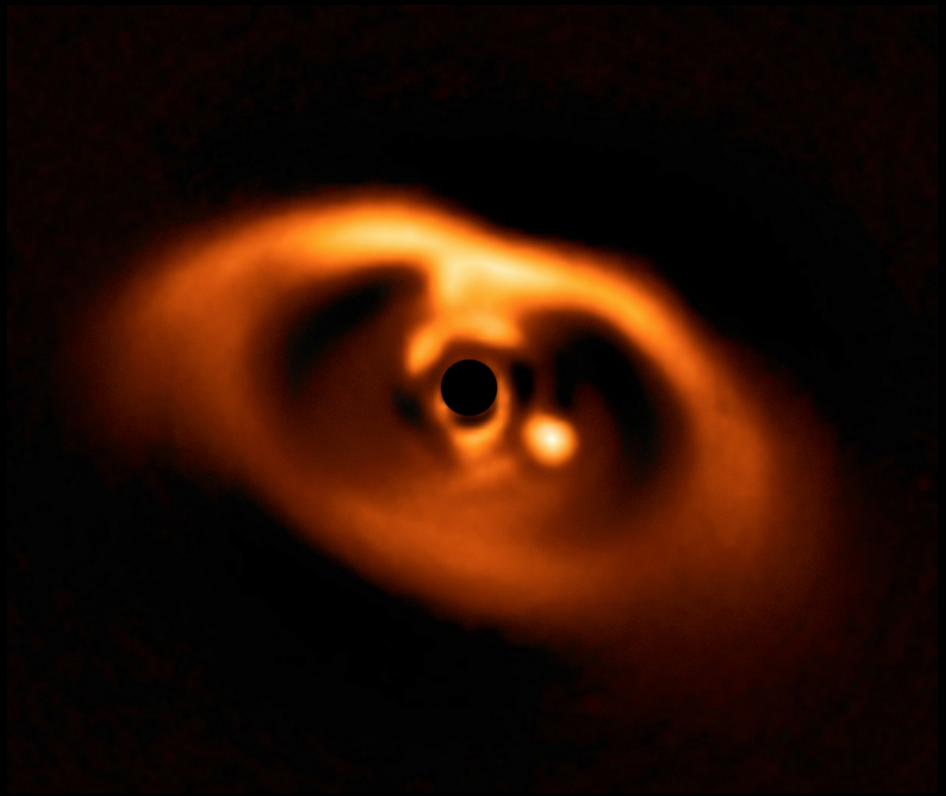

Exoplanets
and
Protoplanetary discs

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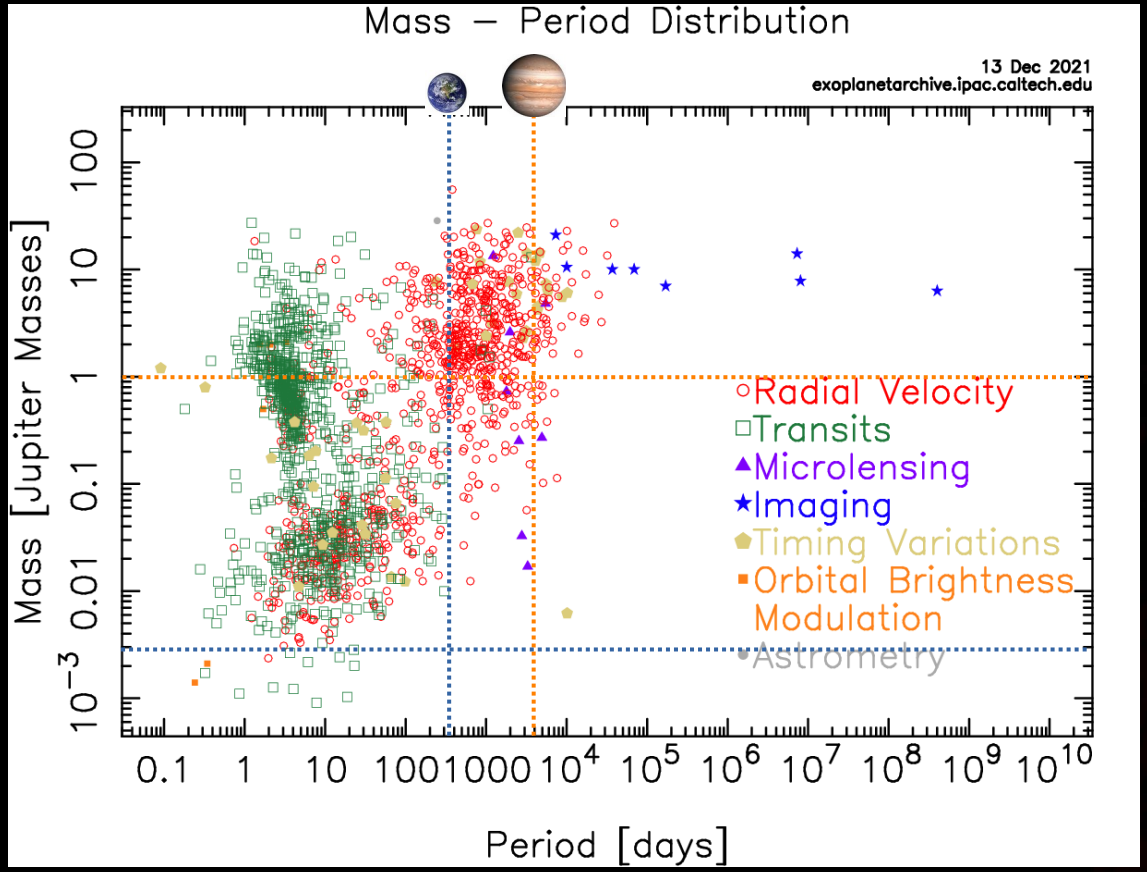
of Mashhad

