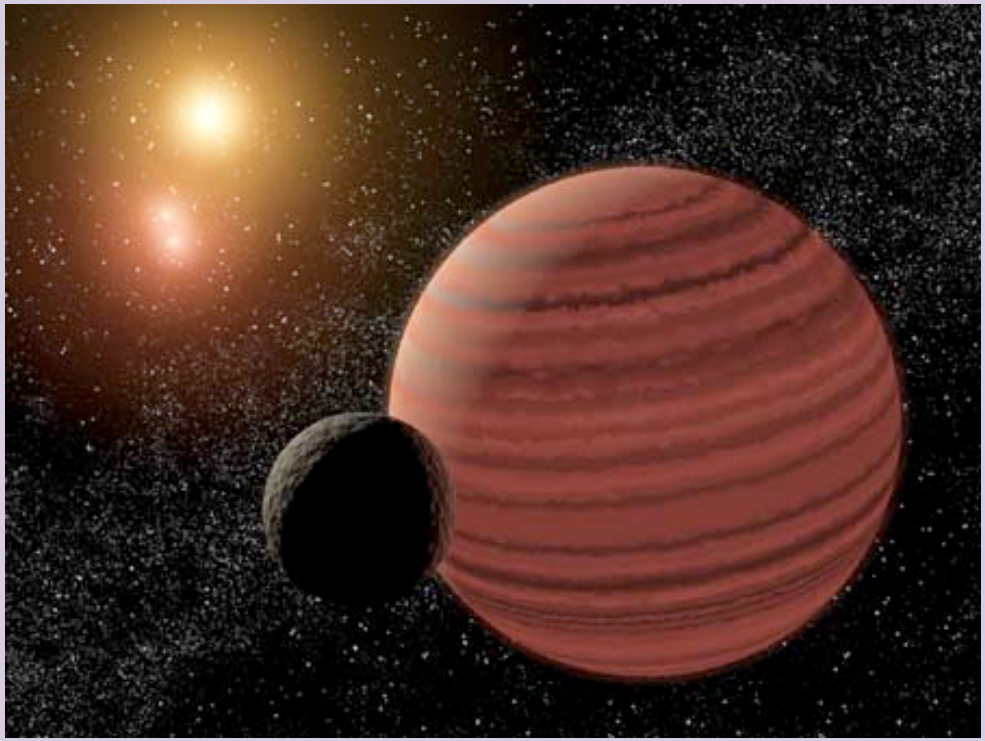
The Brown Dwarf Kinematics Project (BDKP)

Learning from the Motions of Ultracool Dwarfs



By Jackie Faherty
Stony Brook University/AMNH

2/19/09

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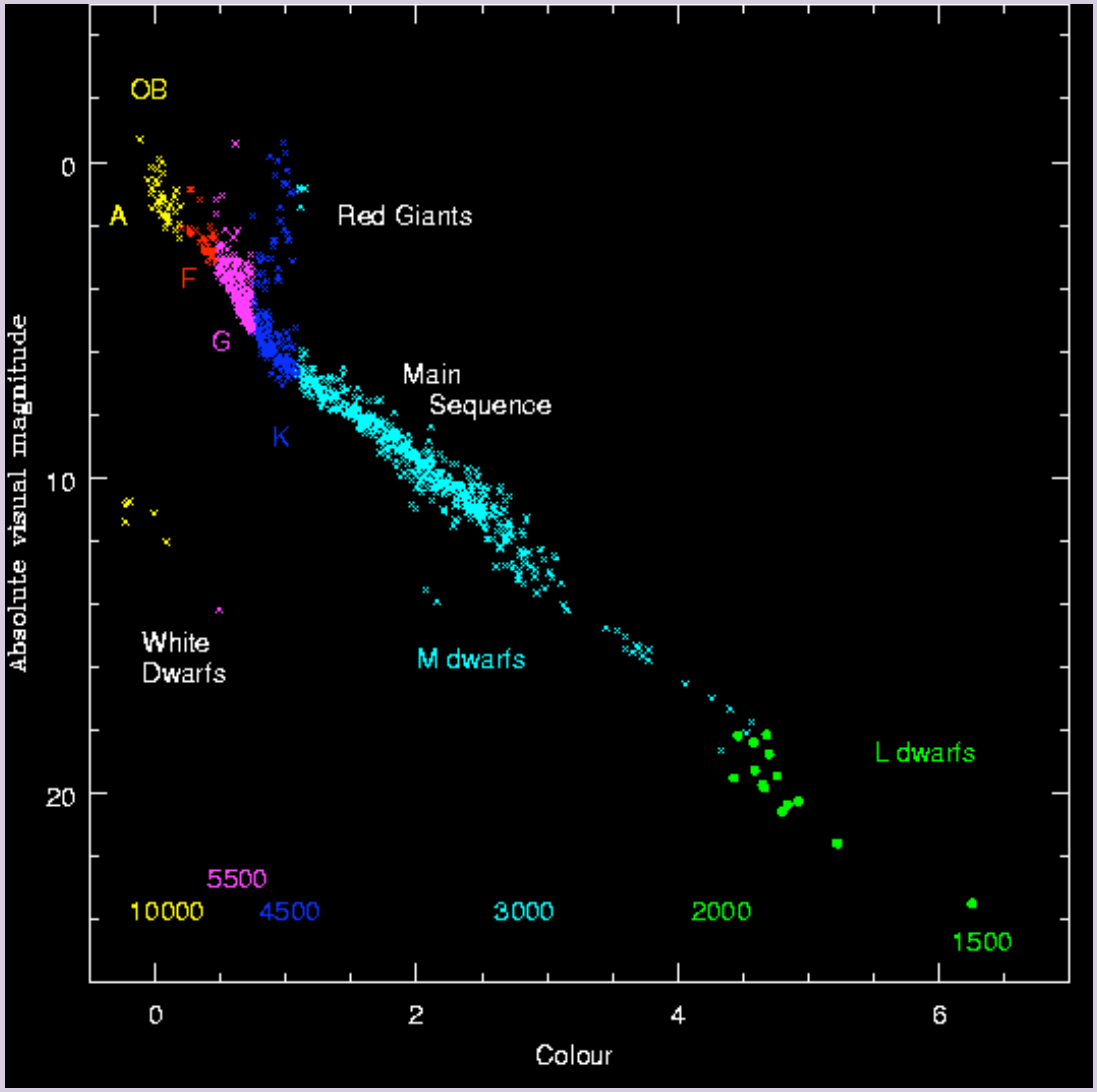
What are UltraCool Dwarfs



