

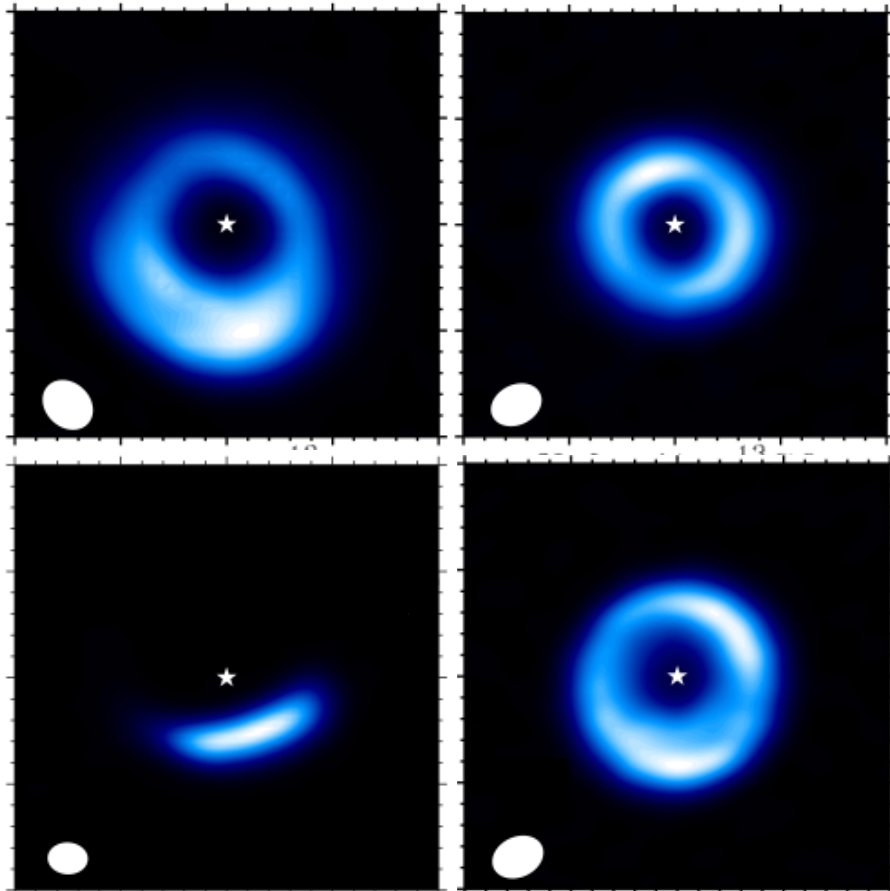
Study Planet Formation with Future Radio Telescopes

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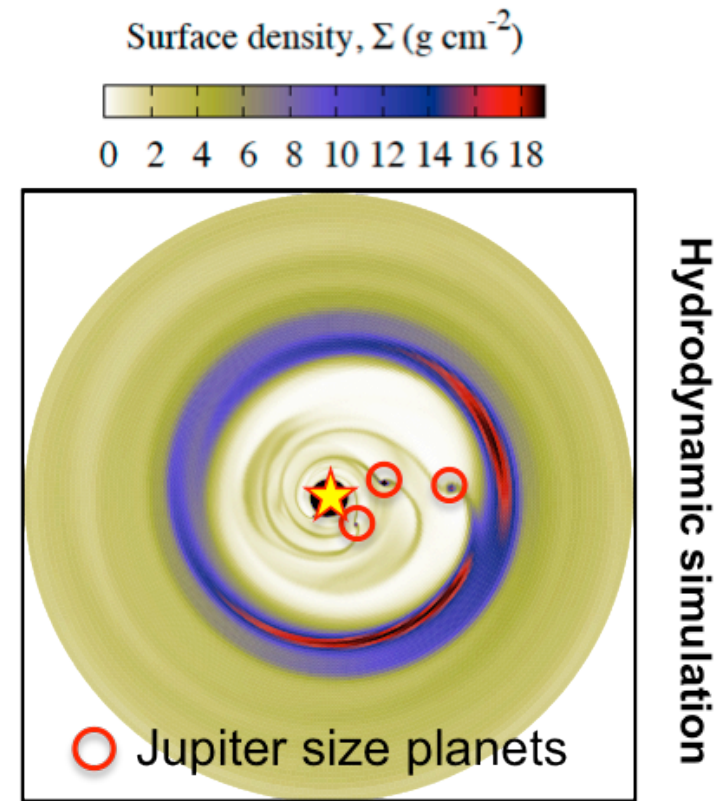


