

The studies of protoplanetary disks with ALMA: towards comprehensive understanding of planet formation

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Thanks to its unprecedented sensitivity and spatial resolution, ALMA is providing us with striking informations about nearby star-forming regions and protoplanetary disks. In this presentation, I will review important results to establish comprehensive understanding of planet formations. The first part will discuss the possible planet formations via disk fragmentation by gravitational instability. ALMA has found ring-gap features in more than 10 protoplanetary disks, and these gaps are likely to be carved by a planet. One can estimate the mass of the planet from the width and depth of a gap by comparing them with hydro-dynamic simulations, and the inferred combination of planet mass and its location around some pre-main sequence stars seems to be realized only through disk fragmentation by gravitational instability in a early evolutionary stage. In fact, ALMA has also revealed disk structure which strongly suggests ongoing disk fragmentation in some protostellar disks. The second part, on the other hand, will emphasize the studies related to the dust growth, which is the most fundamental process in the planet formation via rocky planetesimals. The topics will include the discoveries of dust-concentrated regions in some disks and the estimation of dust particle size based on polarization observations of dust thermal radiation.

Keywords: Planet formation, Protoplanetary disks, Astronomical observations