ALMA/45m/ASTE Users' Meeting 2017
26th Dec. 2017, NAOJ

ALMA Fellow Report

2016-02A
High Resolution Observations of Protoplanetary Disk Structures as a Pathway towards Understanding Planet Formation Processes

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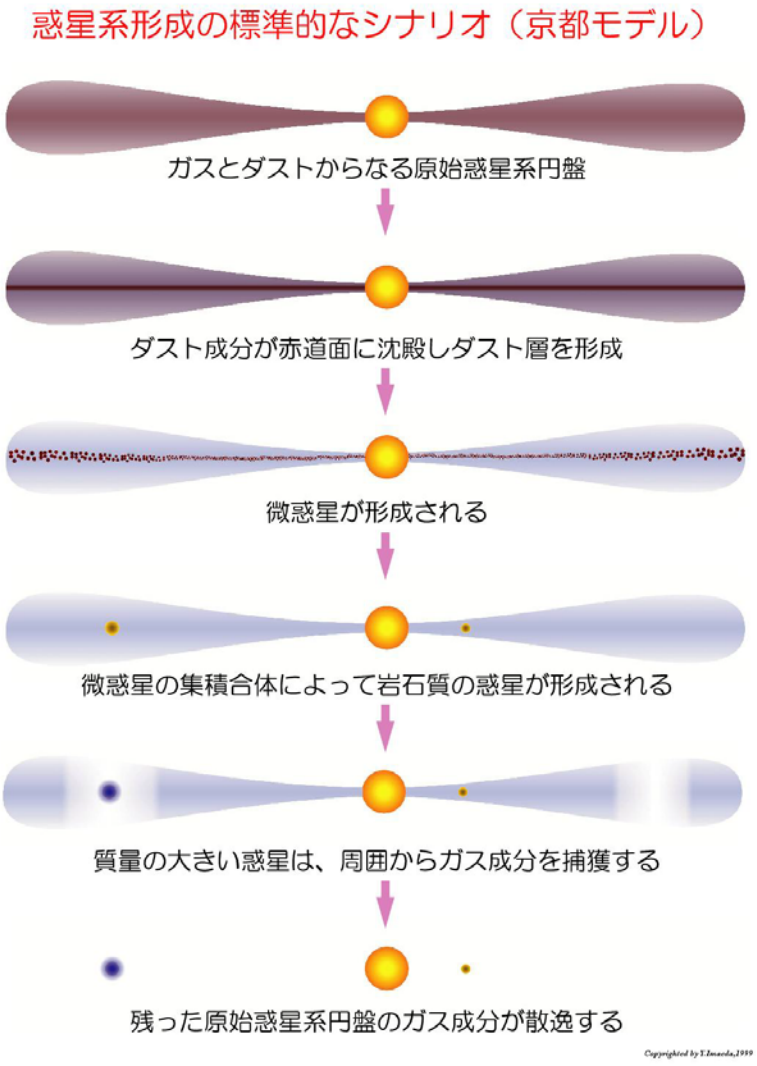
Project Overview

- Goal:
  - to understand planet formation processes through high resolution observations of protoplanetary disks

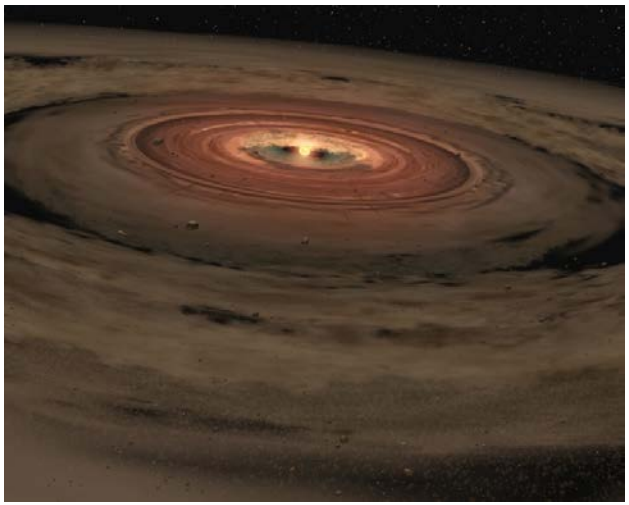
- ALMA Fellow:
  - Sanemichi Z. Takahashi (Poster 32)