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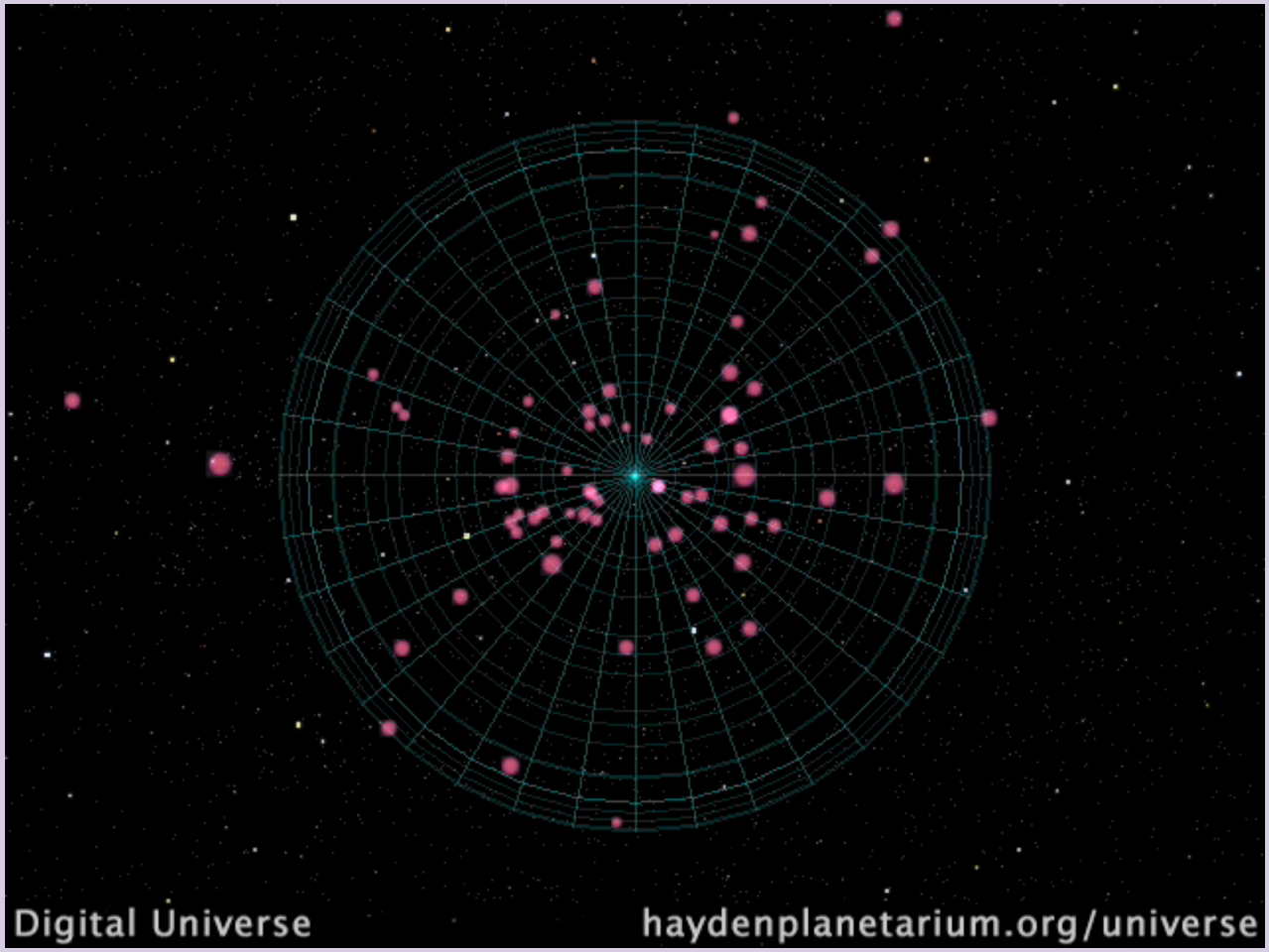
ASTROMETRY