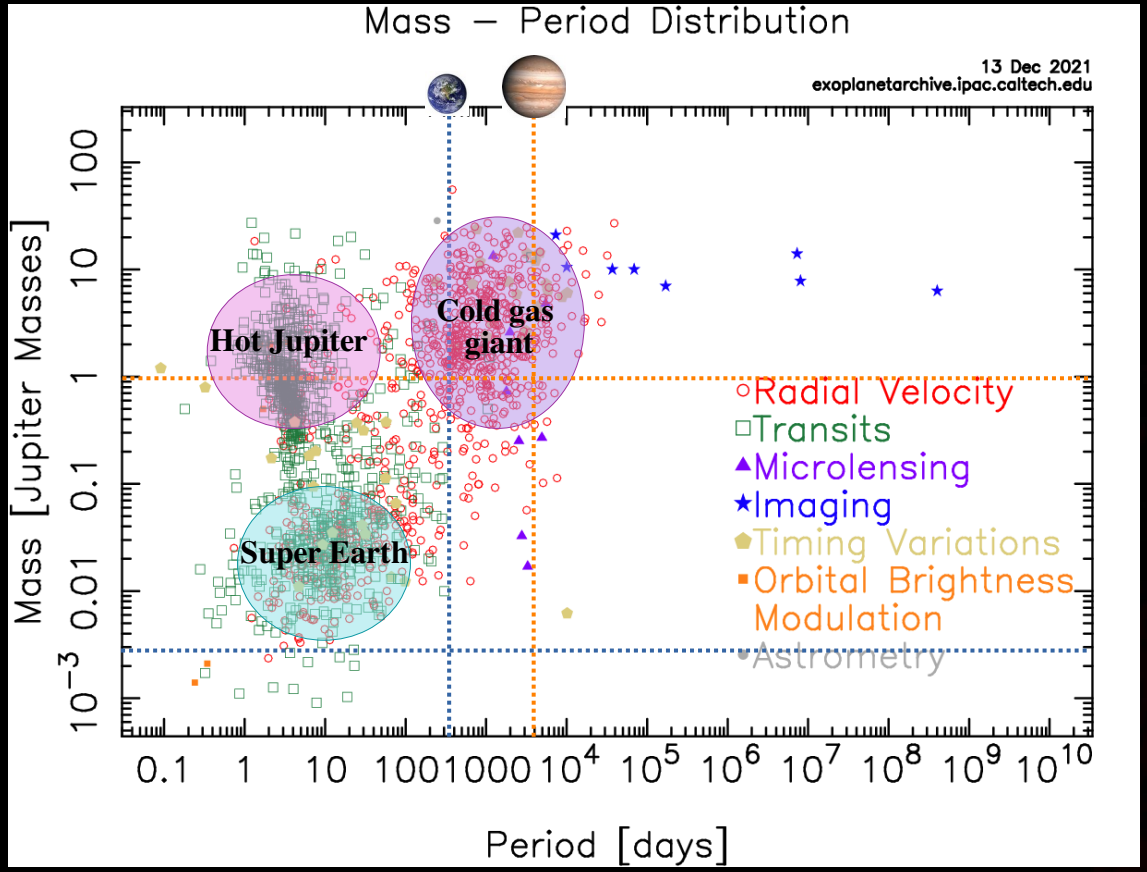
Outline:

- Exoplanets diversity
- Planet formation theories
- Observed forming planets
- Protoplanetary discs diversity
- From discs to planets

