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New M and L Dwarfs Confirmed with CorMASS

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Abstract. We present new M and L-dwarfs confirmed through follow-up of 2MASS color-selected objects with the CorMASS near-infrared spectrograph (R $\sim$ 300) on the Palomar 60-inch telescope as part of a continuing follow-up survey. Most of the objects are bright ($K_s < 13$).

1. Introduction

We have been following up 2MASS color-selected low-mass candidate objects with the Cornell Massachusetts Slit Spectrograph (CorMASS, Wilson et al. 2001a), a near-infrared spectrograph (R $\sim$ 300) on the Palomar 60-inch tele-

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scope. Built specifically for this task, the instrument observes the entire zJHK wave-band simultaneously with its echelle-format design and NICMOS3 HgCdTe 256-square array.

15 M-dwarfs and 14 L-dwarfs have been confirmed thus far. In the following sections we discuss the grid of late-M and L-dwarfs used to define the system for assigning spectral types in the near-infrared, the color-selection criteria, and present the new objects. Some of the work presented here comes from a portion of the author's PhD dissertation (Wilson 2002).

2. Color Selection

Candidate selection leverages the fact that these objects are relatively bright in near-infrared surveys but faint or absent in visual wavebands. The color selection method, including correlation criteria with visual surveys, closely follows that of Gizis et al. (2000). CorMASS follow-up objects are required to have $J - K_s \geq 1.00$ and usually $K_s \leq 13.00$.

3. Grid of Standards and Indices

A grid of known low-mass objects spanning spectral classes M6–T have been observed with CorMASS and serve as reference objects for developing spectral indices and by-eye comparisons. Currently 11 objects, many of which are the brightest known examples for a given spectral type are included. The M-dwarf spectral types are on the Kirkpatrick, Henry & McCarthy, Jr. (1991) system; the L-dwarf classifications are on the Kirkpatrick et al. (1999) system; and the T-dwarf is classified on the Burgasser et al. (2002) system.

The three indices defined in Table 1 are used to assign spectral types for new low-mass objects. Using the grid of known objects, index-spectral type relations are derived. The average of the implied spectral types based on the three indices is the assigned spectral type. The $H\mathrm{H_2O}$ index is the same as defined by Delfosse et al. (1999).

Table 1. Spectral Indices

Index	Definition	Measurement
By-eye	...	Full spectrum comparison to grid
zJ index	$\frac{\langle F_{1.265-1.305}\rangle}{\langle F_{1.10-1.1}\rangle}$	Slope between z and J band
$H\mathrm{H_2O}$	$1.51 - 1.57\mu$m slope	Wing of H_2O absorption band

4. New M and L-dwarfs

Using the indices defined in Table 1, we have assigned preliminary spectral types to 29 M and L-dwarfs spanning M4.5 - L6.5. Some of the objects have been independently confirmed by others. The objects' near-infrared spectra are presented in Figure 1 (with the exception of 2M0026+06, 2M0032+02, 2M0045+16, and 2M1430+29). Table 2 lists 2MASS coordinates, photometry, preliminary spectral type, and previous identifications from the literature.