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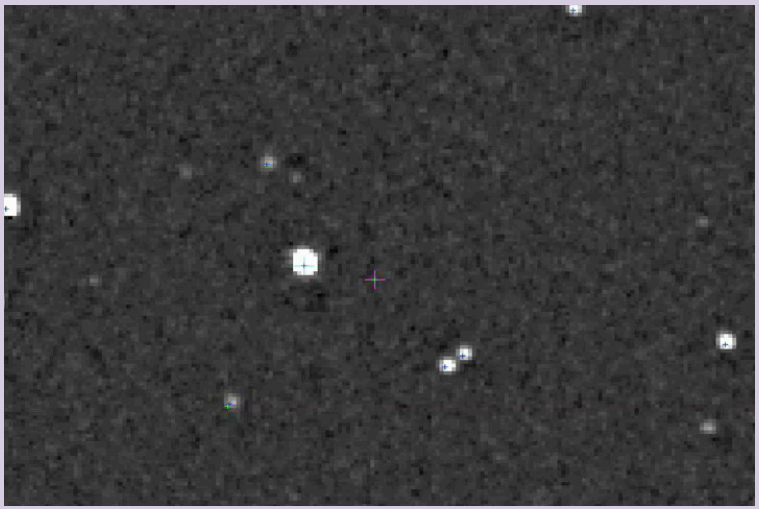
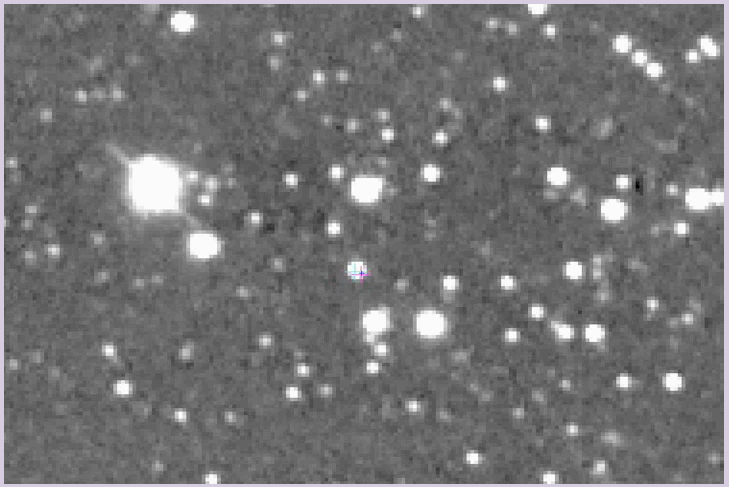
KINEMATICS