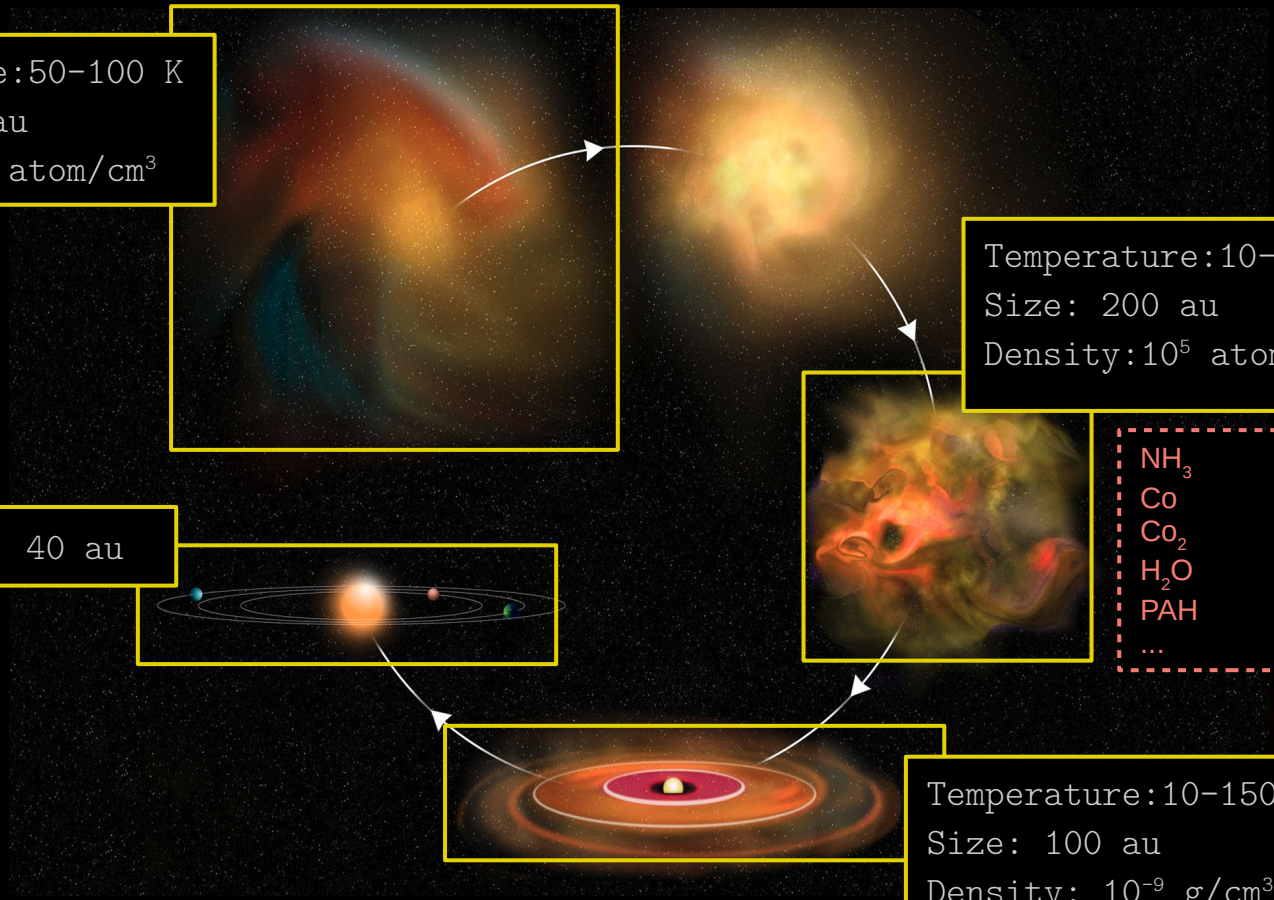
Exoplanets diversity



Exoplanets diversity



Planet formation theories



Temperature:50-100 K
Size: 700 au
Density:50 atom/cm^3

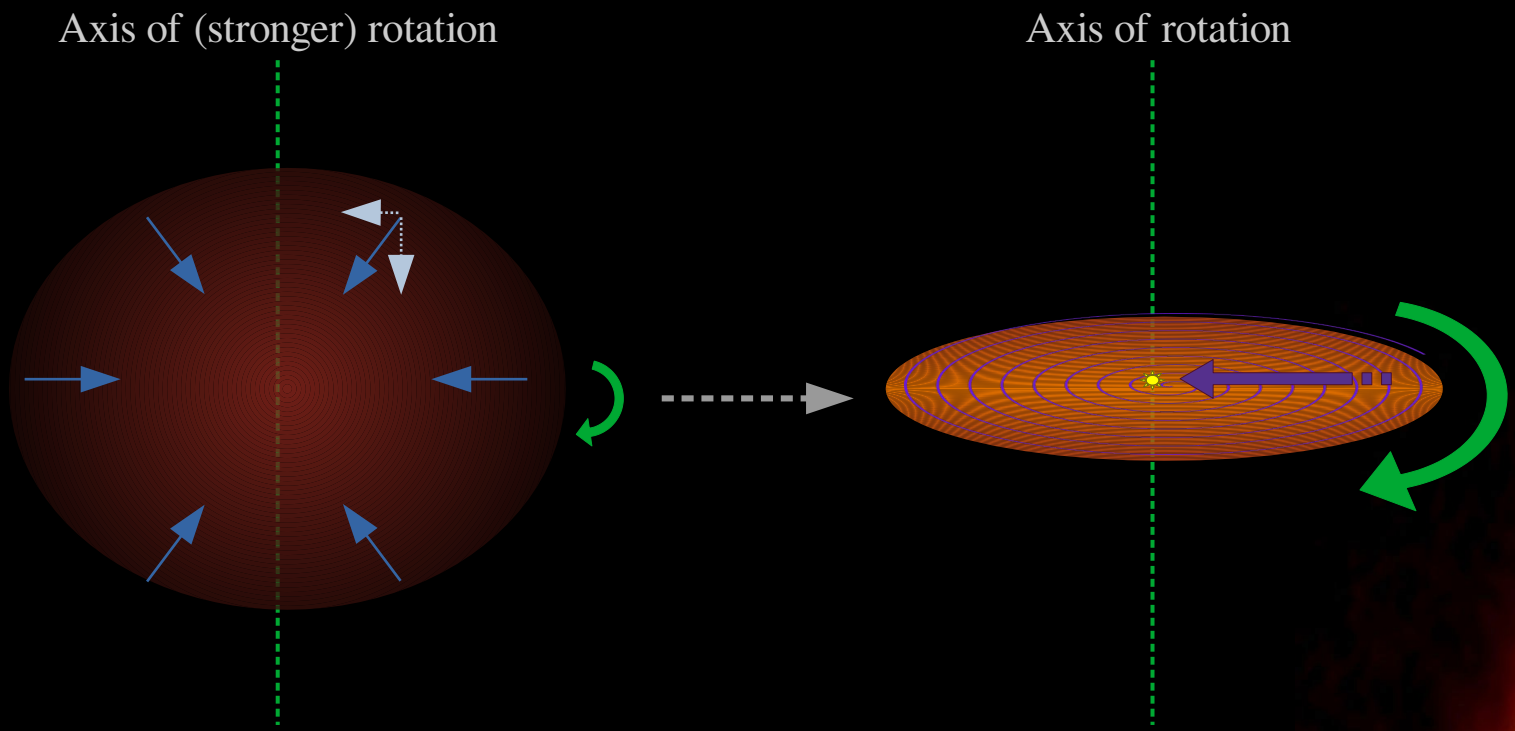
Temperature:10-30 K
Size: 200 au
Density:10^5 atom/cm^3

NH_3
Co
Co_2
H_2O
PAH
...

