Modeling and predicting the shape of the far-infrared/submillimeter emission in ultra-compact HII regions and cold clumps

D. Paradis[1], C. Mény[1], A. Noriega-Crespo[2], R. Paladini[2], J.P. Bernard[1], C. Bot[3], L. Cambrésy[3], K. Demyk[1], V. Gromov[4], A. Rivera-Ingraham[1], M. Veneziani[2]

[1] IRAP, UMR5277 du CNRS, Institut de Recherche en Astrophysique et Planétologie , 9. Av. du Colonel Roche, 31028, Toulouse Cedex 4 - France

[2]SSC, Spitzer Science Center, California Institute of Technology, 1200 E. California Blvd, 91125, Pasadena - USA

[3]Observatoire Astronomique de Strasbourg, UMR7750, 11 rue de l'université, 67000, Strasbourg - France

[4]Space Research Institute, RAS, 84/32 Profsoyuznaya, 117810 Moscow, Russia

Dust properties are likely affected by the environment in which dust evolve. For instance, some analyses of cold clumps (7 K- 17 K) lead to favor the aggregation process in dense environments [1]. However, the study of warm (30 K-40 K) dust emission at long wavelength (λ>300 µm) has been limited by the difficulty in combining far infared-millimeter (FIR-mm) spectral coverage and high angular resolution to observe warm dust grains.

Using Herschel data from 70 to 500 µm, as part of the Herschel infrared Galactic (Hi-GAL) survey associated to 1.1 mm data from the Bolocam Galactic Plane Survey (BGPS), we compare emission in two types of environments: ultra-compact HII (UCHII) regions and cold molecular clumps (denoted as cold clumps). This comparison allows us to test models of dust emission in the FIR-mm domain used to reproduce emission in the diffuse medium [2], in these environments, and to check their ability to predict the dust emission in our Galaxy.

We determine the emission spectra in twelve UCHII regions and twelve cold clumps, and derive the dust temperature (T) using the recent two-level system (TLS) model (Mény et al., 2007) with three sets of parameters, and the so-called T-β (Temperature-dust emissvity index) phenomenological models, with β set up to 1.5, 2 and 2.5.

The applicability of the TLS model in warm regions has been tested for the first time. This analysis points out distinct trends in the dust emission between cold and warm environments, visible through changes in the dust emissivity index. However, with the use of standard parameters, the TLS model is able to reproduce the spectral behavior observed in cold and warm regions, by the only change of the dust temperature, as opposed to a T-β model which requires the knowledge of β.

Références

[1] Stepnik B., et al., A&A 398, 551 (2003)
[2] Paradis D. , et al., A&A 534, 118 (2011)
[3] Mény C. , et al., A&A 468, 171 (2007)