Fast Movers

3.61 arcsec/yr

Slower Movers

.32 arcsec/yr

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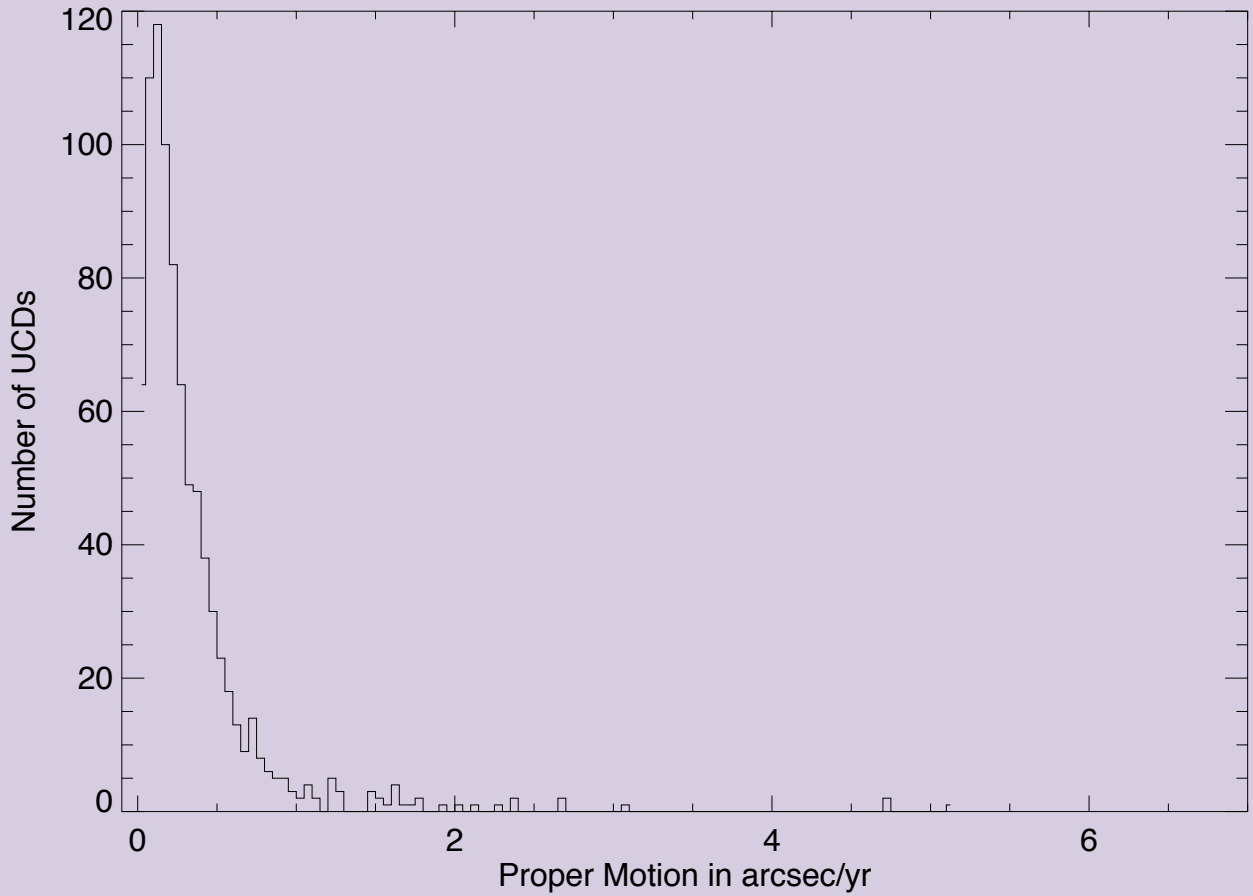
Distribution of UCD Proper Motions



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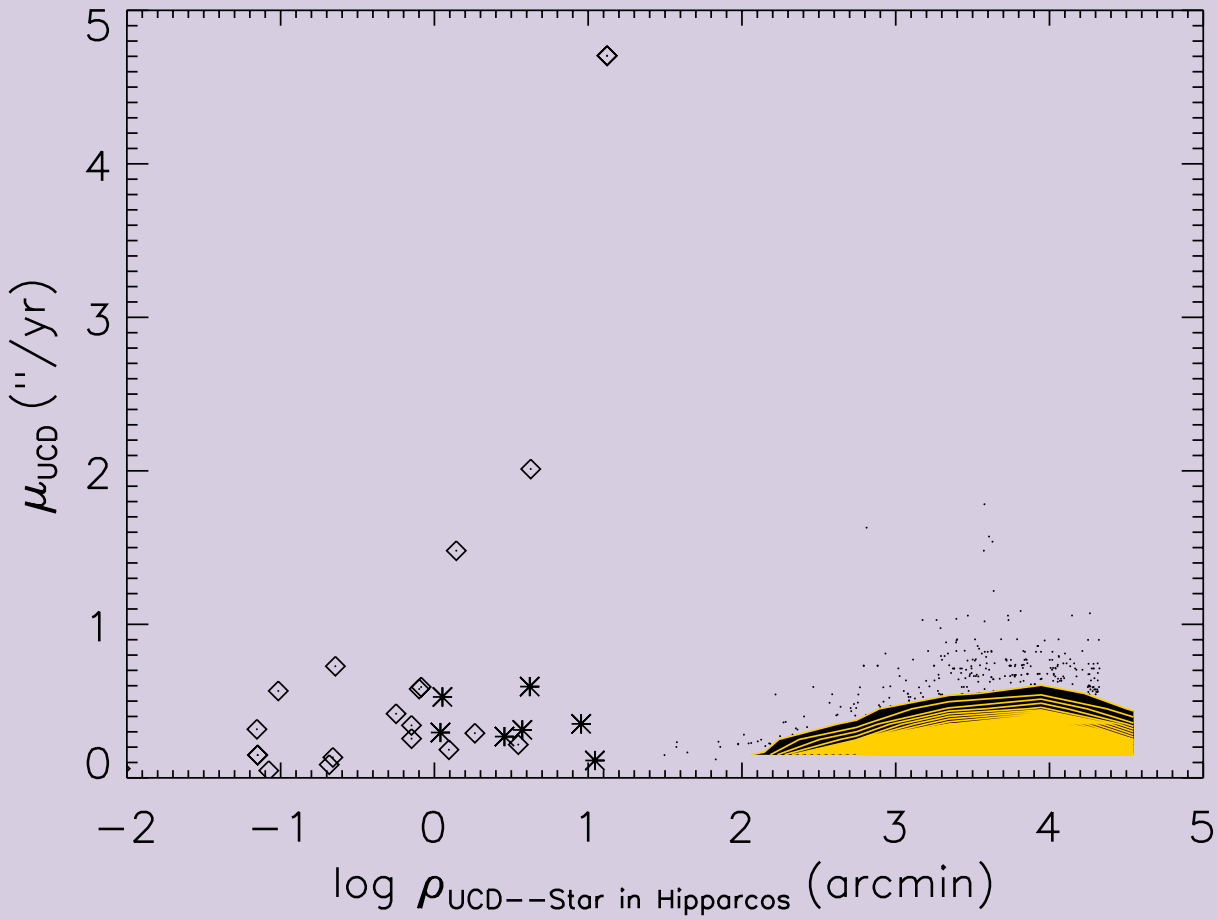
Matches to the Hipparcos Catalog



