compositional links between

warm super-Earths and cold Jupiters

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Volatile-Poor Inner Super-Earths Can Be a Proxy for Cold Jupiters in the System.

Background

Observational studies suggested that inner super-Earths and cold Jupiters tend to occur together around solar-type stars. [1]

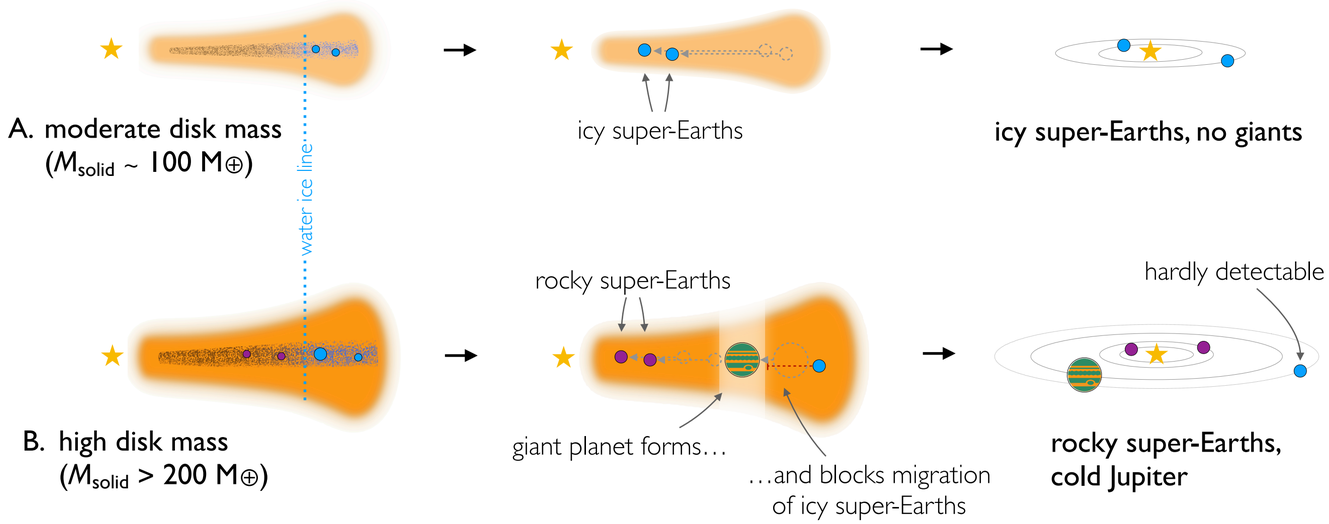
→ Do super-Earths **with/without cold Jupiters** have **different bulk densities**?

Model

We used the Generation III Bern Model of planet formation and evolution[2] to produce a synthetic population of 1000 *multi-planet* systems.

For each system, we modeled

- evolution of a viscous accretion disk (1D)
- planetesimal and gas accretion
- chemical composition tracking
- type-I & type-II planet migration
- N-body interaction of 50 planets
- planet envelope evolution
- stellar evolution



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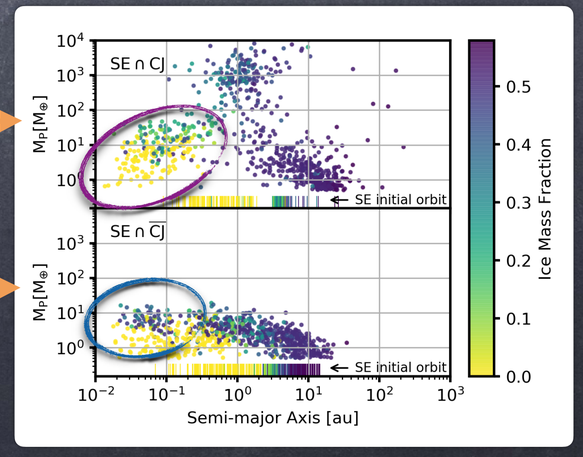
With cold Jupiter: ***rocky*** super-Earths

Without cold Jupiter: ***icy*** super-Earths



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gas disk · rocky/icy solids · orbit migration · icy super-Earth · rocky super-Earth · cold Jupiter

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Results

We discovered a link between system architecture and bulk planet composition: super-Earths in systems hosting a giant planet companion are less ice-rich and thus have a higher bulk density.

→ Prediction: super-Earths of **high bulk density** are **more likely** to have a **cold Jupiter companion**

[1] e.g., Zhu&Wu 2018, Herman+2019, Bryan+2019
[2] Alibert+2005,2013, Mordasini+2012,2015, Emsenhuber+2020