

On the Optical-to-Silicate Extinction Ratio as a Probe of the Dust Size in Active Galactic Nuclei

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Dust plays a central role in the unification theory of active galactic nuclei (AGNs). Whether the dust that forms the torus around an AGN is tenth micron-sized like interstellar grains or much larger has a profound impact on correcting for the obscuration of the dust torus to recover the intrinsic spectrum and luminosity of the AGN. Here we show that the ratio of the optical extinction in the visual band (A_V) to the optical depth of the $9.7\mu\text{m}$ silicate absorption feature ($A_V/\Delta\tau_{\text{sil}}$) could potentially be an effective probe of the dust size. The anomalously lower ratio of $A_V/\Delta\tau_{\text{sil}}\sim 5.5$ of AGNs compared to that of the Galactic diffuse interstellar medium of $A_V/\Delta\tau_{\text{sil}}\sim 18$ (Roche & Aitken 1984) reveals that the dust in AGN torus is substantially larger than the interstellar grains of the Milky Way and of the Small Magellanic Cloud, and therefore, one expects a flat extinction curve for AGNs.