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Goodness of the matches

Name (1)	Num Match LSPM-N (2)	% Match LSPM-N (3)	Num Match Hipparcos (4)	% Match Hipparcos (5)	Num Match Tycho II (6)	% Match Tycho II
2MASS J0003-2822	259	99.99	63	99.99	82	>99.99
2MASS J0025+4759	283	99.15	68	99.98	85	99.99
2MASS J0041+1341	2336	99.56	294	>99.99	496	99.98
2MASS J0207+1355	230	99.96	49	99.999	67	99.997
2MASS J1200+2048	55	99.93	15	>99.999	22	99.999
2MASS J1320+0957	418	98.97	73	99.98	100	99.98
2MASS J1320+0409	11	>99.999	6	>99.999	6	>99.999
2MASS J1416+5006	40	99.88	13	99.99	15	99.98
2MASS J1758+4633	2	>99.9999	3	>99.999	3	>99.999
2MASS J0915+0422[a]	—	—	505	89.96	2612	0

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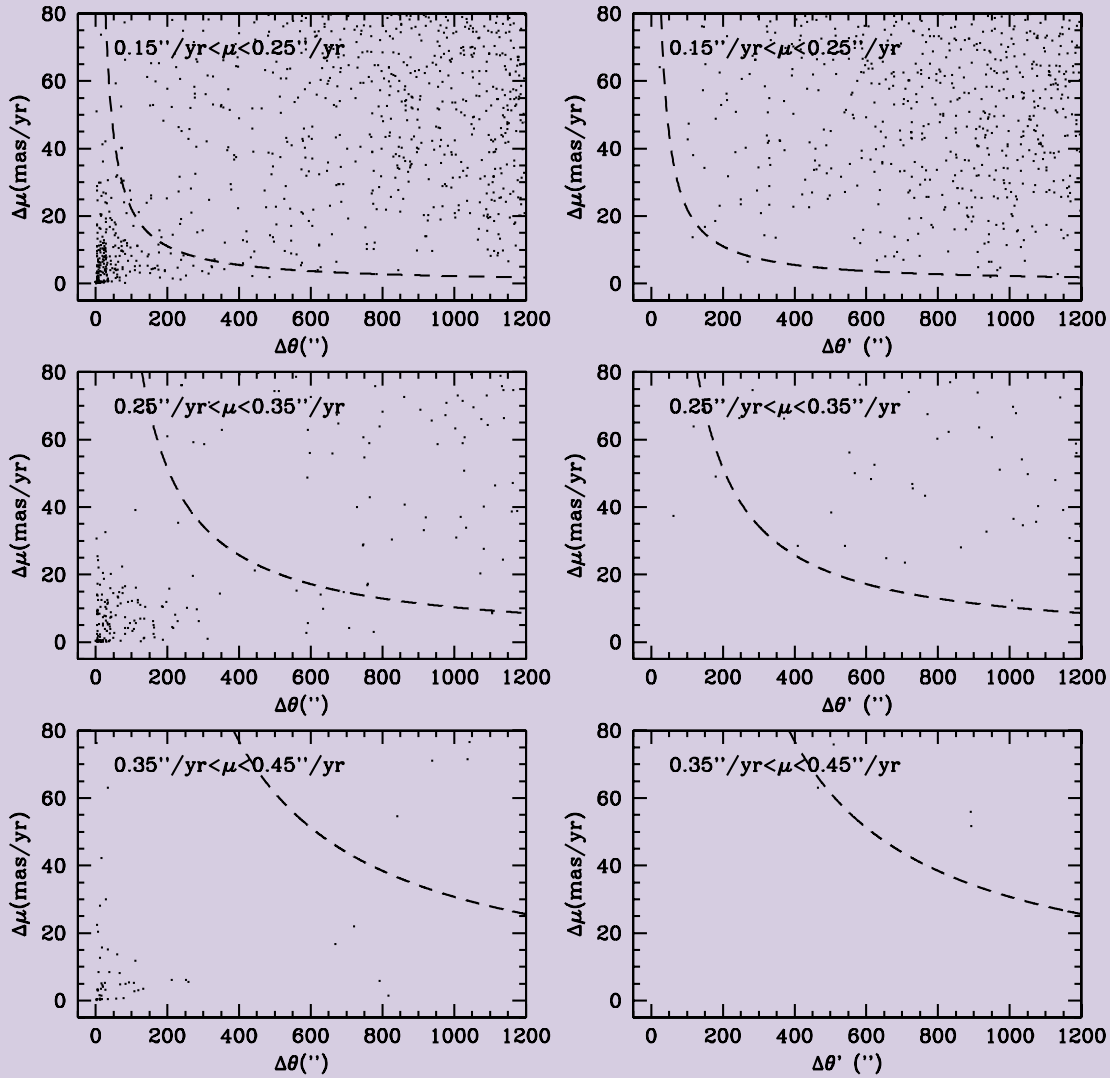
Lepine Reliability Relation: $\Delta\theta\Delta\mu<(\mu/0.15)^{3.8}$