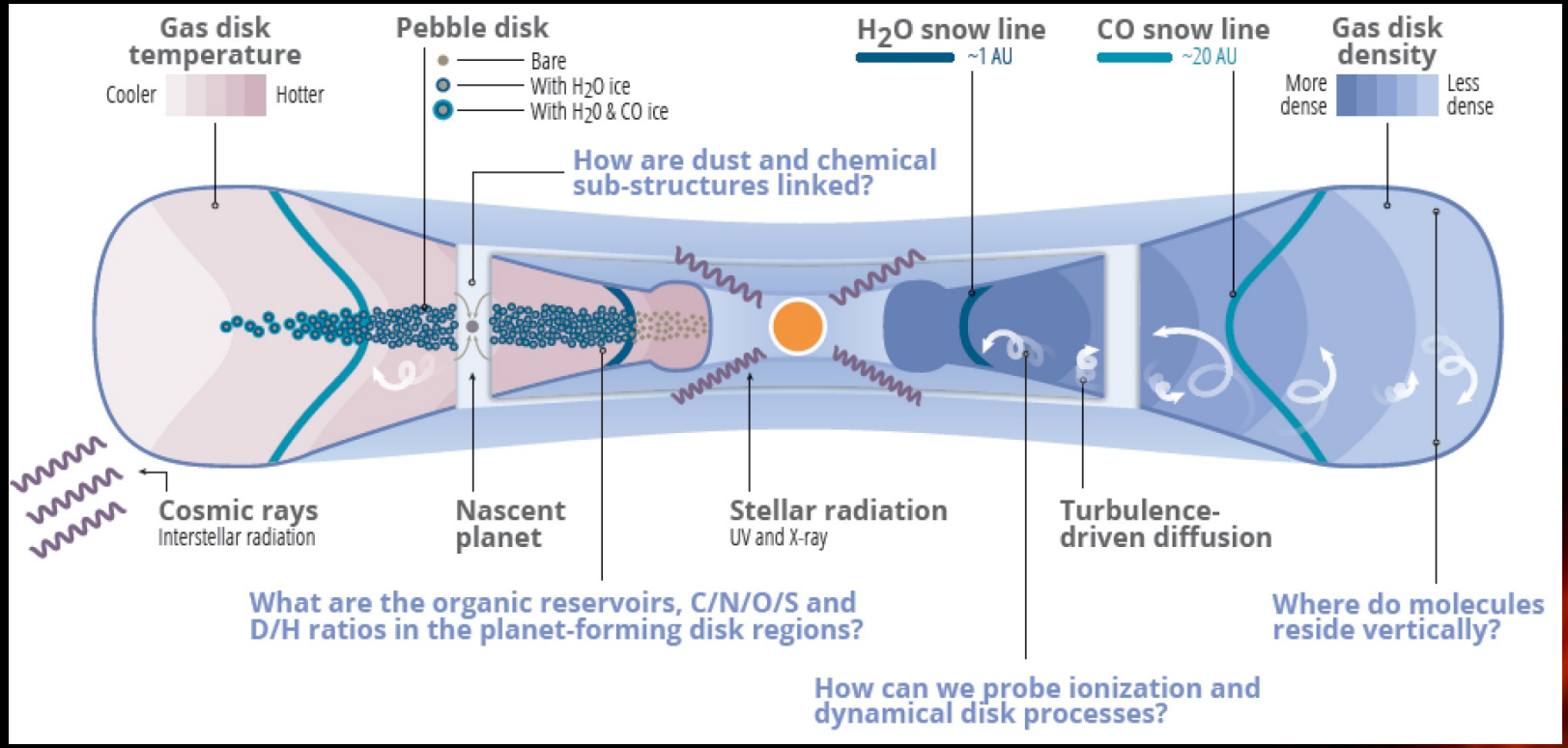
Size: 40 au

Temperature:10-1500 K
Size: 100 au
Density: 10^{-9} g/cm^3

Planet formation theories

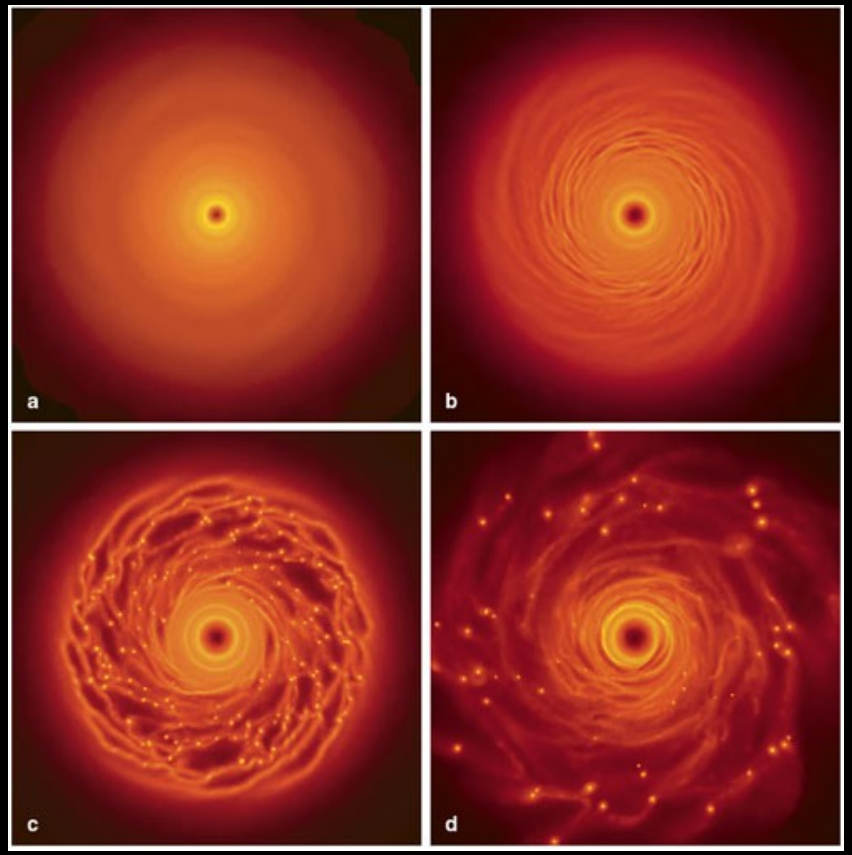


Planet formation theories



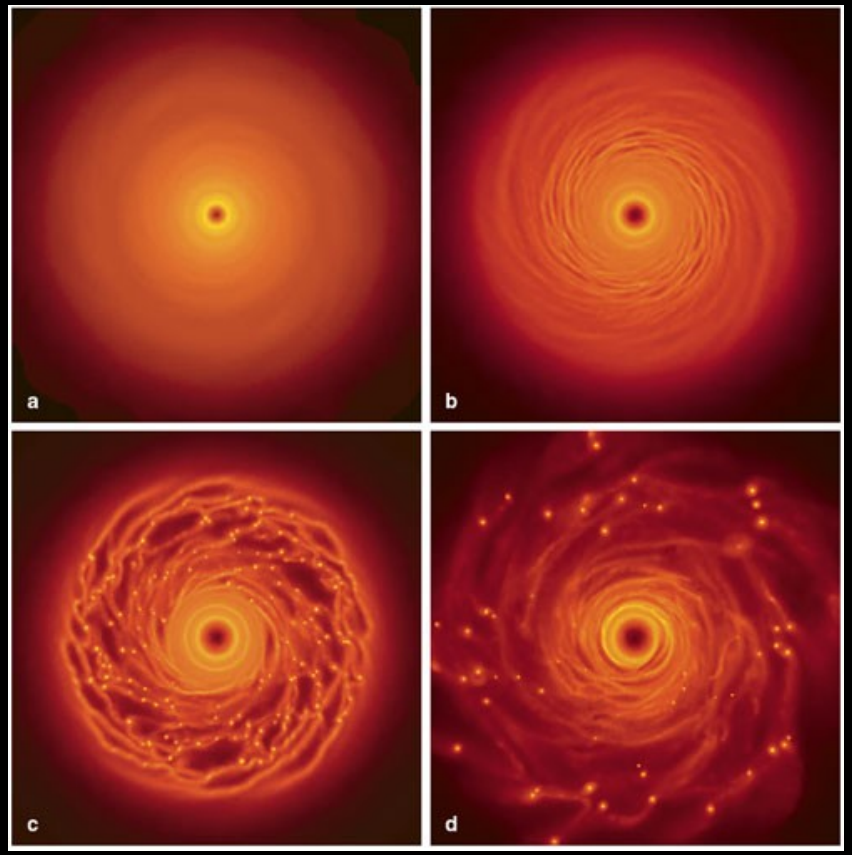
Öberg+ 2021 (MAPS)

