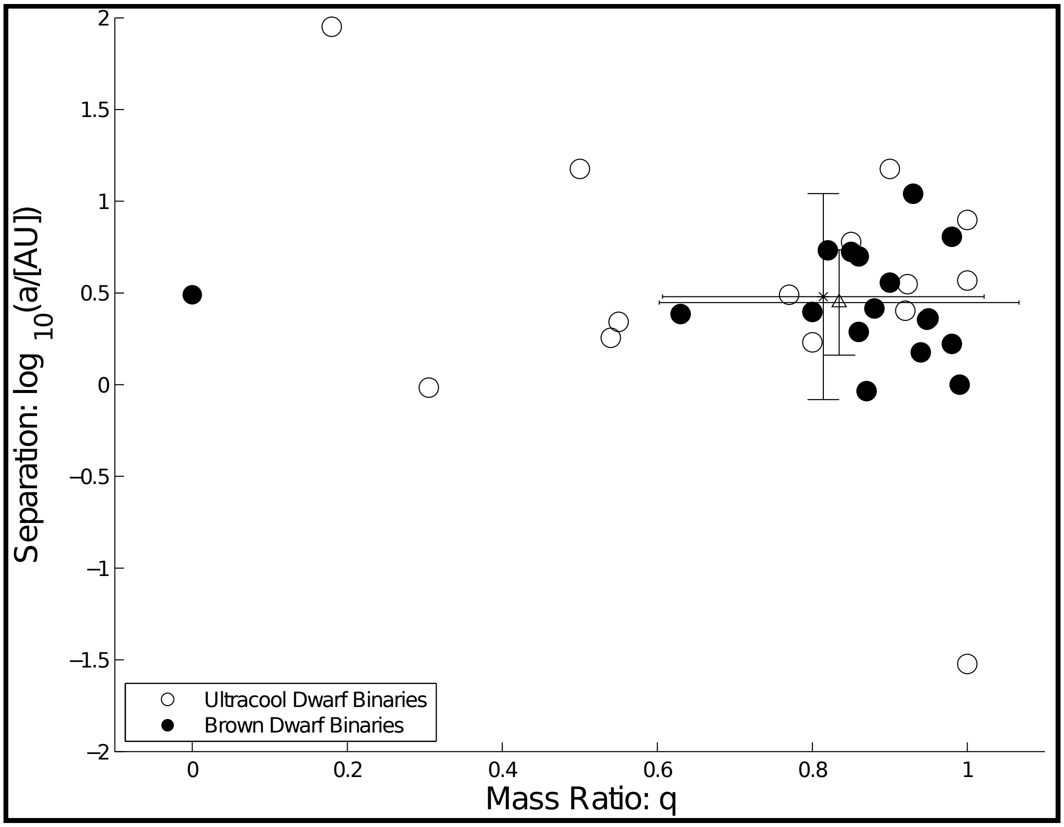

Figure 3.5 Scatter Plot of Ultracool Dwarf Binaries

This plot indicates that the ultracool binaries in my sample tend towards equal mass and small separation. The “ * ” is the mean ultracool dwarf binary separation/ratio (N=30) and the “ ˆ ” is the mean brown dwarf binary separation/ratio (N=17); standard deviation bars are overlayed. Statistically, these means are the same.

CHAPTER 4

CONCLUSIONS

The gravitational contraction of dense cores is the formation basis for stars and brown dwarfs alike; however, the details of contraction and subsequent evolution remain up for debate [Mohanty & Jayawardhana 2006; Burgasser et al. 2007b; Hennebelle 2012]. While beyond the scope of this project to suggest evidentiary support for any given scenario, the multiplicity statistics derived from my compilation are consistent with the Burgasser et al. [2007b] and is congruent with the ejection scenario. That said, the brown dwarf 2MASS J0850359+105716[1] [Faherty et al. 2011] is congruent with massive disk fragmentation [Stamatellos & Whitworth 2009] and the pre-brown dwarf Oph B-11 [André et al. 2012] is congruent with turbulent fragmentation [Padoan & Nordlund 2002]. While the preponderance of tight brown dwarf binaries is congruent with the ejection scenario, the expected greater velocity dispersion is not seen in star forming regions [Whitworth et al. 2007]. The statistics of numerical simulations are crucial to constraining theory as they can be directly compared to observational statistics [Hennebelle 2012]. I hope that this compilation will aid the community's high contrast imaging and planet search programs in addition to highlighting the multiplicity statistics necessary to constrain the brown dwarf theories.

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[1] This object not a part of this compilation.