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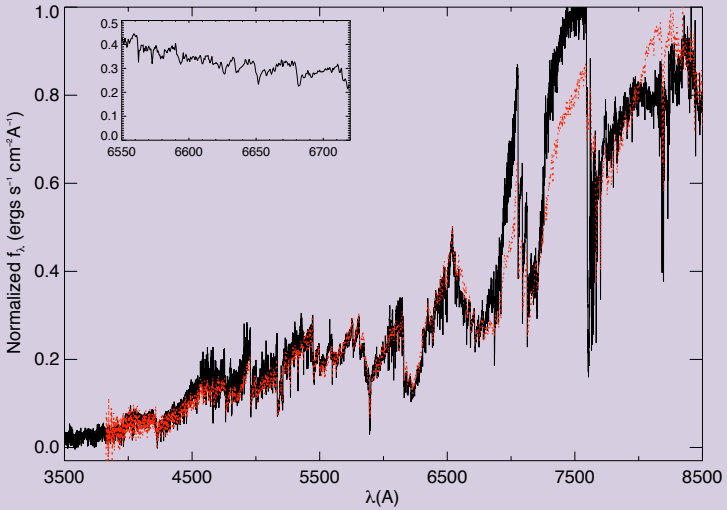
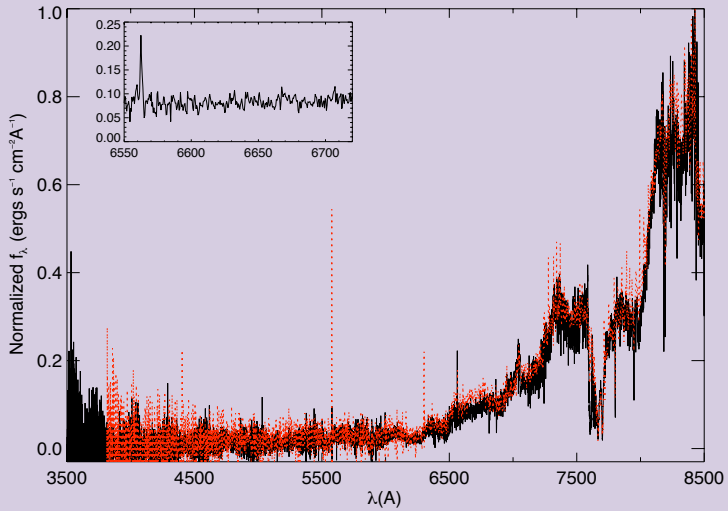
Spectral Features as a Check





LSPM J0041+1341 with SDSS J0041+1341

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Matching the Primary and Secondary

Name	[Fe/H]	$\log(R'_{HK})$	U km/s	V km/s	W km/s	Li EW Å	H_α EW Å	Mass $M_\odot$	Member?	Age Gyr	Ref
HD 225118	0.07	-4.55	-32	-47	-20	—	—	0.94	—	0.6-1.1	
HIP 1987	0.35	—	-48	-26	-4	—	—	1.15	—	0.5-1.0	
LSPM J0041+1341	—	—					—	0.20	—	3.0-7.0	
LSPM J0207+1354	—	—	-44	-88	68		—	0.44	—	0.4-8.0	
LSPM J1200+2050	—	—					—	0.44	—	2.0-7.0	
HIP 65121	-0.18,0.15	—	-73	-21	21	—	—	0.85	—	1.0-6.0	
HIP 65133	—	—	-20	-50	6	—	—	0.67	—	2.0-8.0	
HIP 69709	-0.16	—	-72	-40	-35	—	—	1.01	—	4.0-8.0	
HIP 87938	0.0	—	-35	8	8	—	-.215	0.36	Hyades SC	0.5-1.5	
HIP 45383	-.10	-4.493	-13	-3	-2	—	—	—	Castor	0.1-0.3	