- Starting Date:
  - 31st March 2017

Protoplanetary Disk and Planet Formation

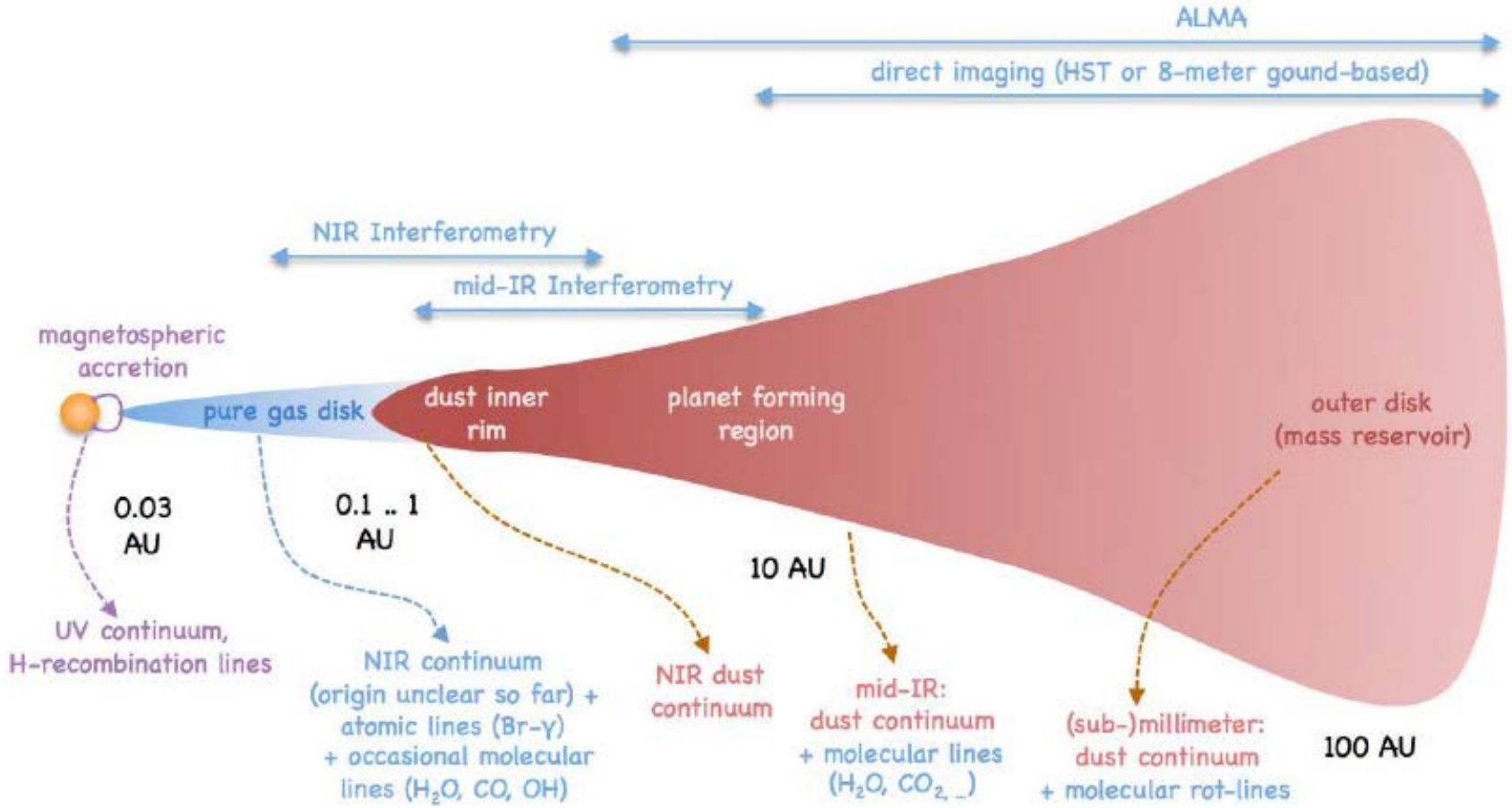


- Protoplanetary disks are birthplace of planets
- Mixture of gas and dust
- Dust grains grow to planets