ALMA observations of Protoplanetary disks

Reveal large scale perturbations on the disk structure possibly caused by the tidal interaction between young planets and the circumstellar material



Dust continuum emission between 345-690 GHz
Resolution of 0.2", corresponding to 30 AU



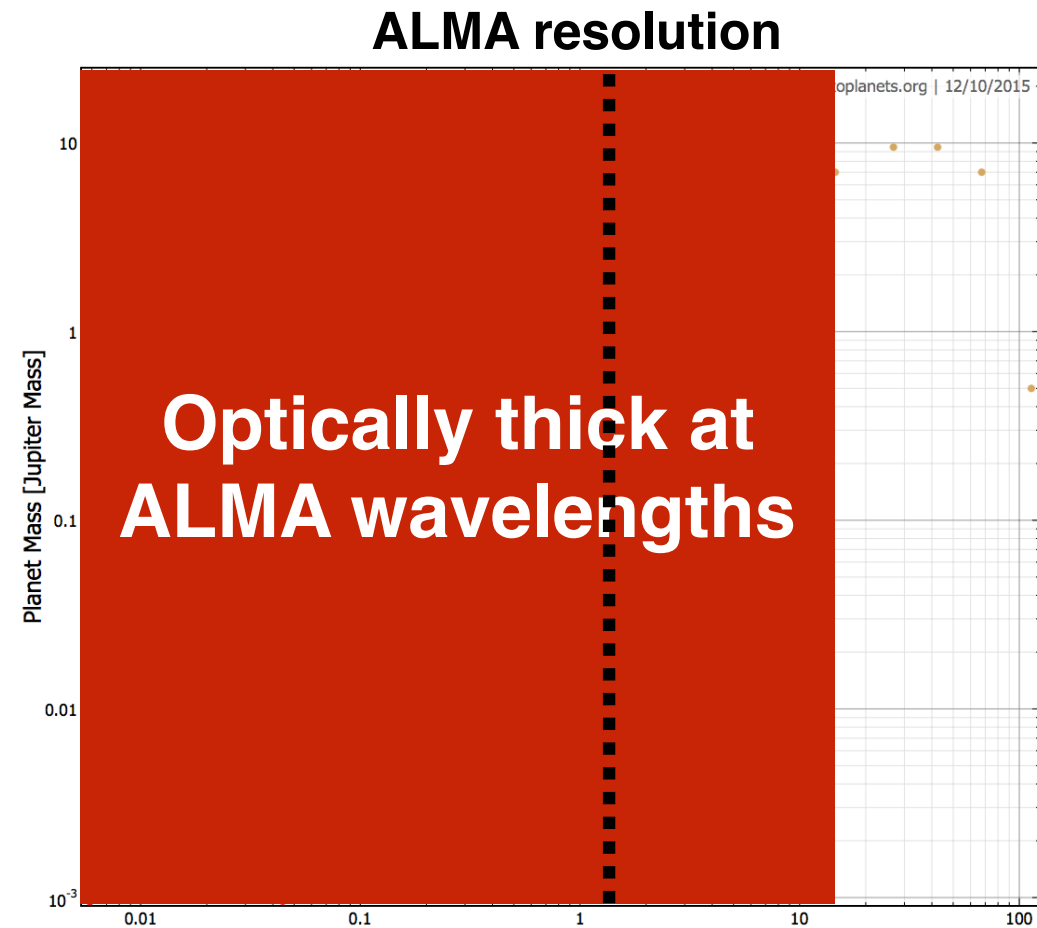
Isella et al. (2013)
Perez et al. (2014)
Van der Marel et al. (2015)

The optical depth problem

The regions where most of the planets form are optically thick at the wavelengths covered by ALMA.



