

Continuum Foreground Polarization and NaI Absorption in Type Ia SNe

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Abstract

We present a study of the continuum polarization over the 400–600 nm range of 19 SNe Ia obtained with FORS at the VLT. We separate them into those that show Na i D lines at the velocity of their hosts and those that do not. Continuum polarization of the sodium sample near maximum light displays a broad range of values, from extremely polarized cases like SN 2006X to almost unpolarized ones like SN 2011ae. The non-sodium sample shows, typically, smaller polarization values. The continuum polarization of the sodium sample in the 400–600 nm range is linear with wavelength and can be characterized by the mean polarization ($\langle P \rangle$). Its values span a wide range and show a linear correlation with color, color excess, and extinction in the visual band. Larger dispersion correlations were found with the equivalent width of the Na i D and Ca ii H and K lines, and also a noisy relation between $\langle P \rangle$ and RV, the ratio of total to selective extinction. Redder SNe show stronger continuum polarization, with larger color excesses and extinctions. We also confirm that high continuum polarization is associated with small values of RV. The correlation between extinction and polarization—and polarization angles—suggest that the dominant fraction of dust polarization is imprinted in interstellar regions of the host galaxies. We show that Na i D lines from foreground matter in the SN host are usually associated with non-galactic ISM, challenging the typical assumptions in foreground interstellar polarization models..