Modeling of Dust Emission from Disk Surrounding HD 142527

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We model the 870 μm dust continuum emission from the azimuthally-asymmetric disk around HD 142527 based on ALMA Cycle 0 observation. The disk is inflated, inclined by 27° to the line of sight, and its major axis is along PA = 341°. High resolution images in NIR scattered light (Fukagawa et al. (2006)) and MIR thermal radiation (Fujiwara et al. (2006)) indicate that the eastern side (PA = 341° −161°) of the disk is farther whereas the western side (PA = 161° −341°) is closer to us. In our model, we assume the radial surface density distribution of the dust disk to be gaussian, and the dust size distribution follows $a^{-3.5}$, where a_{max} = 1 mm. At the observation wavelength, scattering opacity is 10 times larger than absorption opacity in our model (Aikawa & Nomura (2006)). Dust density, temperature, and radiative energy density of the disk are determined by M1 approximation method (Kanno, Harada, Hanawa (2013)).
The peak surface densities of dust, Σ_0, at PA = 21° (the brightest region) and PA = 221° (the faintest region) are 0.8 g cm^{-2} and 0.008 g cm^{-2}, which are consistent with Muto et al. (2015). We cannot reproduce, however, the observed surface brightness in the northwestern region (PA = 291° − 351°), i.e., the near side with about 80% brightness of PA = 21°, even with Σ_0 = 1.25 g cm^{-2}. This is due to: (i) the heavy scattering; (ii) the dependence of the disk surface brightness on the veiwing angle. We solve the problem by reducing the scattering opacity to 10% of its original value. Subsequently, the Σ_0 values for the brighter lopsided region (PA = 291° −71°) become about 50% lower than their original values, while for the remaining optically thin regions Σ_0 values do not change significantly. We will also discuss how such a scattering opacity can be realized.

Keywords: HD 142527, Dust emission, Modeling