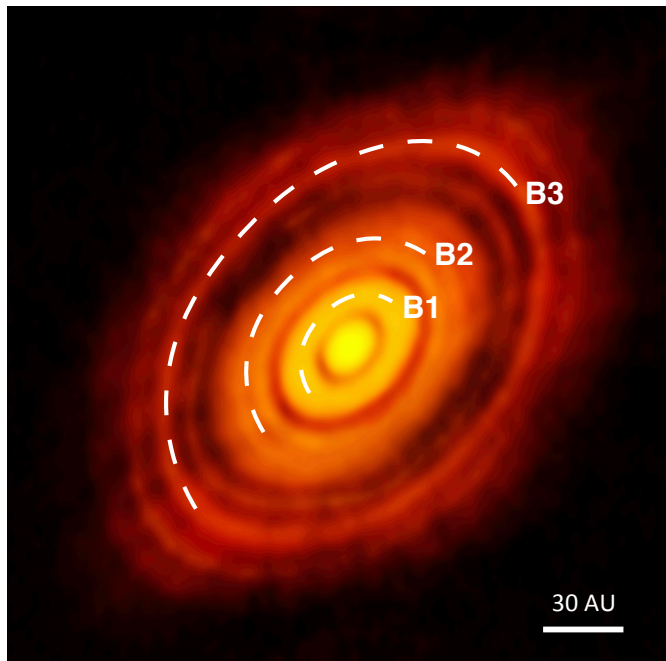
Image credit: Kraus et al. (2014)
Planet Formation Imager



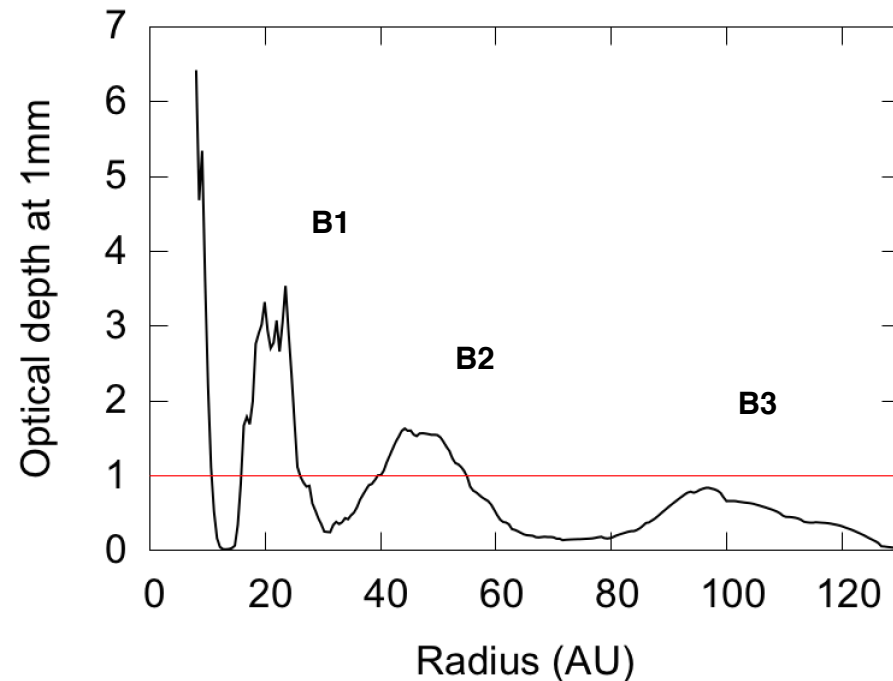
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ALMA partnership (2015)



Jin et al. (2016, ApJ submitted)



