Effects of Cirrus Emission on Detection of Point Sources in the Far-Infrared

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Galactic emission in the far-infrared sky affects the detection of the point sources. The background diffuse emission contributes to the photon noise because of the discrete nature of the photon flux. In addition, the small-scale spatial fluctuation of the cirrus emission causes an uncertainty in the detection and photometry of the point sources. The spatial power-spectrum of the cirrus emission from IRAS data shows a power-law behaviour down to around 6′ (IRAS resolution), and then a small scale power-spectrum may be extrapolated from the same power-law. The cirrus emission in far-infrared was obtained from the two-component dust model (Pollack et al. 1994; Finkbeiner et al. 1999)

We generated the Galactic emission map with high resolution in the far-infrared down to 1″ assuming the power-law power spectrum and random Gaussian shape of the fluctuation. The amplitude of the power-spectrum is found to be roughly proportional to the brightness of the background. Using this high resolution map, we estimated the sky confusion noise by cirrus for various space missions, including ASTRO-F. We also discuss the effect of the small-scale structure in the source detection. We found that the small-scale structure of the cirrus emission make the detection limits increase by a factor of 1.2 ~ 1.7 and the sky confusion noise expected from IRAS data is underestimated in low background and overestimated in high background for the ISO and ASTRO-F/FIS space mission.

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