News from the planetary mass regime in Sigma Ori

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From Stars to Planets
The Sigma Ori cluster

- First noticed by the distinguished astronomer in the picture below.
- D=350pc, age~3 Myr.
- X-ray emitting low-mass stars.
- Rich in brown dwarfs & Planetary mass objects.
The ages and masses of the young BDs are estimated from comparison with evolutionary models in the Hertzsprung-Russell diagram.

- 847 sq. arcmin. 64 candidate members.
- The inferred masses extend down to ~8 $M_{\text{Jupiter}}$. 

The Substellar IMF

• The relative numbers of stars and BDs indicate that the IMF does not change abruptly from stars to planetary-mass objects.
• Power law fit in the mass range 0.11-0.008 solar masses with alpha = 0.7 ± 0.4.
• The low-mass turnoff of the IMF has not been seen yet. It must be at <8M_{Jupiter}
A T dwarf in Sigma Ori

- Mini-survey in I,J,H of 55 sq. arcmin down to J~21 carried out with Keck/WHT.
- SOri70, J=20.0, I-J=5.0, J-H=-0.03, H-K=+0.56
- First T dwarf of known age and mass.
- Comparison of low-resolution NIRC spectrum with synthetic spectra indicates low gravity.
- Most likely mass ~3 Mjup.

Proper motion of SOri70

• Low pm consistent with cluster membership
Photometric gravity diagnostic for T dwarfs

• Color-color diagram is a good tool to single out low-gravity dwarfs.

• Models by Marley et al. 2004

• SOri70 located in low gravity region of the diagram.

Knapp et al. 2004, Zapatero Osorio et al. 2007
Is SOri70 a PMO binary?
Is SOri70 a planet?

- Planets can be qualified according to their location: “pulsar planets”, “solar-system planets”, “close-in planets”.
- SOri70 is located at ~180000 AU from the cluster center.
- Typical separation within the cluster is 50,000 AU.
- Could SOri70 be a “cluster planet”? 
A new deep survey
An IMF similar to the previous one

- Alpha=0.6 down to PMOs
Disks around PMOs
SOri PMO SEDs
Conclusions

• Smooth IMF from stars to planets down to 5 Jupiter masses, and possibly 3 Jupiter masses.

• BDs and PMOs harbour dusty disks => possible planet formation.