Planet formation theories

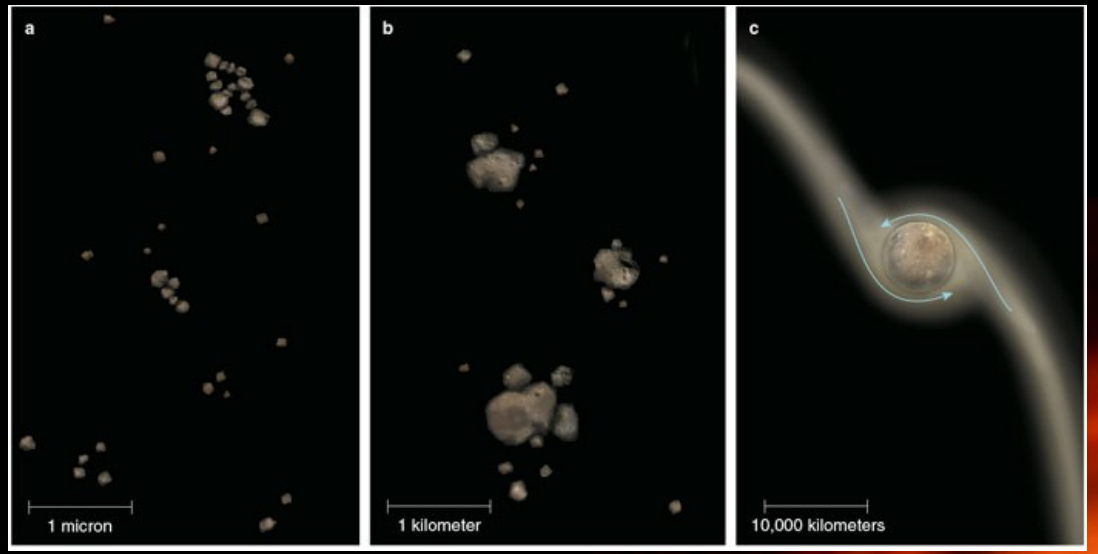


Rice et al. 2006

Planet formation theories

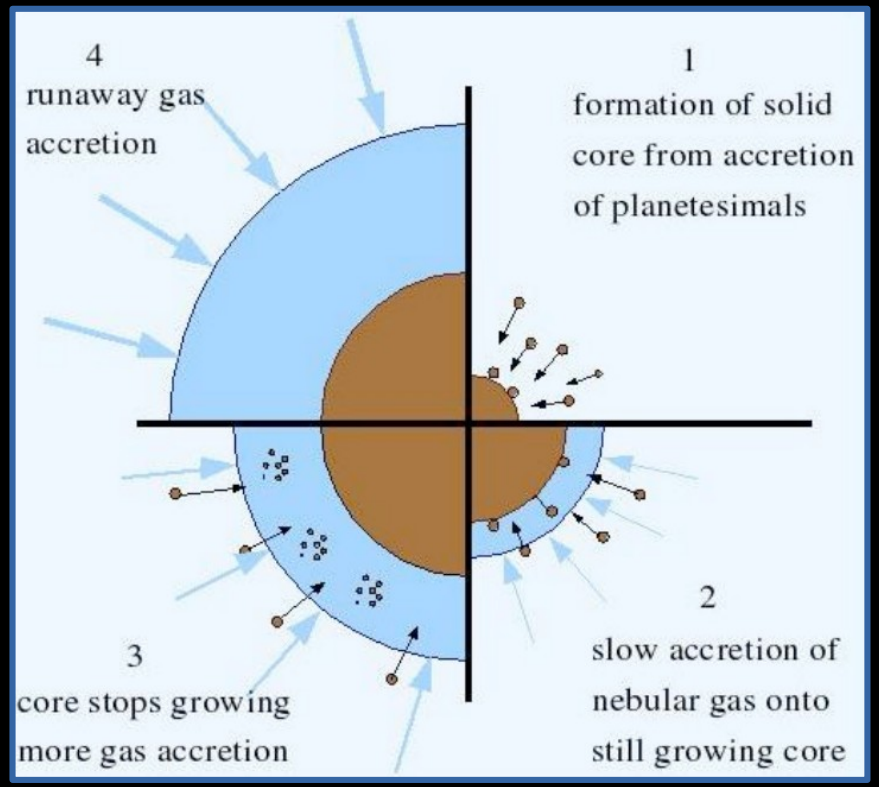


Rice et al. 2006



By: Stephanie Freese

Planet formation theories



By: Willy Benz

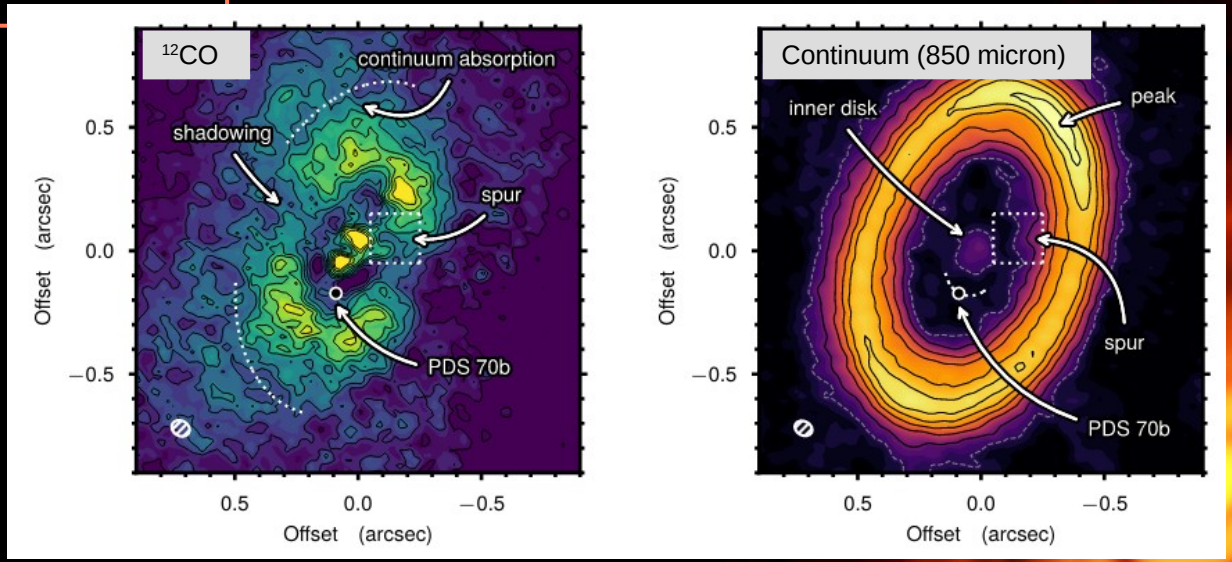
Observed forming planets

Distance: 113 pc
Mass: 0.76 Solar mass
Constellation: Centaurus
Age: 5.4 Myr
Disc: Transitional
PDS70 b (~22 au): Müller+ 2018, Keppler+ 2018

Müller+ 2018

Observed forming planets

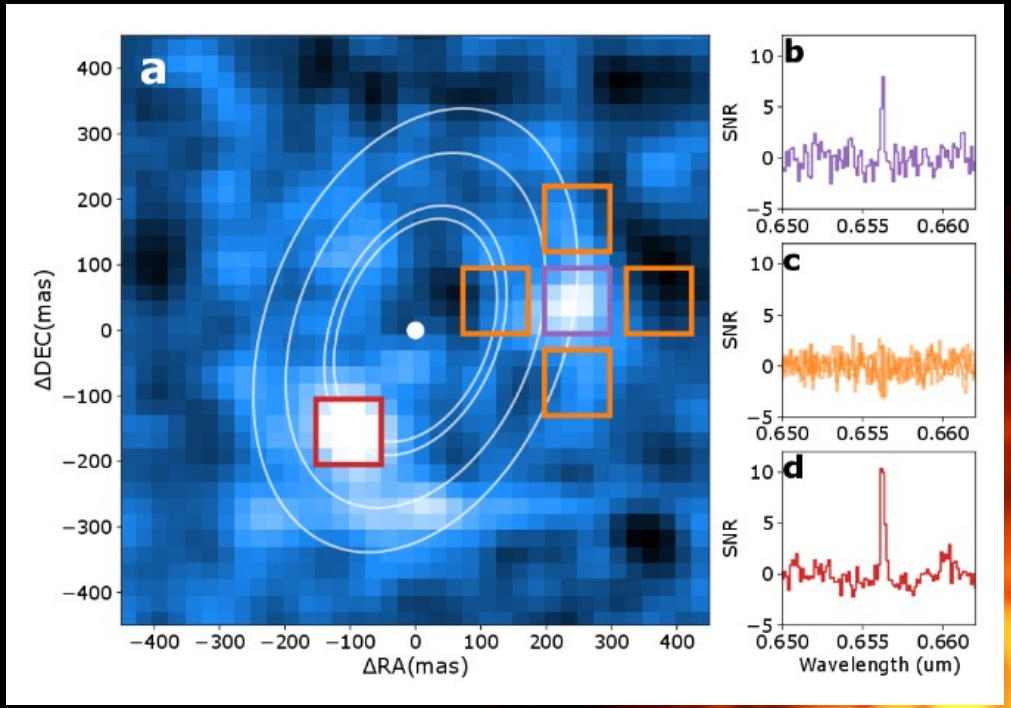
Distance: 113 pc
Mass: 0.76 Solar mass
Constellation: Centaurus
Age: 5.4 Myr
Disc: Transitional, Structured
PDS70 b (~22 au): Müller+ 2018, Keppler+ 2018



