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Are peculiar extinction and polarization properties along the sightlines toward Type Ia Supernovae produced by circumstellar or interstellar matter?

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Polarimetry offers an independent method to the study inter/circum-stellar dust properties by observing the continuum polarization. Some highly reddened Type Ia Supernovae (SNe Ia) display peculiar extinction curves with low R_V values and polarization curves steeply rising towards blue wavelengths, different from typical Serkowski-like polarization curves observed towards normal Milky Way stars.

We acquired imaging polarimetry of a statistical sample of 68 SNe Ia in host galaxies of different morphological types, and found that the source of the peculiar polarization curves steeply rising towards blue wavelengths (and the peculiar extinction curves with low R_V values) observed towards some reddened SNe Ia is likely the result of interstellar material as opposed to circumstellar material. Thus, the peculiar polarization and extinction properties observed toward some SNe Ia may be explained by the radiative torque disruption mechanism induced by the SN or the interstellar radiation field (Chu et al. 2022).

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