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ORIGINAL ARTICLE

Large scale extinction maps with UVIT

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Abstract The Ultraviolet Imaging Telescope (UVIT) is scheduled to be launched as a part of the ASTROSAT satellite. As part of the mission planning for the instrument we have studied the efficacy of UVIT observations for interstellar extinction measurements. We find that in the best case scenario, the UVIT can measure the reddening to an accuracy of about 0.02 magnitudes, which combined with the derived distances to the stars, will enable us to model the three-dimensional distribution of extinction in our Galaxy. The knowledge of the distribution of the ISM will then be used to study distant objects, affected by it. This work points the way to further refining the UVIT mission plan to best satisfy different science studies.

Keywords GALEX: Space missions: UVIT, SDSS · Interstellar medium: extinction

1 Introduction

It is very difficult to model the three-dimensional distribution of interstellar matter (ISM) in our Galaxy because of the general lack of distance information. One of the few ways to probe the distance of the interstellar gas and dust is through absorption line measurements (in the case of gas) or through extinction (in the case of the dust), but these have been limited to a relatively small number of directions. This has impacted studies of extragalactic objects, not to mention the extragalactic background, because of the unknown effects of interstellar dust in the Milky Way.

The most reliable means of determining the amount of dust in a given line of sight is through observations of the extinction along the line of sight to stars across the sky. This originally involved comparing similar stars and measuring the difference between their spectra, but stellar models have now become sufficiently accurate so that they can be used for comparison instead, greatly extending the utility of this procedure (Fitzpatrick and Massa 2007). Further, if the distance to a star is known, then, in principle, the distance to the actual scattering dust may be inferred. This method traditionally required spectral observations of moderate resolution and has been limited to those specific sight lines where such observations existed.

A much wider coverage was achieved by Burstein and Heiles (1982) who combined observations of 21 cm emission with the gas-to-dust ratio of Bohlin et al. (1978) to provide reddening maps over the sky. This was supplanted by Schlegel et al. (1998) who used the infrared emission from the Infrared Astronomy Satellite (IRAS) and the Cosmic Orbiting Background Explorer (COBE) to estimate the extinction over the entire sky. Both methods are model-dependent and, moreover, can only estimate the integrated dust column density. This can be overcome by using modern photometric surveys which observe large areas of the sky in multiple bands. Amongst these are Marshall et al. (2006), who have used the Two Micron All Sky Survey (2MASS) to model the extinction in the Galactic plane, and Finkelman et al. (2008),

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