Investigating the gas-to-dust ratio in the protoplanetary disk of HD 142527

*Soon Kang-Lou[1], Munetake Momose[1], Takayuki Muto[2], Takashi Tsukagoshi[3], Akimasa Kataoka[3], Tomoyuki Hanawa[4], Misato Fukagawa[3], Kazuya Saigo[3], Hiroshi Shibai[5]

1. Ibaraki University, 2. Kogakuin University, 3. National Astronomical Observatory of Japan, 4. Chiba University, 5. Osaka University

We present the ALMA observations of the 98.5 GHz dust continuum and the ^{13}CO J = 1 −0 and C^{18}O J = 1 −0 line emission towards the protoplanetary disk of HD 142527. The 98.5 GHz continuum shows a strong azimuthal-asymmetric distribution similar to the previously reported 336 GHz continuum, and its peak emission at the dust concentrated northern region is optically thin at approximately 8 K. In every position angle, the peak brightness temperature of C^{18}O J = 1 −0 emission (≦ 25 K) is lower than that of the optically thick ^{13}CO J = 3 −2 (≈ 36 K), indicating that the C^{18}O is optically thin. We derive the gas and dust surface densities, Σ_g and Σ_d, of the disk of HD 142527 by using the ALMA Band 3 and Band 7 observations. In the analyses we assume the local thermodynamic equilibrium and the disk temperature to be the same as the peak brightness temperature of ^{13}CO J = 3 −2 with continuum emission. We successfully derived the gas-to-dust ratio G/D, defined as Σ_g/Σ_d, distribution across the disk. The ratio varies azimuthally, where it is ~3 and ~20 in the disk northern and southern regions, respectively. We also found that Σ_g varies approximately as $\propto \Sigma_d^{0.5}$, or equivalently G/D $\propto \Sigma_d^{-0.5}$. In addition, our results show that the peak Σ_d is located ahead of the peak Σ_g; if the latter correspond to a vortex of high gas pressure, the results indicate that the dust are trapped ahead of the vortex, which is predicted by theoretical studies.

Keywords: HD 142527, protoplanetary disk, gas-to-dust ratio

