Initial stages of star formation

M. Juvela

Department of Physics, FI-00014 University of Helsinki; mika.juvela@helsinki.fi

Star formation is an ongoing process in our home Galaxy, the Milky Way. The initial stages of the star formation process are difficult to investigate because stars are born deep inside interstellar clouds that are opaque to optical radiation. Therefore, the studies need to be conducted using observations of far-infrared and radio wavelength radiation that is able to penetrate the dense clouds that consist of molecules and a small amount of solid particles, interstellar dust. Information on the physical state of star-forming clouds can be obtained using both the line emission from gas molecules and the continuum thermal emission from dust.

The Herschel satellite programme Galactic Cold Cores is carrying out a survey of dense cloud cores within interstellar clouds of the Milky Way [1]. The study is based on the all-sky maps made by the Planck satellite. Planck is particularly sensitive to the emission from very cold dust with temperatures of the order of 10 degrees above absolute zero. Such temperatures are expected to exist only in very dense cloud regions that are ready to collapse under gravity and are thus pre-stellar. A sample of Planck-detected cold cloud cores are being studied in more detail with Herschel satellite observations. With higher spatial resolution, Herschel is revealing the real structure of the star forming regions. I will discuss the general goals of the Cold Cores project and present results from the analysis conducted so far.

In addition to observations, the study of star formation relies on numerical modelling. Models help in the analysis of measurements and will eventually incorporate a full description of the physical processes affecting the star formation. I will present some examples that illustrate how the models help us to understand the problems involved in the interpretation of observations of pre-stellar and star-forming clouds.

[1] M. Juvela, I. Ristorcelli, L. Pagani, et al., Astronomy & Astrophysics, **2012**, 541, A12.