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APPENDIX A

NOTABLE OBJECTS

A number of notable discoveries have been made in recent decades – and continue to be made. What follows is a sampling of some of the most important low mass object discoveries in recent times.

A.1 GD 165 B (1988)

Discovered by Becklin & Zuckerman [1988], this L4 [Kirkpatrick et al. 1999b] brown dwarf candidate is the first known L dwarf and also the companion of the white dwarf WD 1422+095. It remains uncertain whether or not this object is a cooling brown dwarf or low mass star due to large uncertainty in its age and the lack of dynamic mass measurement[1]; however, while theoretical plots suggest a "transition dwarf"[2], Kirkpatrick et al. [1999a] noted that the absence of lithium does not preclude GD 165 B from being a brown dwarf.

A.2 ISO-Oph 102 (1992)

ISO-oph 102 was discovered by Greene & Young [1992] and has a model derived mass of about 60 M_{Jup} [Natta et al. 2002]. Phan-Bao et al. [2008] discovered that this young object is undergoing a phase of bipolar molecular outflow, which is typical of young stars though diminished by two and three orders of magnitude for the outflow mass and mass loss rate, respectively. This discovery is suggestive that brown dwarfs can form in the same manner as stars; they form from gravitational collapse, albeit from a cloud core of lesser initial mass. The authors also estimated that the object's disk has a mass of $8{\times}10^{-3}$ $M_\odot$ and a radius of 80 AU.

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[1] See figures 5 and 6 in Kirkpatrick et al. [1999a]

[2] Kirkpatrick et al. [1999a] defined dwarfs with masses between 0.072 and 0.075 $M_\odot$ as "transitional": such objects have not yet stabilized, though may achieve core hydrogen fusion after – and possibly beyond – 10 Gy. They employed the models of Chabrier & Baraffe [1997] and Baraffe et al. [1998]

A.3 GJ 229 B (1995)

Discovered by Nakajima et al. [1995], GJ 229 B [T7; Burgasser et al. 2006a] is the first confirmed brown dwarf and it is also the first confirmed brown dwarf companion to a primary star.

A.4 PPL 15 and Teide 1 (1996)

The proposal of the so-called "lithium test" by Rebolo et al. [1992], and subsequent development by Nelson et al. [1993], lead to the first confirmation of an object's substellar nature via detection of lithium. Basri et al. [1996] found the young brown dwarf PPL 15 and Rebolo et al. [1995] found the young brown dwarf Teide 1. Basri et al. [1996] and Rebolo et al. [1996] showed that these two objects are substellar. Basri & Martín [1999] determined PPL 15 as also the first brown dwarf spectroscopic binary. According to Martin et al. [1996], the composite spectral type is M6.5.

A.5 Kelu-1 AB (1997)

Discovered by Ruiz et al. [1997], Kelu-1 AB are the first field brown dwarfs to be discovered; however, it was not known to be binary in nature at the time of discovery. Liu & Leggett [2005] and Gelino et al. [2006] confirmed that it is binary. The primary is an L2 dwarf [Gelino et al. 2006] and the secondary is an L3 dwarf [Stumpf et al. 2009].

A.6 GJ 4052 C (2001)

Two likely substellar astrometric companions to the solar type star GJ 4052 A, which has a spectral type of G6V [Gray et al. 2006], were discovered by Marcy et al. [2001] using the Keck/HIRES spectrometer. Using re-reduced Hipparcos data from van Leeuwen [2007], Reffert & Quirrenbach [2011] found a best-fit mass of $30.3^{+9.4}_{-12.2}$ M_{Jup}, which is well within the brown dwarf regime. With a 3σ upper mass limit of 65 M_{Jup}, the substellar nature of GJ 4052 C is all but confirmed. The mass of GJ 4052 B has not been well constrained enough to determine whether it is a planet or a brown dwarf.

A.7 GJ 845 BaBb (2003)

This subsystem was discovered by Scholz et al. [2003] and in a followup paper, McCaughrean et al. [2004] determined that GJ 845 B is not only the closest known brown dwarf, but also binary. They assigned a spectral type of T1 to the primary and T6 to the secondary.

A.8 GJ 164 B (2004)

GJ 164 B was discovered astrometrically by Pravdo et al. [2004]. By combining these observations with aperture masking interferometry, Martinache et al. [2009] were able to fix the parallax of the system and determine the model-independent mass of each component. They found that GJ 164 B has a mass of 90±7 M_{Jup}, which most likely places it above the substellar limit of ~80 M_{Jup},[3] and that the star GJ 164 A has a mass of 269±20 M_{Jup}. The authors found that the pair is at least as metallic as the Sun and that models underestimate the luminosity of very low mass stars that have settled on the main sequence. They suggest further analysis of this system to help constrain models.