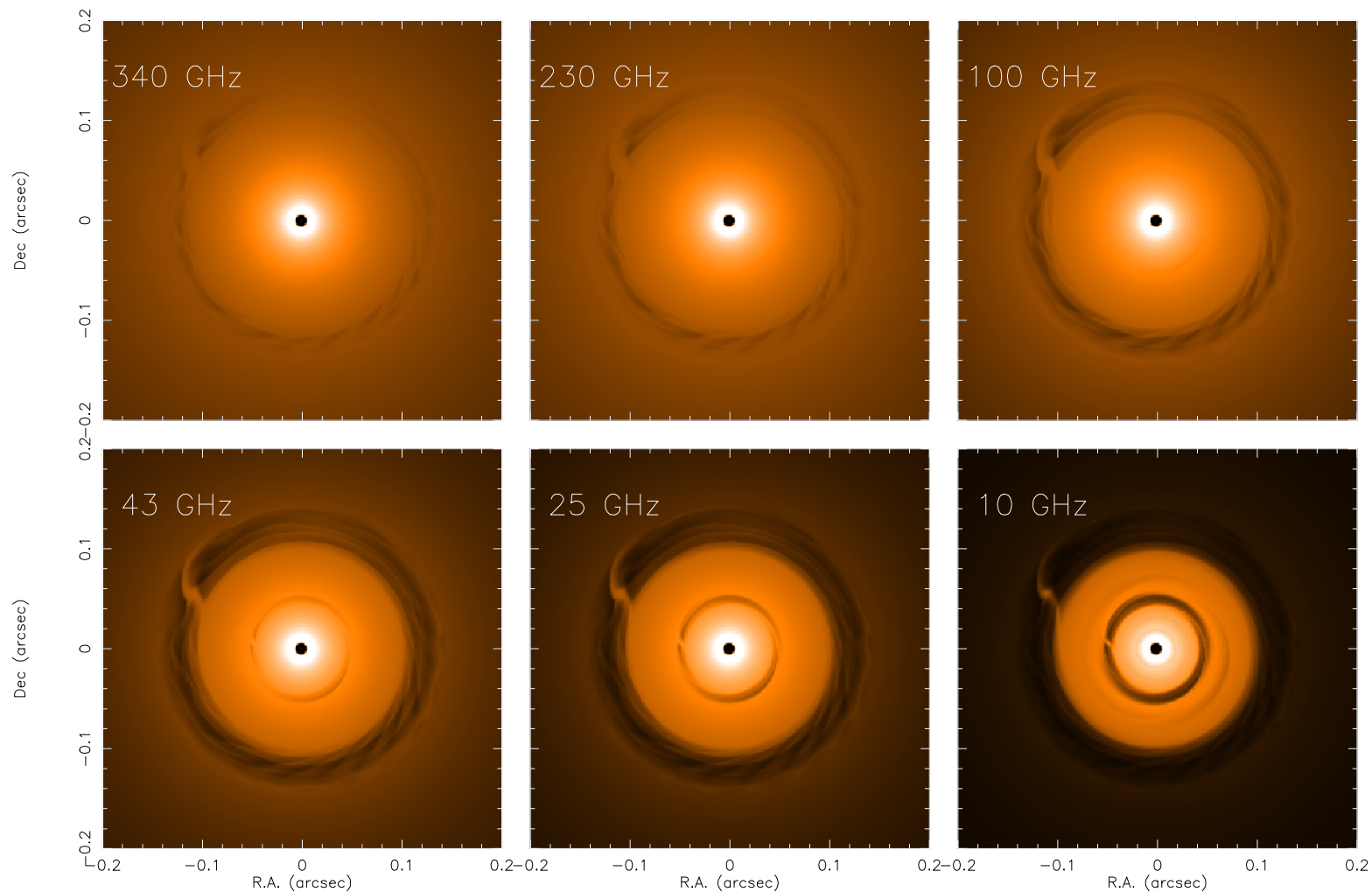
How do we access planet forming regions?

