From Star Formation to Exoplanets: How did we get here?

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Hogerheijde, 1998 from Shu et al 1987

Thursday, December 8, 2011
How did we get here?
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F. Rasio + SOC
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Marois et al 2010

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Star formation

Marois et al 2010

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How did we get here?

Star formation = Infall, Irradiation

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Rasio + SOC

Star formation

Kratter et al 2010

Marois et al 2010

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The two key questions for GI depend on infall and irradiation:

1. Does the disk fragment?

2. Do fragments make planets?
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Thermodynamics and infall control gravitational instability

Kratter & Murray-Clay, 2011

\[ Q = \frac{c_s \Omega}{\pi G \Sigma} \]

See also Rice et al 2011

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Thermodynamics and infall control gravitational instability

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Q=1?

Fragment Survives?

viscous
irradiated

Is the viscous criterion satisfied?

low mass
high mass

FFC satisfied
FFC not satisfied

Fragmentation successful

collisions
tides

Do spiral arms keep Q>1?

Are fragments disrupted?

See also Rice et al 2011

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What is an “irradiation dominated” disk?

- Background / stellar radiation is more important than dissipation of turbulence.
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- Background / stellar radiation is more important than dissipation of turbulence.

![Graph showing irradiation and turbulence relationships](image)

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What distinguishes extreme \textit{stellar} systems from extreme \textit{solar} systems?

\begin{itemize}
\item Hinkley + 10, Marois+ 10, Lafreniere +11, Janson+11, Ireland+11
\end{itemize}
Fragments like to grow!

\[ \frac{M_{iso}}{M_*} \]

GI predicts a population of more massive objects. Recent work + posters (A. Vigan) at this meeting.

- Brown dwarf and massive planet Desert is real (Nielsen & Close 2009, Lafreniere et al 2007, Quanz et al 2011)
- Massive stars do not have frequent high mass planets (HR 8799-like) (Leconte et al 2010, Hinkley et al 2010 Janson et al 2011)


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GI predicts a population of more massive objects

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Currie et al, 2011,
Kratter, Murray-Clay & Youdin, 2010

Desert is real (Nielsen & Close 2009, Lafreniere et al 2007, Quanz et al 2011)

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