Anomalous extinction laws? More like the norm...

Guido De Marchi*[1], Nino Panagia[2], and Antonino P. Milone[3]

[1]European Space Research and Technology Centre – Netherlands
[2]Space Telescope Science Institute – United States
[3]INAF - Osservatorio Astronomico di Padova – Italy

Abstract

Our previous HST studies of the extinction curve in and around the Tarantula Nebula, making use of thousands of red giants as standard candles, have revealed a flattening at optical wavelengths, corresponding to a ratio of total-to-selective extinction Rv=Av/E(B-V) exceeding 4.5 and implying a larger fraction of big grains than in the diffuse interstellar medium (ISM). Our further investigation of the ultraviolet extinction properties revealed that big grains are not formed at the expense of small grains, since a steepening of the curve at wavelengths shorter than 2000 A clearly shows that small grains are even more abundant than in the diffuse ISM. In environments such as the Tarantula Nebula, where formation of massive stars has been ongoing for over 20 Myr, a process able to naturally account for the injection of new grains is the explosion of massive stars as type-II SN. We now show that this is not just the case of the massive Tarantula Nebula. A value of Rv_~4.5 is characteristic of all the young and intermediate-age clusters observed with Hubble in the Large Magellanic Cloud that contain enough dust to reveal an elongated red giant clump. By dating ongoing and previous star-formation episodes through isochrone fitting, we show that the elevated Rv value is present in these regions for at least 60 Myr and possibly 200 Myr after the most recent star formation event. In these environments, an anomalous extinction law considerably shallower than that of the diffuse Galactic ISM appears to be the norm rather than the exception. Herschel observations of all these regions reveal considerable dust emission that is not present in older regions with standard extinction properties.

*Speaker

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