Kepler+ 2019

Observed forming planets

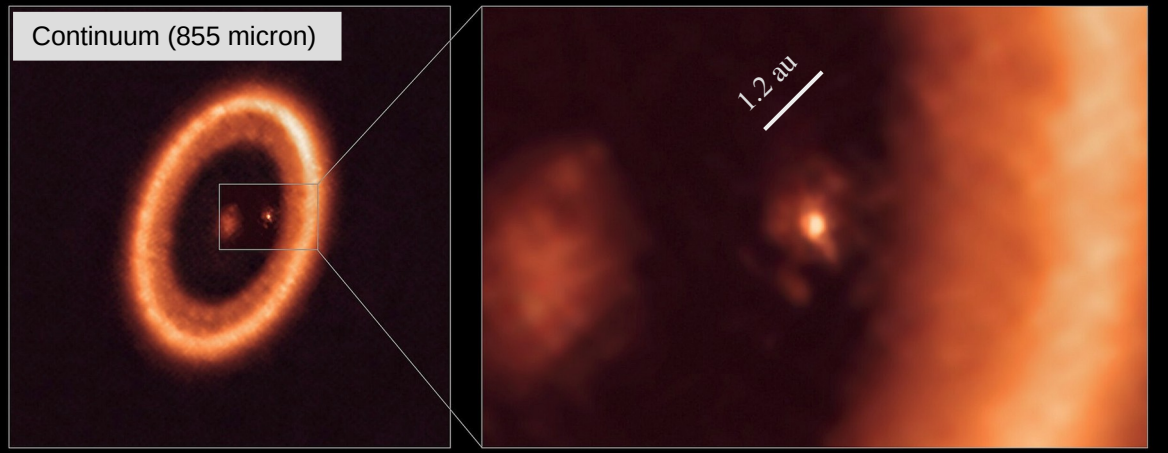
Distance: 113 pc
Mass: 0.76 Solar mass
Constellation: Centaurus
Age: 5.4 Myr
Disc: Transitional, Structured
PDS70 b (~22 au): Müller+ 2018, Keppler+ 2018
PDS70 c (~34 au): Haffert+ 2019



Haffert+ 2019

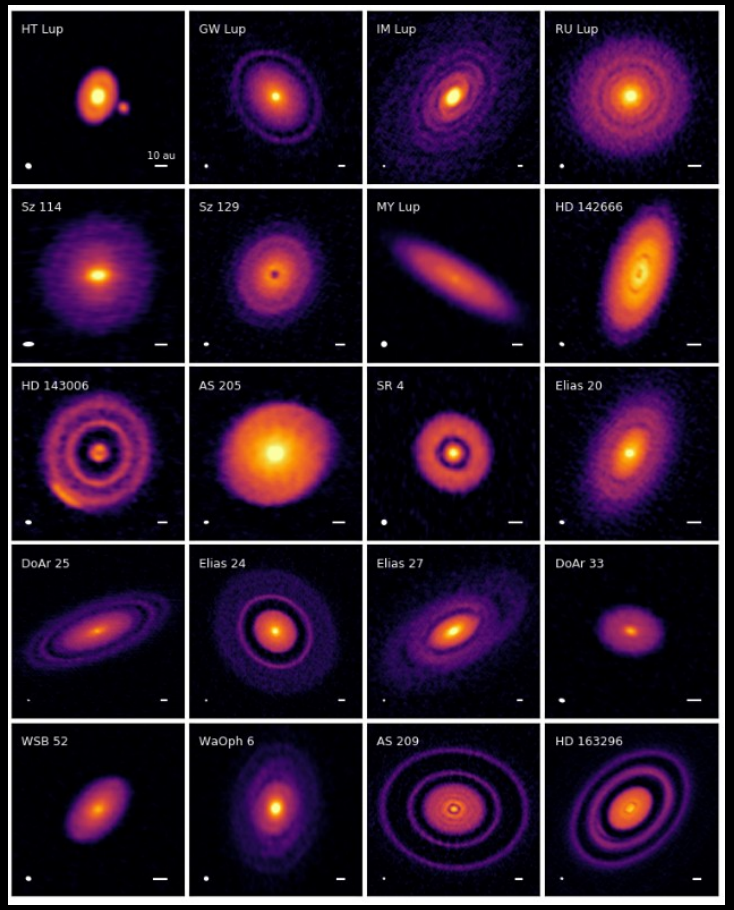
Observed forming planets

Distance: 113 pc
Mass: 0.76 Solar mass
Constellation: Centaurus
Age: 5.4 Myr
Disc: Transitional, Structured
PDS70 b (~22 au): Müller+ 2018, Keppler+ 2018
PDS70 c (~34 au): Haffert+ 2019
PDS70 c CPD (moon?): Benisty+ 2021



ALMA (ESO/NAOJ/NRAO)/Benisty+2021

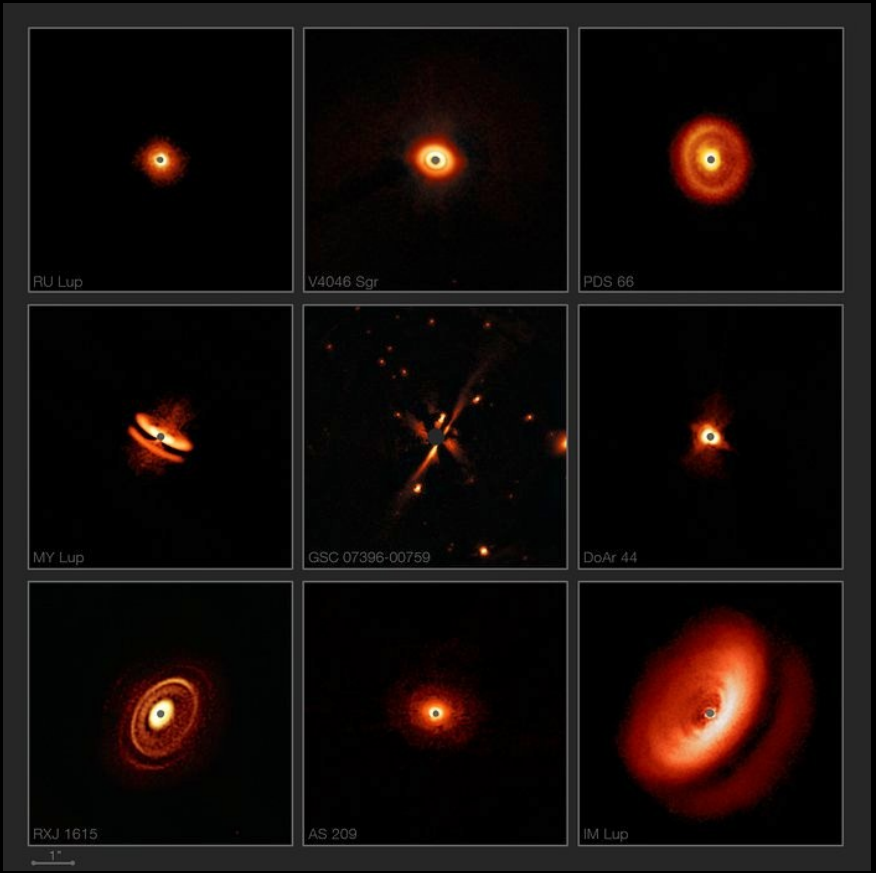
Protoplanetary discs diversity



Andrews+ 2018 (DSHARP)

Wavelength: 1.25 mm
Continuum emission
Beam size on the left
Scale bar of 10au on the right
Distances: 100-161 pc
Stellar masses: 0.5-1.7 Solar mass

