A systematic study of the dust of Galactic supernova remnants I. the distance and the extinction

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Abstract

By combining the photometric, spectroscopic, and astrometric information of the stars in the sightline of SNRs, the distances to and the extinctions of 32 Galactic supernova remnants (SNRs) are investigated. The stellar atmospheric parameters are from the SDSS-DR14/APOGEE and LAMOST-DR5/LEGUE spectroscopic surveys. The multi-band photometry, from optical to infrared, are collected from the Gaia, APASS, Pan-STARRS1, 2MASS, and WISE surveys. With the calibrated Gaia distances of individual stars, the distances to 15 of 32 SNRs are well determined from their produced extinction and association with molecular clouds. The upper limits of distance are derived for 3 SNRs. The color excess ratios $E(g\!-\!\lambda)/E(g\!-\!r)$ of 32 SNRs are calculated, and their variation with wavebands is fitted by a simple dust model. The inferred dust grain size distribution bifurcates: while the graphite grains have comparable size to the average ISM dust, the silicate grains are generally larger. Along the way, the average extinction law from optical to near-infrared of the Milky Way is derived from the 1.3 million star sample and found to agree with the CCM89 law with $RV = 3:15$.

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