P215a Investigating the gas-to-dust ratio in the protoplanetary disk of HD 142527

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We investigate the gas-to-dust ratio (g/d) in the protoplanetary disk of HD 142527 (located at 156 pc) using the ALMA Band 3 data of ^{13}CO and C^{18}O $J = 1 - 0$ lines and 99.5 GHz continuum emission (beam size $\approx 0.5''$). The continuum map shows that the northern region has a peak optical thickness of ~ 0.2 and is brighter than the south by a factor of ~ 60. The gas distribution is also revealed to be azimuthal-asymmetric, where the peak of C^{18}O spectral-averaged optical thickness is ~ 0.9 in the north and ~ 0.3 in the south.

We derive the gas and dust surface densities within a radius of $\approx 0.5'' - 1.6''$, or $78 - 250$ au, of the disk from the C^{18}O line and 99.5 GHz continuum emission from simple LTE calculations. The calculations assume that the peak brightness temperature of the ^{13}CO line is the same as the excitation temperature and that the C^{18}O abundance is the same as the interstellar value. The g/d map shows that the ratio is spatial dependence and g/d ≈ 7.7 $(\Sigma_{\rm d,peak}/0.1$ g cm$^{-2})^{-0.52}$, where $\Sigma_{\rm d,peak}$ is the peak dust surface density in each azimuthal direction. The ratio is ~ 5 at the dust peak emission in the north and ~ 30 in the south; they are consistent within a factor of ~ 2 with the results obtained by Muto et al. (2015), who model the optically thick ^{13}CO and C^{18}O $J = 3 - 2$ lines and 336 GHz continuum emission. The low g/d in the north may indicate the existence of a vortex that traps dust grains with a larger size.