Longer wavelengths

$$\tau_d \propto \lambda^{-1}$$

$$\lambda > 3 \text{ mm}$$

$$\nu < 100 \text{ GHz}$$



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Longer wavelengths

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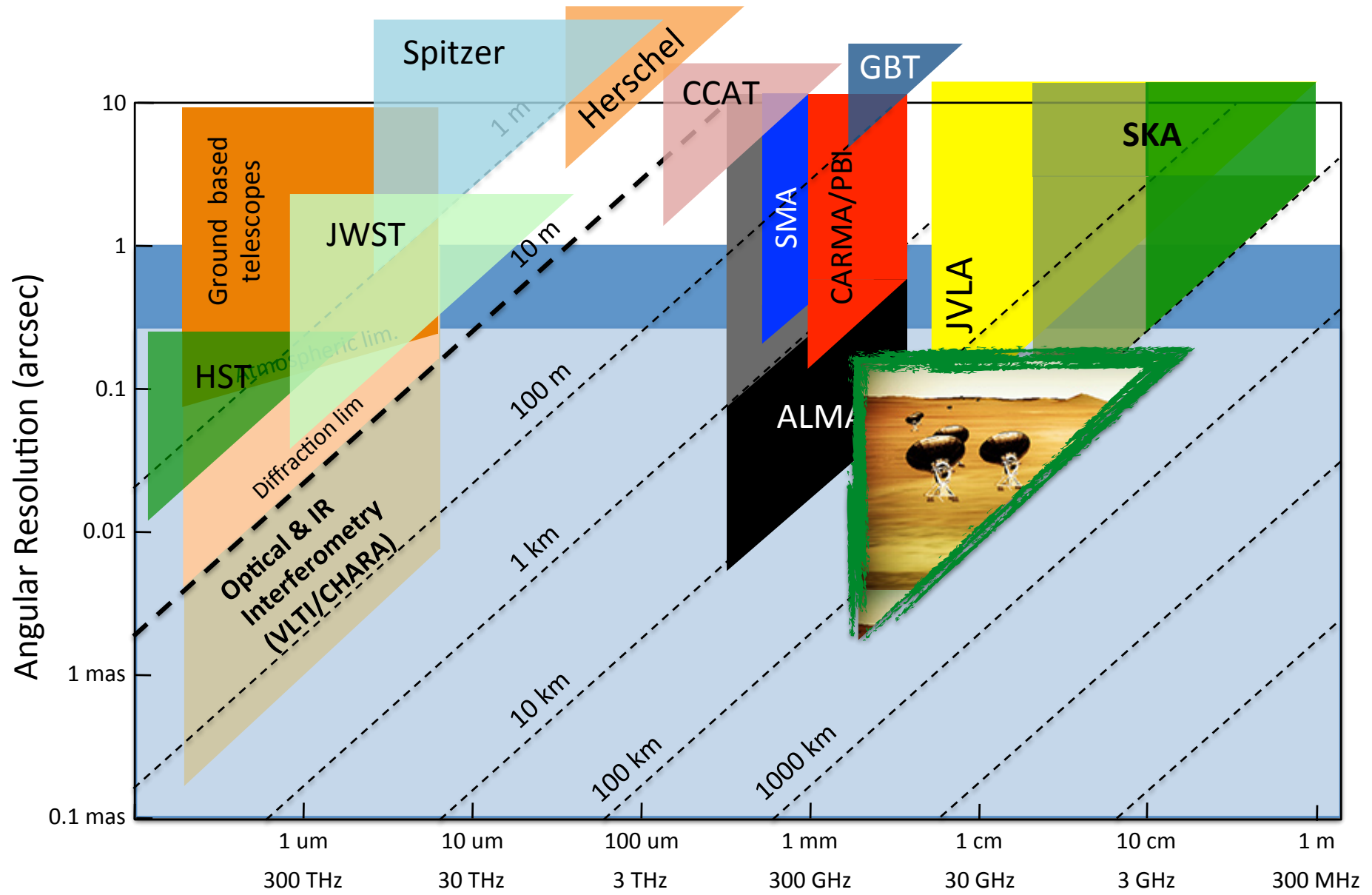
... but not too long.

$$I_\nu \propto \lambda^{-3} \quad \lambda < 6 \text{ cm} \quad \nu > 5 \text{ GHz}$$

high angular resolution

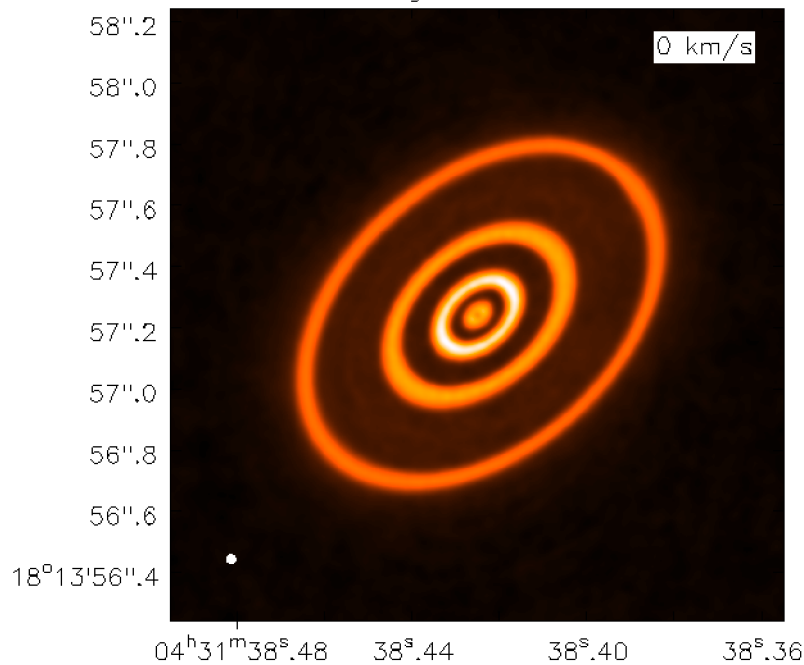
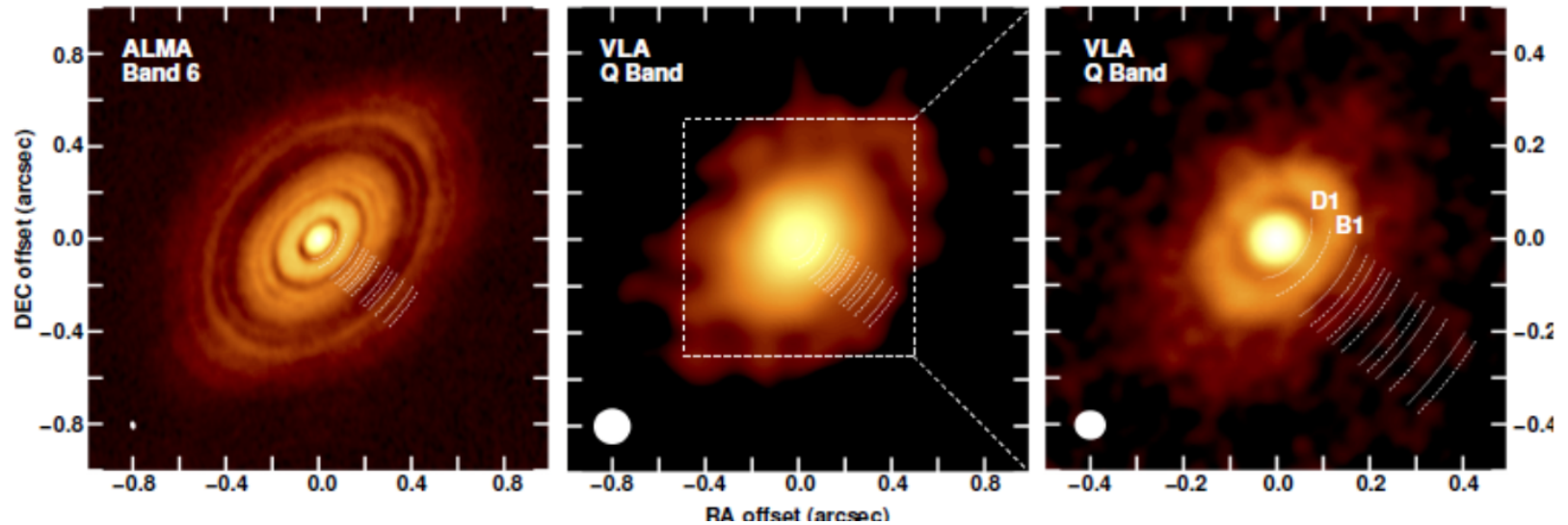
$$\lambda = 1 \text{ cm} \quad \theta < 1 \text{ AU} \quad \theta < 0.008'' \quad D > 250 \text{ km}$$