Name (1)	T_{eff} K (2)	H_α EW Å (3)	Li EW Å (4)	$J-K_s$ (5)	Age Gyr (6)	Mass $M_\odot$ (7)	References (8)
2MASS J0003-2822	2000-2400	13.0	—	1.096	0.6-1.1	0.062-0.078	
2MASS J0025+4759	1650-1950	—	10.0	1.938	0.5-1.0	0.050-0.071	
2MASS J0041+1341	1950-2275	2.2	—	1.218	3.0-7.0	0.078-0.082	
2MASS J0207+1355	1600-1950	—	—	1.550	0.4-8.0	0.045-0.071	
2MASS J1200+2048	2300-2600	2.9	<0.7	1.001	2.0-7.0	0.08-0.085	
2MASS J1320+0409	1600-1900	—	—	1.625	1.0-6.0	0.078-0.083	
2MASS J1320+0957	2000-2400	—	—	1.117	2.0-8.0	0.06-0.079	
2MASS J1416+5006	1450-1650	—	—	1.560	4.0-8.0	0.073-0.077	
2MASS J1758+4633	650-850	—	—	0.180	0.5-1.5	0.015-0.03	
2MASS J0915+0422	1400-1600	—	—	1.537	0.1-0.3	0.02-0.04	

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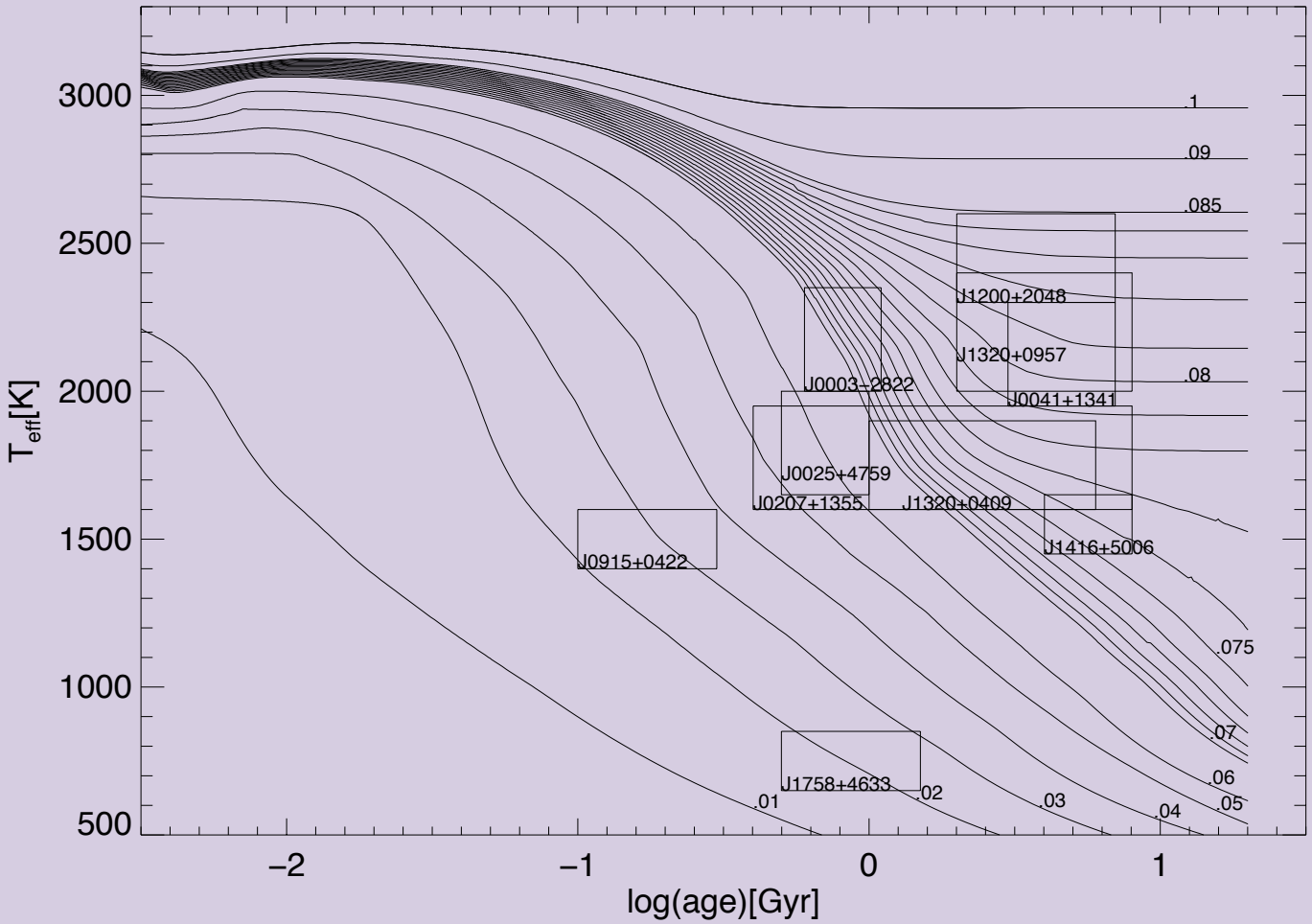
Masses from the Models



