Astronomy in Focus - XXX
Proceedings IAU Symposium No. XXX, 2018
M. T. Lago, ed.

doi:10.1017/S1743921319004678

Nano dust and the far ultraviolet extinction

Biwei Jiang

Department of Astronomy, Beijing Normal University, Beijing 100875, China
email: bjiang@bnu.edu.cn

The ultraviolet (UV) extinction is determined by comparing the color or spectrum of reddened stars with un-reddened stars. Fitzpatrick & Massa (1998) obtained the UV extinction of 45 OB stars by using the IUE spectra and found that the UV extinction curves unanimously have a prominent feature around 2175 Å and keep rising in the far-UV ($\lambda \lesssim 1800$ Å) until ~ 115 nm — the short-wavelength limit of the IUE spectrophotometry. This law is confirmed by other studies, including those based on the GALEX UV photometry (e.g. Sun *et al.* 2018). Meanwhile, the UV extinction curve is steeper towards diffuse sightlines than dense environment. The sightline to HD 210121 has an extremely steep far-UV (FUV) extinction at $\lambda^{-1} \gtrsim 6\,\mu\mathrm{m}^{-1}$ with a remarkably small $R_V = 2.1$. M31, the other giant galaxy in the local group, displays similar UV extinction curves as the Milky Way galaxy. In the neighbouring Magellanic clouds that are metal-poor and have a much lower dust-to-gas ratio, the FUV extinction curve is steeper than our Galaxy, and the 2175 Å bump becomes weaker. Distant AGNs show almost no bump at 2175 Å and the FUV extinction becomes flat.

Nano dust grains are inferred from the rising FUV extinction because a dust grain is most effective in extinction when its size is comparable to the wavelength. Several species of nano dust grains are suggested to explain the observed UV extinction curve, such as nano carbon grains and nano silicate grains (Li & Mann 2012). The size distribution of nano dust is derived from dust infrared emission other than the FUV extinction that constrains the dust volume rather than the dust size (Wang *et al.* 2015). Weingartner & Draine (2001) explained the lack of 2175 Å bump by models lacking carbonaceous grains (graphite and PAH) with radii $< 0.02\,\mu$m and the rise in FUV by models with nano silicate grains.

The questions remain. Because the UV extinction is much more severe than in the optical wavebands ($A_{2000\,\mathrm{Å}}$ is about $3\times A_V$), the UV extinction law probes generally only diffuse environment or the shallow surface area of dense clouds. Deep UV survey is needed to investigate the UV extinction law in dense medium. The identification of nano dust species is another open question.

References

Fitzpatrick, E., & Massa, D. 1998, *ApJ*, 328, 734
Li, A., & Mann, I. 2012, *ASSL*, 385, 5
Sun, M.X., Jiang, B.W., Zhao, H. *et al.* 2018, *ApJ*, 861, 153
Wang, S., Li, A., & Jiang, B. W. 2015, *ApJ*, 811, 38
Weingartner J. C., & Draine B. T. 2001, *ApJ*, 548, 296