Contribution ID: **70** Type: **not specified**

Radial variations of grain sizes and dust scale heights on the protoplanetary disk of HD 163296

Thursday, 17 October 2019 15:40 (15 minutes)

Contributed talk

Abstract:
HD 163296 is one of the best examples of the ring and gap structured protoplanetary disks. In addition, this disk is the only target where the ring and gap are spatially resolved in millimeter-wave polarization as well. By performing radiative transfer calculations of self-scattering polarization, we find that grain size and the dust scale height are the key parameters to reproduce the azimuthal and radial distributions of the observed polarization signature.
Azimuthal variation in polarization fraction is enhanced if the dust scale height is increased. In contrast, radial variation is mainly determined by the grain size because a polarization fraction is high if the particle size is $\sim \lambda/2\pi$ and low if the particle size is larger or smaller than that size.
With the comparison of our detailed modeling and observation, the best model of the HD 163296 polarization is that the dust scale height is one-tenth of that of the gas inside the 70 au ring, while it is 2/3 of the gas scale height outside of the 70 au ring. The grain size is 140 micron at the gaps while it is significantly smaller or larger in the rings. Furthermore, we constrain the gas turbulent parameter at the two gaps because both of the grain size and the dust scale height is constrained. The turbulent is α ~ 1.9x10E-6 inside of the 70 au ring and α ~ 1.5x10E-4 outside of the 70 au ring, respectively.

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Session Classification: Circumstellar Disks