The Interstellar Extinction Law in the Near- and Mid-Infrared Based on the APOGEE Spectroscopic Survey

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It is widely accepted that the interstellar extinction law in UV/optical differs apparently in the diffuse and dense environments and can be parameterized by the ratio R_V of the total extinction in the visual band A_V to the color excess $E(B-V)$. Meanwhile, the variation of the extinction law in the infrared has no such consensus. Whether or how the law changes with sightline or environment is controversial. An important reason for the discrepancy between studies is that previous studies are mostly based on stellar photometry, in which the uncertainty is induced when assuming a constant intrinsic color for the selected extinction-tracer sample stars and brings about the uncertainty of the results. With the availability of stellar parameters (mainly $T_{\rm eff}$, log g and Z) from the APOGEE spectroscopic survey, the stellar intrinsic colors can be calculated with significantly higher accuracy than from photometry only. Based on this spectroscopical database, the intrinsic colors of giant stars are derived by taking the blue envelop in the color index vs. $T_{\rm eff}$ diagram. Using the newly determined intrinsic colors, the near- and mid-infrared extinction law is revisited. The extinctions relative to the K_S band are derived in the 1-20μm range, covering the photometric bands involved in the 2MASS, WISE, Spitzer/IRAC and AKARI surveys. The near-infrared extinction law is found to be universal in a wide range of interstellar extinction with a stable $E(J-H)/E(J-K_S)$~0.64, corresponding to a power law index of 1.95. With the WISE and AKARI bands for the first time to be taken into account, the mid-infrared extinction law is more completely covered and still agrees with previous results, being much flatter than classical interstellar dust model derived from UV/optical extinction curve.