Brown Dwarfs
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News of Effective Temperatures of L Dwarfs

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Abstract. In this work we report recent spectral analyses of L dwarfs and our success in measuring T_{eff} and log(g). Using dust filled atmospheres for early L dwarfs and rained out atmospheres for late L dwarfs we could derive T_{eff} of 1400 to 2000 K for L8 to M9.5 dwarfs respectively. We also give an outlook what we can achieve with future models that are improving the fits to intermediate L dwarfs and IR spectra.

1. Analysis of L dwarfs

In two recent papers (Schweitzer et al. 2001, 2002) we performed a detailed multiwavelength spectroscopic study of L dwarfs. We used optical low resolution spectra from Kirkpatrick et al. (2000, and references therein), high resolution

Table 1. The derived values for T_{eff} and log(g) for the sample.*

Name		Spectral Type	T_{eff}	log(g)
2MASSW	J0149090+295613	M9.5	2100 K	6.0
2MASS	J2234139+235956	M9.5	2000 K	6.0
2MASP	J0345432+254023	L0	1900 K	6.0
2MASSW	J0147334+345311	L0.5	1900 K	6.0
2MASSI	J0746425+200032	L0.5	2000 K	6.0
2MASSW	J1439284+192915	L1	1900 K	6.0
2MASSI	J1726000+153819	L2	1900 K	6.0
2MASSW	J1146345+223053	L3	1800 K	5.0
2MASSW	J0036159+182110	L3.5	1800 K	5.5
2MASSs	J0850359+105716	L6	1700 K	5.5
2MASSW	J0920122+351742	L6.5	1700 K	6.0
2MASSI	J0825196+211552	L7	1700 K	6.0
2MASSW	J0929336+342952	L7.5	1400 K	5.0
2MASSI	J0328426+230205	L8	1400 K	6.0
2MASSW	J1632291+190441	L8	1400 K	5.5
2MASSW	J1523226+301456	L8	1400 K	5.5

*We used AMES-Dusty models for the top eight objects, AMES-Cond models for the bottom seven objects and both for the L3.5.

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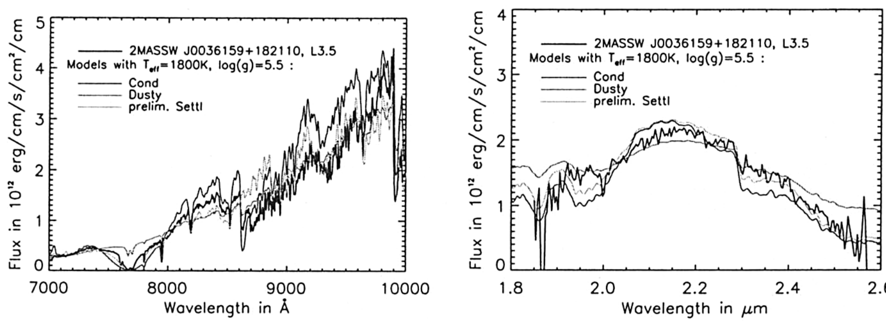

Figure 1. Comparison of the best fitting Dusty and Cond models for the L3.5 dwarf with a preliminary model that accounts for settling.

spectra obtained with HIRES on Keck I (see Schweitzer et al. 2001, for details) and K band spectra obtained with CRSP (see Schweitzer et al. 2002, for details). We used our then latest models to perform the analysis. A detailed description of the physics can be found in Allard et al. (2001). The most important features are line lists for all important molecules, dust formation in equilibrium inside the photosphere and dust opacities due to 40 dust species. For the two previous papers the models were available in two limiting cases: AMES-Dusty and AMES-Cond. For the AMES-Dusty models the dust stays in the layer in which it forms. This effectively adds maximum dust opacity and fits early L dwarfs (Tab. (1)). For the AMES-Cond models the dust rains out completely. This effectively removes the fraction of elements bound in dust from the atmosphere and fits late L dwarfs. None fit intermediate L dwarfs and IR spectra consistently.

2. Outlook

We are currently calculating newer models which calculate self consistent rain out of dust. These models are producing a dust stratification depending on stellar parameters where the settling of grains is counter–balanced by convective mixing into the upper layers of the photosphere. Although we could not do a detailed fitting with different models, we find that the same parameters now seem to be in good agreement with both optical and infrared spectra (Fig. (1)).

References

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