From NASA

Overview of Protoplanetary Disk

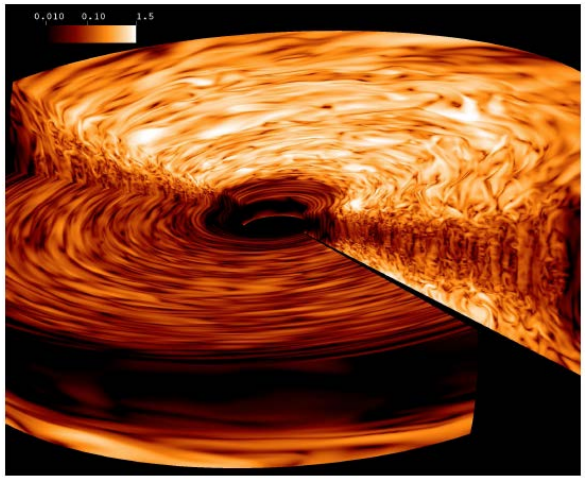


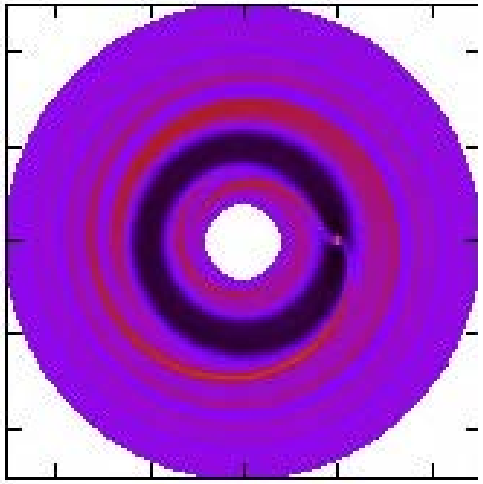
- Cold, thin disk
- Many are located at >~140 pc (the closest one at ~50 pc)

Dullemond and Monnier 2010

Why high resolution?

- Key to understand dynamical structure
  - Important scale: disk scale height
  - H ~ (sound speed) * (Kepler time) ~ 10 AU at r=100 AU
  - Need to resolve ~ 0.1 asec structures at d=140 pc