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[3] This threshold assumes solar metallicity [Burrows et al. 2001]

A.9 GJ 9492 B (2004)

This object is a L0 brown dwarf candidate discovered by Forveille et al. [2004]. It is a companion to the M3V [Golimowski et al. 2004] main sequence primary. Forveille et al. used the identifier G 239-25 B and it should be noted that SIMBAD only associates both the "G" and "GJ" identifiers with the original GJ 9492 identifier. See Appendix B for more on this matter.

A.10 SCR 1845-6357 B (2006)

This object was discovered by Biller et al. [2006] just two years after Hambly et al. [2004] had discovered the M8.5V primary. This T6 [Henry et al. 2006] is the first such brown dwarf discovered around a low mass star [Biller et al. 2006].

A.11 GJ 758 B (2009)

This ~T9 brown dwarf was discovered by Thalmann et al. [2009] and is a companion to the G8V Perryman et al. [1997] solar-type primary. Thalmann et al. originally cited a second candidate companion; however subsequent work by Currie et al. [2010] and Janson et al. [2011] determined this not to be the case.

A.12 UGPS J072227.51-054031.2 (2010) & WISEP J173835.52+273258.9 (2011)

These objects were declared to be the T9 and Y0 standards, respectively, by Cushing et al. [2011]; this is affirmed in Kirkpatrick et al. [2012]. UGPS J072227.51-054031.2 was discovered by Lucas et al. [2010] and WISEP J173835.52+273258.9 was discovered by Cushing et al. [2011].

A.13 GJ 240.1 B (2011)

This is an L9 brown dwarf companion to an F7V [Abt 2009] star discovered by Loutrel et al. [2011]. Due in large part to how well known the primary is, this L/T transition object – with estimates of both age and distance – serves as a useful calibrator of brown dwarf models.

A.14 GJ 3483 B (2011)

Discovered by Luhman et al. [2011], this object is a cold brown dwarf orbiting the white dwarf WD 0806-661 A. They gave it the name WD 0806-661 B and since it is only associated with this identifier on SIMBAD, it is easy to miss that this object is a companion to a "GJ" object. Moreover, the "WD" acronym is confusing as it suggests this brown dwarf is a white dwarf.[4] Luhman et al. [2012] and Rodriguez et al. [2011] determined that GJ 3483 B, with T_{eff} ~ 300 K, is likely a member of the new spectral class Y as it is redder than most of the dwarfs typed as Y in Cushing et al. [2011]. GJ 3483 B is potentially an important benchmark object for testing models of substellar objects as it's one of a few whose age is known via the primary; however, a better fix on the temperature is still needed [Luhman et al. 2012].

A.15 Oph B-11 (2012)

This is a candidate pre-brown dwarf core André et al. [2012] discovered in the L1688 star forming region of the Rho Ophiuchi cloud complex. The authors identified Oph B-11 as "a self-gravitating condensation of gas and dust with a mass in the brown-dwarf regime,"

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[4] See Rodriguez et al. [2011] for commentary and updated analysis

which, given an indicated mass of ~0.02-0.03 $M_{\odot}$, supports the theory that brown dwarfs form in the same manner as stars.

APPENDIX B

DISCREPENCIES

A number of catalog discrepancies cropped up as we pursued this compilation. Below is a list of some of these and where they originated.

B.1 Simbad

1. G 204-39 B is a companion to GJ 4040 A; however, no GJ designation is listed.
2. Due to its spectral type of T6 [Artigau et al. 2010], 2MASS J08173001-6155158 is classified correctly as a brown dwarf on `dwarfarchives.org`; however, it is incorrectly classified as a star on Simbad.
3. There is an incorrect note on 2MASS J17054834-0516462, stating that it is a double object. Andrei et al. [2011] stated that what led Reid et al. [2006] to suspect a binary nature was most likely due to a background M dwarf.
4. GJ 758 C is actually a background object and is not physically associated with this ultracool system [Janson et al. 2011].
5. GJ 27 (or HD 3651) is binary in nature; however, a GJ designation for the brown dwarf secondary is not listed on Simbad.
6. The coordinates listed for ULAS J101721.40+011817.9 are from Burningham et al. [2008]; however, these coordinates are epoch J2007.2046 and not epoch J2000. It was confirmed through private correspondence that there is presently no way to store the actual epoch of the default coordinates; epoch 2000 is the default, using proper motions when available.

