Modeling the infrared extinction law and reestimating the extinction at the visual band towards the Galactic Center

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ABSTRACT

Towards the Galactic center (GC), the recent observed extinction curve by Fritz et al. (2011) shows a steeper near-infrared (NIR) extinction than the one obtained by previous studies, and shows a same flat mid-infrared (MIR) extinction consistent with the one towards other sightlines. Using a mixed dust model consisting of graphite grains and amorphous silicate grains with a dust grain size distribution $dn/da \propto a^{\alpha}e^{-a/a_c}$ ($50\,\text{Å} < a < 1\,\mu\text{m}$), we fitted the extinction curve towards the GC from 1 to $19\,\mu$m. Our dust model can well model the standard average extinction curve of $R_{\rm V} = 3.1$ for the diffuse interstellar medium. Although it can reproduce the steep NIR extinction and the strong silicate features, the fitting results show that the dust model isn't good enough to reproduce the flat extinction in the MIR wavelength range. Some groups of dust grains with different size distribution or something else may be necessary to explain the flat MIR extinction towards many different sightlines. Our best modeled extinction curve shows that the extinction at the visual band $A_{\rm V}$ is $\sim 38-42$ mag, larger than the previous estimated $A_{\rm V} \approx 31$ towards the GC. In the mean while, from the ultraviolet (UV) to NIR wavelength range, the modeled extinction curve shows that the extinction towards the GC is more similar to the theoretical extinction curve of $R_{\rm V} = 2.1$, rather than the one with $R_{\rm V} = 3.1$. The extinction curve toward the GC obtained by Fritz et al. (2011) may be a combination with the steep extinction from UV to NIR bands of $R_{\rm V} = 2.1$, the flat MIR extinction of $R_{\rm V} = 5.5$, and the strong silicate absorption features of $R_{\rm V} = 3.1$.

Subject headings: ISM: dust, extinction - infrared: ISM - Galaxy: center

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