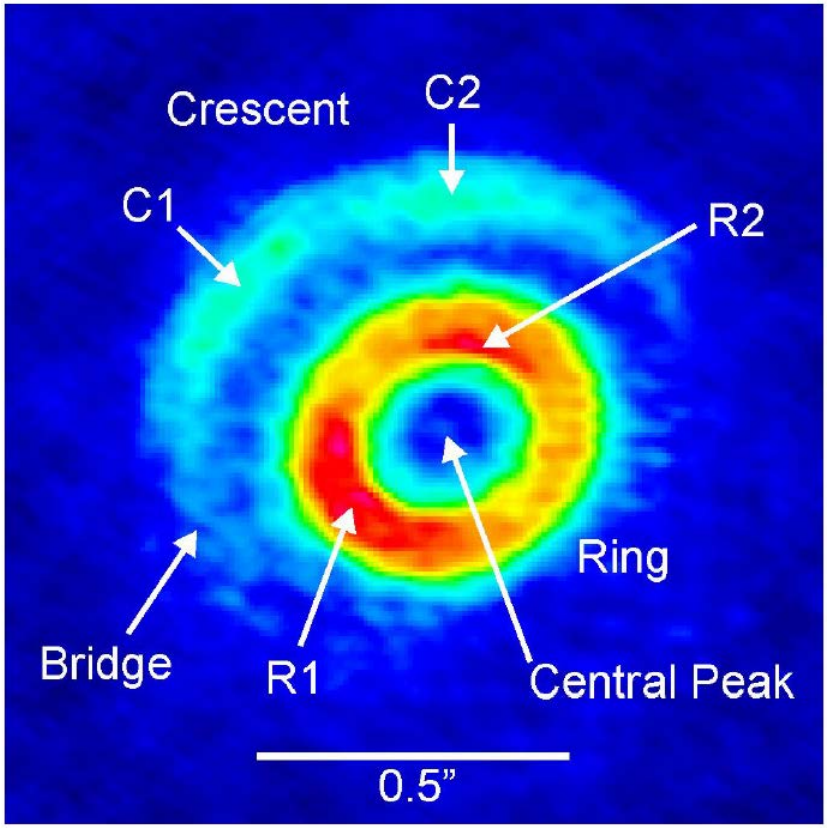


Flock et al. 2011
FARGO simulation

Some Key Questions and Projects

- What's happening in protoplanetary disks?
  - Project 1: V1247 Ori – ring and crescent disk
- What are protoplanetary disks?
  - Project 2: Search for possible asymmetric structures
- How do protoplanetary disks form?
  - Project 3: young, evolved disk?

Project 1: V1247 Ori



- F0V star at 320 pc
- ALMA Cycle 3, Band 7, ~0.04asec resolution
  - ~13 AU resolution
- Ring + crescent structure
  - Possible “dust trap”?
- Follow-up observations and analyses ongoing

Krauss, Kreplin, Fukagawa, Muto et al. (2017)

Project 2: Search for Asymmatric Disk

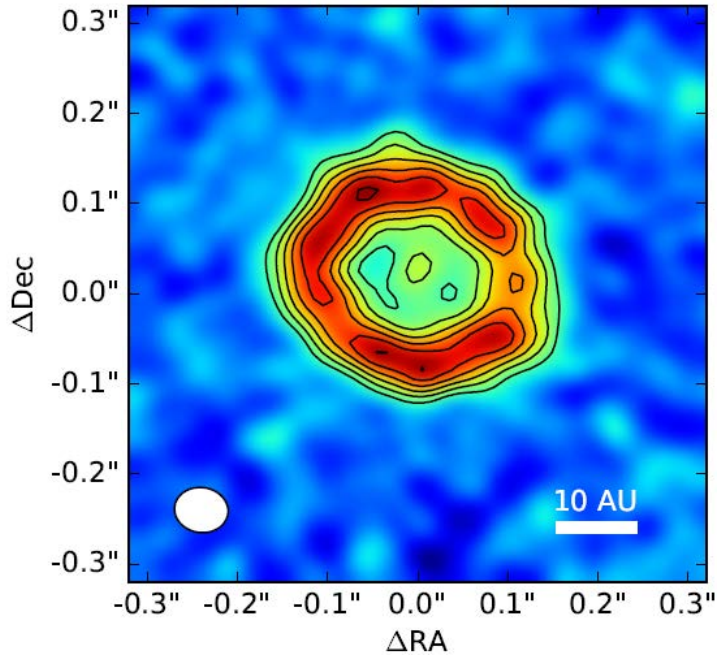
- 2017.1.00286.S (PI:Muto), Grade B
- Three targets are proposed
- Some data are delivered, investigation under way

Project 3: Young transitional disk

- M3 protostar, Embedded in envelope
- Age ~ 0.5 Myr

- ALMA found an inner hole in the disk
  - Already evolved disk?

- Modeling work under way
  - Takahashi and Muto in prep.



Sheehan and Eisner 2017

Summary

- ALMA fellow program 2016-02A
- Protoplanetary disk high resolution observations to understand planet formation

- Ring + Crescent structures in V1247 Ori
  - Hint of dust trap?
- Search for asymmetric structures
  - Data just delivered, analyses ongoing
- Model for young transitional disk
  - Disk *formation* and *evolution* within one model