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Mapping Interstellar Dust in 3D with Stellar Colors

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ABSTRACT

Interstellar dust, the particulate matter in interstellar space, is of concern to astronomers because it makes background objects appear fainter and redder. As a site of most interstellar chemistry, it is interesting in its own right. Dust emission maps have long been used to estimate the total reddening caused by dust, integrated along the line of sight. These 2D maps are not adequate for reddening estimates within the Milky Way, where the object of interest may not be behind all of the dust. Using colors of 800,000,000 stars from the 2MASS and Pan-STARRS surveys, we can now infer the location of dust along each line of sight in about 30 distance bins, making a crude 3D dust map with ~ 5 arc minute angular pixels over 3/4 of the sky. I will describe our publicly available map from 2015, and show improvements in the 2017 version. I will also argue that reddening-based dust maps are superior for certain cosmological applications because they do not include contamination from the FIR emission from large-scale structure.We anticipate that this approach to mapping and correcting for the effects of dust will be important for future large surveys, such as LSST.

BIO:

As a student at UC Berkeley, Prof. Finkbeiner worked with Marc Davis and David Schlegel on a dust map, motivated by cosmic microwave background (CMB) foregrounds and large-scale structure cosmology. Later he became interested in other microwave foregrounds: spinning dust and the microwave "haze." The haze might have been a signal from dark matter annihilation, and this led to a series of papers on astrophysical signatures of dark matter. Instead, the haze turned out to be associated with gamma-ray bubbles expanding out from the Galactic center, the so-called "Fermi Bubbles," for which he and his students won the Rossi Prize in 2015. More recently, Finkbeiner's group has been mapping the Milky Way in 3-D using star colors.