B.2 Confounded Designations

Over the millennia, humanity has given all manner of names to the stars. The names sufficed, however, only until telescopes allowed astronomers to splits these sources into separate objects. This presented a problem. Hartkopf & Mason [2004] illustrated this well with a fictitious stellar system. Suppose a visual binary is discovered with the components "A" and "B". After some time, a wide companion is discovered and it is designated as component "C". Some time further on, component "A" is discovered to be a spectroscopic binary. Should the components be designated "A" and "a"; "A" and "D"; or "Aa" and "Ab"? The last option originates with the Washington Double Star Catalog (WDS) and was expanded and refined with the Washington Multiplicity Catalog (WMC). Despite the IAU's adoption of the WMC designation system [Hartkopf & Mason 2004; Tokovinin 2006], a number of contemporary articles do not follow the aforementioned prescription when assigning designations to newly discovered companions. Naturally, other naming schemes will be found when delving into literature previous to the adoption of the WMC designation system; it is important to be mindful of what object's the author's employed designations actually apply.

The WMC designation system is meant to preserve the hierarchy of a stellar system in the naming scheme: the first level is designated with capital letters (e.g.: GJ 866 AB); the second level is designated with lowercase letters (e.g.: GJ 866 AaAbB). In this way, a bit of history is preserved and extra distinction is maintained: "A" will always refer to the subsystem and "Aa" and "Ab" will always refer to the components of subsystem "A". After the discovery of the binary nature of GJ 866 A, Woitas et al. [2000] designated the subsystem primary GJ 866 A and the secondary GJ 866 a. To minimize any chance of component confusion, we adopted the IAU/WMC convention.

- The primary of the hierarchical triple GJ 866 is binary: GJ 866 ACB in Delfosse et al. [1999], though GJ 866 AaB in Woitas et al. [2000]. We employ the designations GJ 866 AaAbB.

- The hierarchical quintuple GJ 423 has the components GJ 866 AaAbBaBbC. The visual binary GJ 423 AB (or ADS 8119 AB) was discovered by Sir William Herschel in 1780. Subsequently, both visual components were discovered to be binary in nature. The component designations GJ 866 ACBD may be found in the literature. WISE J111838.70+312537.9 is a companion to the quadruple discovered by Wright et al. [2012]

- The hierarchical triple GJ 105 has the components GJ 105 AaAbB, though it appears as GJ 105 ACB in Golimowski et al. [2000].

- The hierarchical triple GJ 1245 has the components GJ 1245 AaAbB, though it appears as GJ 1245 ACB in Henry et al. [1999] and Rojas-Ayala et al. [2012].

- GJ 337 AB is also known as WDS J09123+1500AaAb; however, WDS J09123+1500 B is not physically associated with this system.

APPENDIX C

PROFILE QUESTIONS

The seven symbol code of the object profile is generated by answering the following question:

1. Is the object a) the system primary or b) the beginning of binary subsystem or c) none?

   If a), mark with “$$”.

   If b), mark with “bi”.

   If c), mark with “ee”.

2. Is the object a) the first component of subsystem primary or b) a companion or c) the first component of a field binary or d) none?

   If a), mark with “bi”.

   If b), mark with “co”.

   If c), mark with “bf”.

   If d), mark with “ee”.

3. Is the object a) an ultracool dwarf or b) a non-ultracool star or c) a white dwarf?

   If a), mark with “uc”.

   If b), mark with “st”.

   If c), mark with “wd”.

4a. If the object is a non-ultracool star, is it a) a solar type (spectral types F6 through K3) or b) earlier than solar type (<F6) or c) later than solar type (>K3).

If a), mark with “so”.

If b), mark with “ea”.

If c), mark with “la”.

4b. If the object is an ultracool dwarf, is it a) a brown dwarf or b) a brown dwarf candidate or c) an ultracool star or d) unspecified.

If a), mark with “bd”.

If b), mark with “bc”.

If c), mark with “st”.

If d), mark with “un”.

5. Can the ultracool object be determined to be so due to a) its assigned dynamic mass or b) not.

If a), mark with a “1”.

If b), mark with a “0”. item[6.] Can the ultracool object be determined to be so due to a) its assigned model mass or b) not.

If a), mark with a “1”.

If b), mark with a “0”.

7. Can the ultracool object be determined to be so due to a) its spectral type or b) not.

   If a), mark with a “1”.

   If b), mark with a “0”.