CO survey of debris disks with ALMA

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Debris disks are at the final stage of the formation of main sequence stars and their planetary system. Clarifying this stage is crucial to understand the origin of the Oort clouds in our solar system. Debris disks were thought to be gas-less for a long time, but molecular gas (e.g., CO) is detected in recent observations. One of the possible origins for such gas is “primordial”, or the remnant gas of proto-planetary disks. If circumstellar disks maintain the gas components from proto-planetary to phase, the gas depletion process significantly affects planet formation within the disks. The other possibility for such gas origin is “secondary”. Several different mechanisms can be considered: sublimation of dust grains or planetesimals, photo-sputtering of dust grains, collisional vaporization of dust grains and collision of comets or icy planetesimals. The age dependence of CO detection rate and gas composition are the keys to determining the origin of gas. Thus, it is necessary to carry out statistical studies.

We reduced CO data towards 44 debris disks obtained with ALMA in order to study the CO detection rate. We found that CO emission have been detected toward 6 objects (detection rate of 14%) in our list. Derived column densities are raging from 10^{15} to 10^{16}cm^{-2}. We will present the relation between CO column density and the age of the central star. Furthermore, the relative abundance of atomic carbon(C) and CO in debris disks will give a clue for understanding the origin of the gas in the debris disk. Our catalogue of gaseous debris disks is valuable for the future survey observations of atomic C line with ALMA.

Keywords: debris disk