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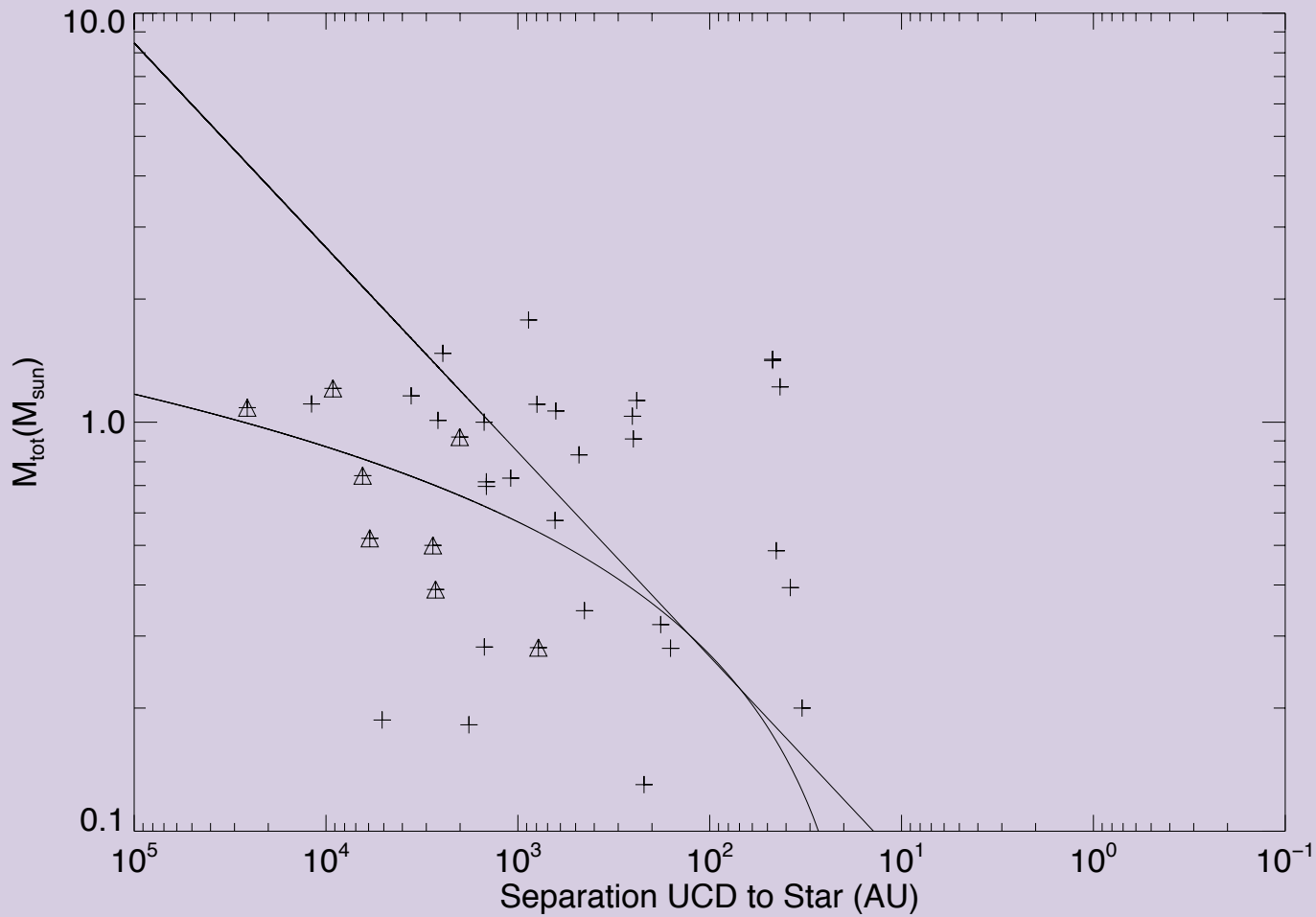
Wide UCD Field Objects with companions



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Conclusions

- Using proper motion as a criterion for companionship is now possible and leads to new co-moving systems

- Our survey examines objects at wider separations than was previously thought possible

- Monte Carlo Simulations to check on the reliability of the proper motion

- Spectral Features for confirmation of companionship and of co-evality