The abundance of small dust particles in cirrus clouds: the impact of turbulence and the implication for the thermal balance of the gas

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We present a study of the impact of the gas dynamics on dust properties based on 21 cm and ISOCAM (between 5 and 18 microns) observations of a Galactic cirrus located in the Ursa Major constellation. The comparison of these two observations revealed strong abundance variations of the small dust particles in a Hi filament. Using the spectral information provided by the 21 cm line emission we were able to trace the dust abundance of the Hi as a function of velocity. We have found that the small dust particles are up to ten times more abundant in a filament in comparison with the more diffuse Hi that surrounds it. Furthermore, this filament is characterized by a strong transverse velocity gradient (10 km/s/pc) that can be attributed to a rotation. The particular kinematics of this filament, that could be related to a turbulent vortex, may be at the origin of this dust abundance variation via enhanced grain-grain collisions.

Recently, it as been suggested by Falgarone & Puget (1995) that the dissipation of the turbulent energy, that occurs in vortex, could have an impact on the heating of the gas, on the dust size distribution, on the formation of molecules and therefore on the global evolution of the diffuse ISM. The filament observed here could be an observational evidence of such a process in the Hi gas. FIRST will allow to make an important step further in the characterization of the impact of turbulence of the ISM evolution, by providing high resolution informations on the structure, the kinematics and the physical conditions of such diffuse structures. For example, by taking advantage of the sensitivity and the high spectral resolution of the HIFI instrument, it will be possible to trace the C^+ and CI emission in diffuse clouds, and study the temperature, the pressure and the carbon abundance as a function of velocity. By comparing these observations with dust emission, we will be able to constrain the thermal balance of the diffuse medium.