How do we access planet forming regions?



A view of the HL Tau disk at 1 cm

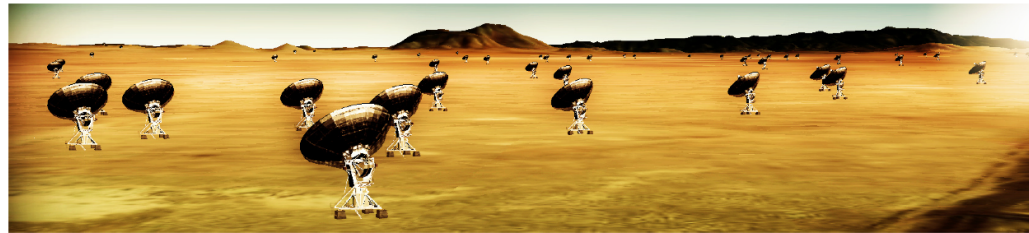
Carrasco-Gonzalez, Henning, et al., (2016)



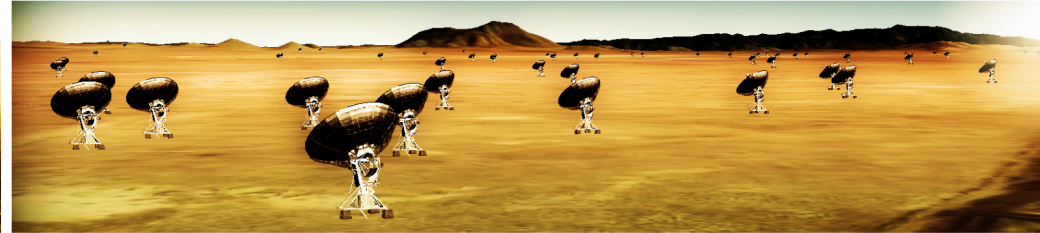
**Simulated observation
(noise is included)
at the wavelength of 1 cm.
Angular resolution 0.025''.**

Jin et al. (2016, ApJ submitted)

Available on arXiv>astro-ph



Next Generation Very Large Array Memo No. 5 Science Working Groups Project Overview



Next Generation Very Large Array Memo No. 6 Science Working Group 1 The Cradle of Life

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