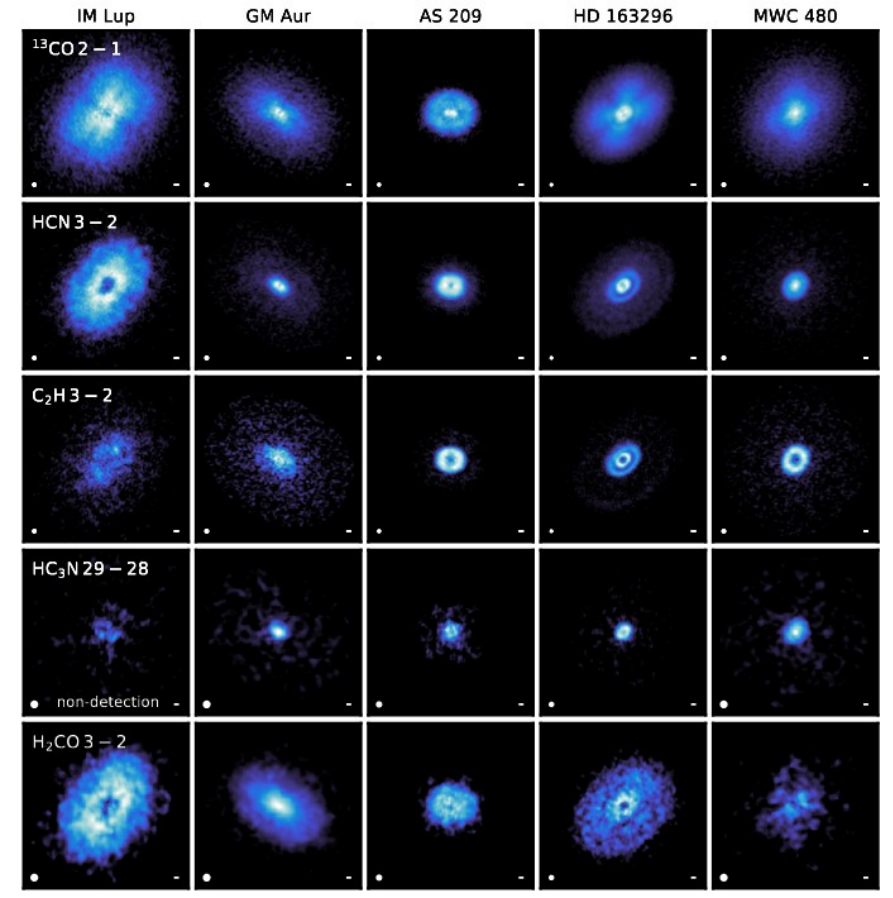
Protoplanetary discs diversity



Credit: ESO/H. Avenhaus et al./E. Sissa et al./DARTT-S and SHINE collaborations

Wavelength: H-band (1.5-1.8 micron)
Scattered light
Resolution on lower left
Distances: 73-185 pc
Stellar masses: 0.7-1.4 Solar mass
Detected signals up to 500au

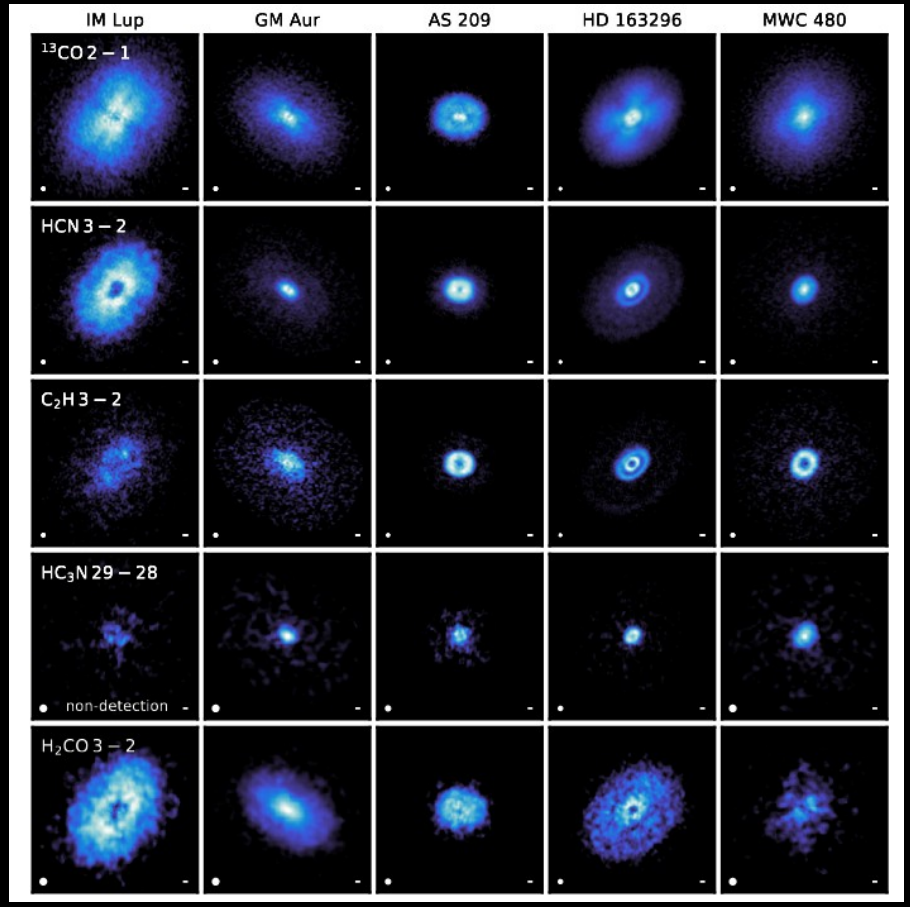
Protoplanetary discs diversity



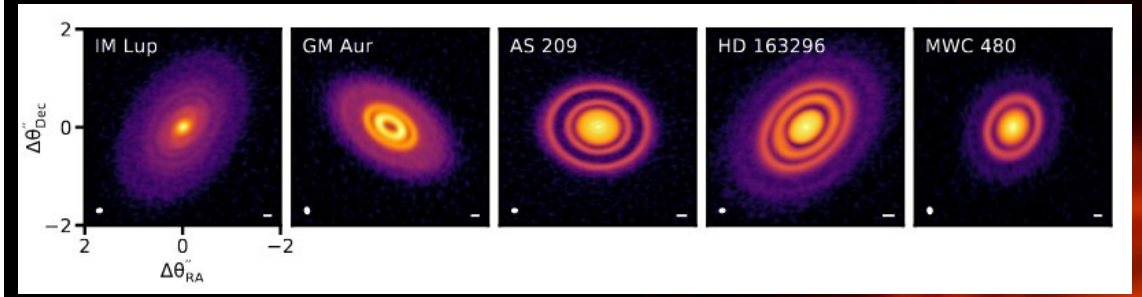
Wavelength: 1.2-3.4 mm
Line emission
Beam size on the left
Scale bar of 20au on the right
Distances: 101-162 pc
Stellar masses: 1.5-2.0 Solar mass

Öberg+ 2021 (MAPS)

