Spectral studies of the interstellar dust submillimetre emissivity

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Abstract

Observing the submillimetre emission of interstellar dust has recently improved thanks to Planck, Herschel and ground-based observatories: e.g. Laboca/Apex, Artemis/Apex, Scuba2/JCMT, Nika2/IRAM. Dust submillimetre emissivity mostly follows a power-law with an emissivity index of 1.5-2, which is expected from submicronic grains. These findings have been accompanied by odd observations:
- the emissivity index is anti-correlated with the dust temperature in star-formation regions, with cold regions being associated with an index as high as 2.5 (Bracco et al., 2017; Désert et al., 2008; Planck Coll., 2011; Rigby et al., 2018),

- some nearby galaxies seem to have a submillimetre excess which is not accounted for in models (Galliano et al., 2018).

Interstellar dust emission has so far been observed with photometric eyes only. We think it is time to bring spectral studies. Concerto on Apex (Concerto Coll., 2020) can spectrally measure the dust millimetre emissivity in star-forming regions, nearby galaxies and the Magellanic Clouds. With an instantaneous field-of-view of 20 arcminutes and an angular resolution of half an arcminute, Concerto just started regular observations and provides a data cube, with a 1.5 GHz resolution over the 1-3 mm window. With open-time proposals, we intend to observe spectrally the regions where dust emissivity behaves oddly.

More generally, the scientists in Grenoble (IPAG, IRAM, Néel Institute, LPSC) are working on the R&D for next-generation submillimetre cameras with KIDs (Groupement d'interet scientifique being signed). We advocate the need for spectro-polarimetric capabilities in the future instrumentation. The implication for cosmology (how to subtract dust polarized foreground from the cosmic microwave background) can be addressed fundamentally with these new techniques.

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