Anomalous Interstellar Extinction Curves: HD 93222 and HD 29647

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Cardelli, Clayton, & Mathis (1989; CCM) proposed an analytical formula which only involves one parameter—R_V, the total to selective extinction ratio – to parametrize the interstellar extinction curves from the near infrared (IR) to the far ultraviolet (UV). While the CCM parametrization satisfactorily approximates most of the observed extinction curves in the Milky Way, a number of interstellar lines of sight exhibit anomalous extinction curves which appreciably deviate from the CCM representation. We perform a systematic investigation of the anomalous extinction curves, aiming at gaining insight into the properties of the dust responsible for the unusual extinction curve and its relation to the physical and chemical conditions of the region where the extinction curve is found.

Here we report our first results on the sightlines toward HD93222 situated in the southern region of the Carina Nebula, and HD29647 in the Taurus dark cloud. We employ the IUE data and the Kurucz stellar atmosphere model to determine their extinction curves. It is found that for both lines of sight the extinction curves are peculiar. HD 93222 has a large R_V of 4.76, characteristic of dense regions, while its extinction curve shows a sharp 2175 Å bump and a steep far-UV rise, which are typical of diffuse regions with $R_V < 3.1$. In contrast, HD 29647, a highly reddened late B HgMn star, has a relatively smaller R_V of 3.6, but its extinction curve exhibits a weak hump which is more typical of dense regions with a larger R_V. While the extinction curves of both HD 93222 and HD 29647 differ substantially from what are expected from the CCM parametrization, they can be closely explained by mixtures of silicate and graphite grains or silicate core-carbon mantle grains combined with nano-sized carbon dust.