Protoplanetary discs diversity



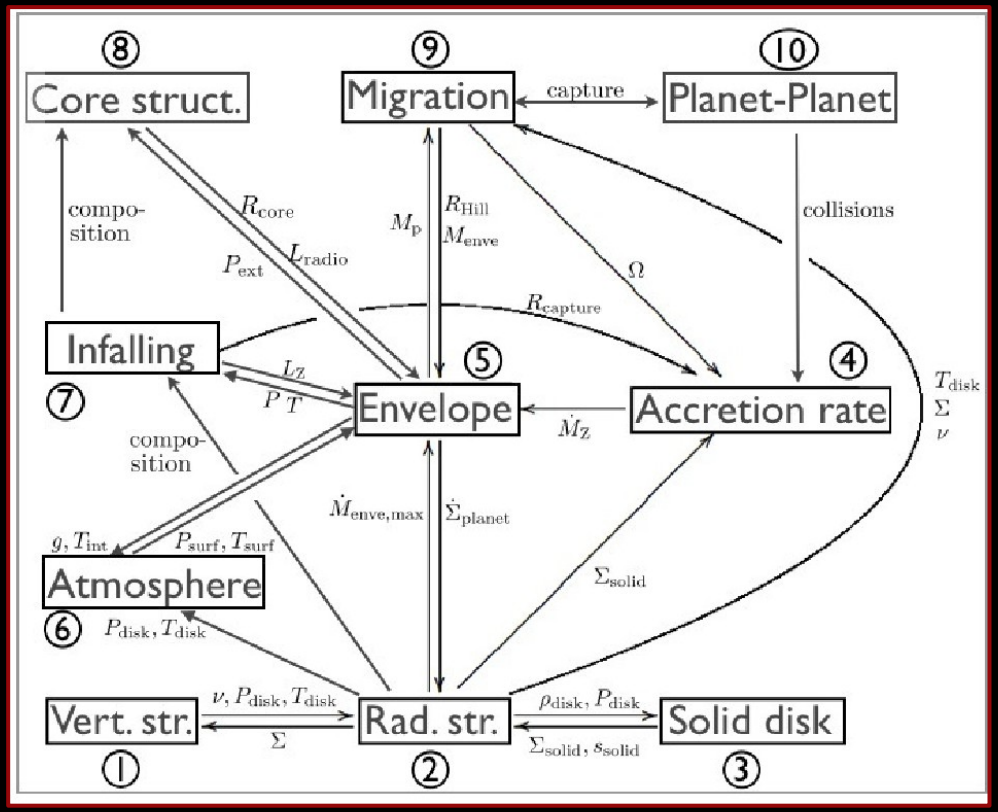
Wavelength: 1.2-3.4 mm
Line emission
Beam size on the left
Scale bar of 20au on the right
Distances: 101-162 pc
Stellar masses: 1.5-2.0 Solar mass



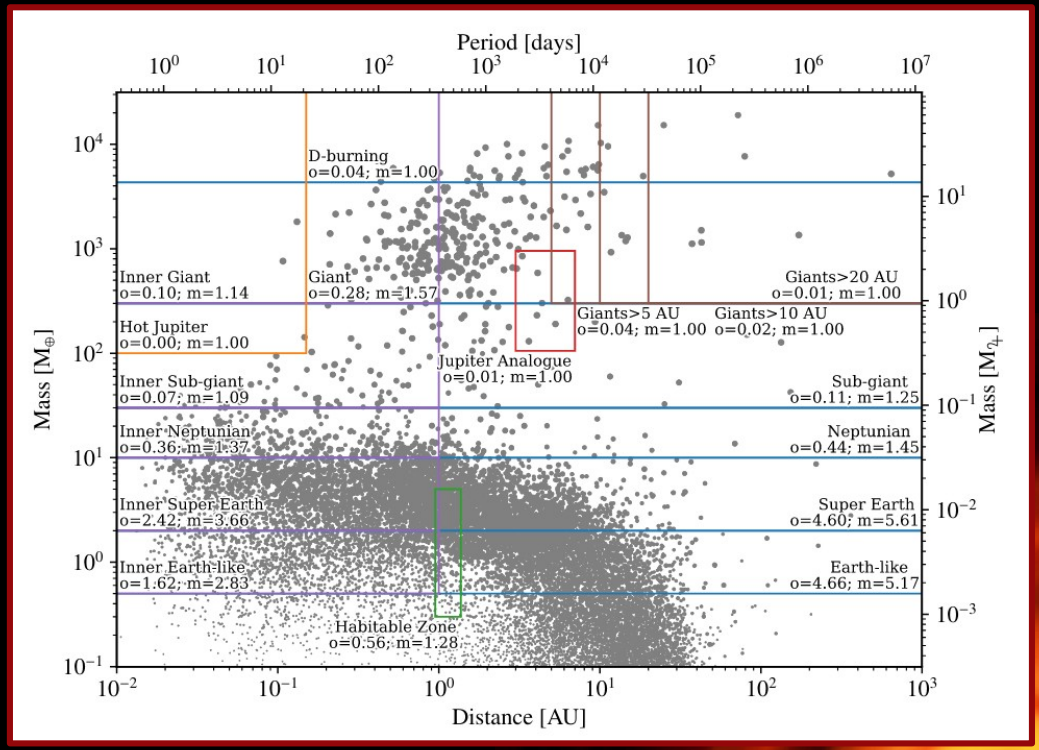
Wavelength: 1.3 mm
Continuum emission

Öberg+ 2021 (MAPS)

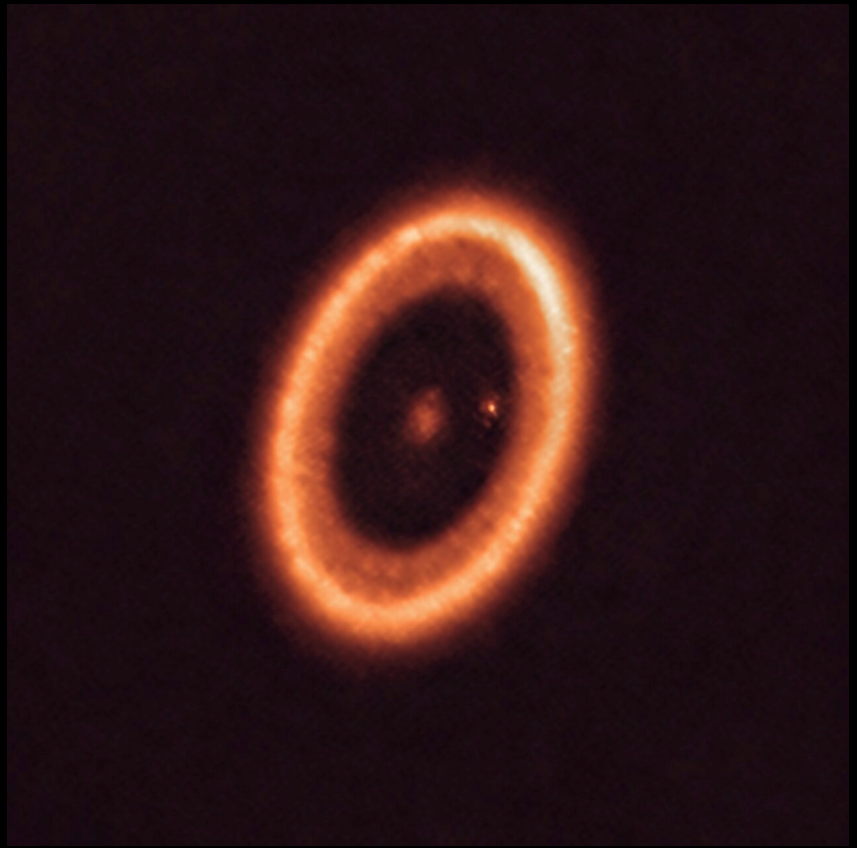
From discs to planets



Benz+2014



Emsenhuber+2021



Thanks for your attention!