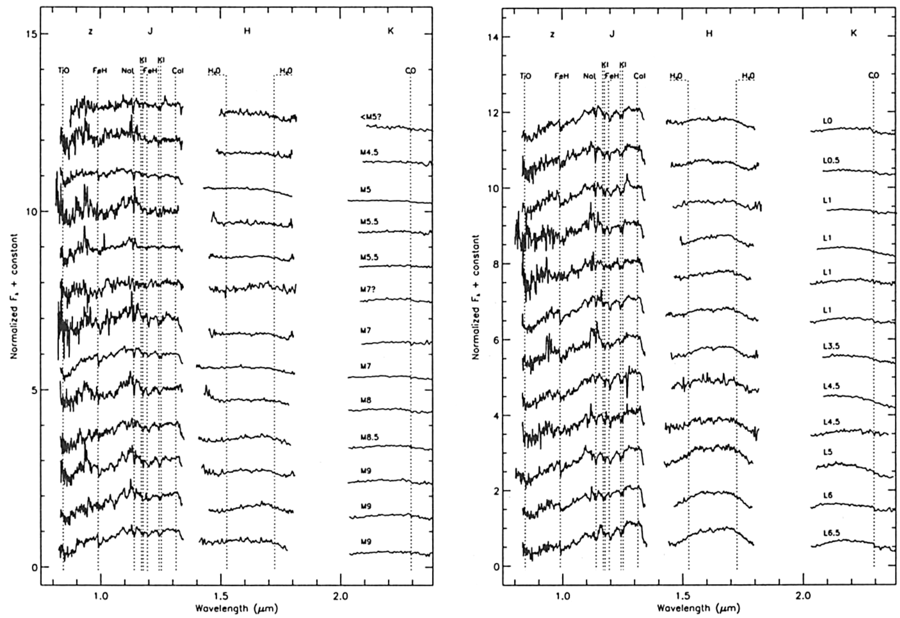

Figure 1. zJHK spectra of new confirmations from CorMASS

The uncertainty in spectral type is estimated based upon the difference between the highest and lowest index assignment for any given object (deviation). The average of the deviations for these objects, $\overline{\Delta} = 2.38$, infers our system of spectral type assignment has an internal consistency of better than ± 1.25 spectral sub-type.

At least 12 of the objects in Table 1 have been independently discovered by others (see e.g. contribution by Kirkpatrick regarding his new web-based archive of L-dwarfs). Of the these, four have spectral type assignments that vary by a sub-type or more: the M7 2M1048+01 (Hawley et al. (2002); L1), the L1 2M1017+13 (Cruz et al. (2002, hereafter C02b); L3), the L4.5 2M0408-14 (C02b; L1.5) and the L5 2M0523-14 (C02b; L1.5).

The L6 dwarf 2M1515+48 deserves further mention. It happened to be imaged at more than one epoch by 2MASS. Analysis of the images implies a proper motion of $\sim 1.7''$ / yr (R. Cutri, priv. comm.), and a $v_{tan} \sim 100$ km/sec (see contribution by Kirkpatrick).

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Table 2. New Confirmation Observation Log

Object	$J-K_s$	K_s	Prelim Sp Type	Notes
2MASS J0017534+145325	1.05	12.15	<M5	
2MASS J2025477-083531	1.13	12.01	M4.5	
2MASS J0410481-125142	1.04	10.02	M5	M5.5, C02a
2MASS J0107043+243528	1.29	12.22	M5.5	
2MASS J1555560-204519	1.75	12.14	M5.5	
2MASS J0436104+225956	1.57	12.19	M7?	M8, M01
2MASS J1048428+011158	1.31	11.58	M7	L1, H02
2MASS J0807261+321311	1.15	10.98	M7	
2MASS J0228424+163934	1.28	11.85	M8	
2MASS J0443376+000205	1.35	11.17	M8.5	M9, H02
2MASS J1204303+321300	1.32	12.56	M9	L0, C02b
2MASS J0046484+071518	1.40	12.47	M9	
2MASS J0928256+423055	1.12	11.97	M9	
2MASS J0032051+021902	1.44	12.77	M9	
2MASS J0026405+063216	1.38	13.17	M9.5	
2MASS J0228110+253738	1.40	12.45	L0	L0.5, C02b
2MASS J0320284-044636	1.14	12.11	L0.5	
2MASS J1430436+291541	1.53	12.75	L0.5	L2, C02b
2MASS J1017075+130840	1.45	12.68	L1	L3, C02b
2MASS J0251149-035246	1.43	11.65	L1	L1.5, C02b
2MASS J1552591+294849	1.47	12.01	L1	
2MASS J1807160+501532	1.32	11.61	L1	L1.5, C02b
2MASS J1448256+103159	1.92	12.66	L3.5	
2MASS J0045214+163445	1.72	11.35	L3.5	
2MASS J0141032+180450	1.31	12.51	L4.5	
2MASS J0408291-145033	1.43	12.78	L4.5	L1.5, C02b
2MASS J0523382-140302	1.49	11.63	L5	L1.5, C02b
2MASS J1515008+484742	1.58	12.49	L6	
2MASS J0717163+570543	1.69	12.95	L6.5	

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