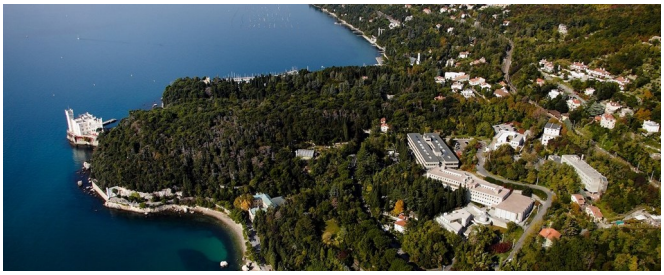

Contribution ID: **67** Type: **not specified**

CSFD: A More Accurate Galactic Dust Map with Minimal Extragalactic Contamination

Monday, 28 August 2023 22:30 (5 minutes)

The widely used Milky Way dust reddening map, the Schlegel, Finkbeiner, & Davis (1998, SFD) map, was found to contain extragalactic large-scale structure (LSS) imprints (Chiang & Ménard 2019). Such contamination is inherent in maps based on infrared emission, which pick up not only Galactic dust but also the cosmic infrared background (CIB). When SFD is used for extinction correction, over-correction occurs in a spatially correlated and redshift-dependent manner, which could impact precision cosmology using galaxy clustering, lensing, and supernova Ia distances. Similarly, LSS imprints in other Galactic templates can affect intensity mapping and cosmic microwave background experiments. This paper presents a generic way to remove LSS traces in Galactic maps and applies it to SFD. First, we measure descriptive summary statistics of the CIB in SFD by cross-correlating the map with spectroscopic galaxies and quasars in SDSS tomographically as functions of redshift and angular scale. To reconstruct the LSS on the map level, however, additional information on the phases is needed. We build a large set of 180 overcomplete, full-sky basis template maps from the density fields of over 600 million galaxies in WISE and find a linear combination that reproduces all the high-dimensional tomographic two-point statistics of the CIB in SFD. After subtracting this reconstructed LSS/CIB field, the end product is a full-sky Galactic dust reddening map that supersedes SFD, carrying all Galactic features therein, with maximally suppressed CIB. We release this new dust map dubbed CSFD, the Corrected SFD, at https://idv.sinica.edu.tw/ykchiang/CSFD.html and NASA's LAMBDA archive.

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Session Classification: Virtual only posters (ignore time)