

Silicate Dust in Active Galactic Nuclei

Yanxia Xie^{1,2}, Aigen Li², Lei Hao¹

¹*Shanghai Astronomical Observatory, China,* ²*University of Missouri, USA*

An anisotropic dust torus is invoked by the unification theory of active galactic nuclei (AGNs) to account for the observational dichotomy, i.e., all AGNs are proposed to be the same kind of object or “*born equal*” but viewed from different lines of sight. Little is known about the dust in the circumnuclear torus of AGNs. There is evidence suggesting that the size and composition of the dust in AGNs may differ substantially from that of the Galactic interstellar dust, as reflected by the flat/“gray” or steep, SMC-like extinction curves. Besides, the anomalous silicate emission or absorption features observed respectively in type 1 and type 2 AGNs suggests that the AGN silicate grains were probably not “born equal”. To address and to clarify the observed silicate diversity among AGN dichotomy, we model the silicate emission or absorption of a large and well defined AGN sample, considering various dust compositions and grain sizes. By modeling the *Spitzer*/IRS spectra of 147 AGNs of various types using the plane-parallel slab radiative transfer method of Laor & Draine (1993), we obtain constraints on the AGN silicate composition and size. We find that the Draine & Lee (1984) silicate can well explain the silicate emission in 110 AGNs while the rest requires amorphous olivine and pyroxene. Moreover, it appears that larger dust grains are preferred in quasars, specifically, in 129 AGNs the mid-infrared emission can be reproduced with silicate dust of radii $\sim 1.5 \mu\text{m}$. The temperature of the $\sim 5\text{--}8 \mu\text{m}$ continuum emitter (which is essentially carbon dust) of AGNs is $\sim 600\text{--}1300 \text{ K}$, much higher than that of typical starburst which is $\sim 30\text{--}40 \text{ K}$. The correlations between the dust temperature, size and the AGN luminosity, types, black hole mass are also investigated.