Cosmic Dusty Objects
at the far-infrared and submillimeter wavelengths

Motivation and main features

Dust is present in most cosmic objects from the Solar system to nuclei of distant active galaxies, and practically everywhere the dust grains play an important role in physics and chemistry of the interstellar matter.

The dusty objects are observed in almost all regions of the electromagnetic spectrum. The investigations in the infrared part of spectrum are of special interest because the dust emission is the dominating process in here. The main contribution to the cosmic radiation at the far-infrared and submillimeter wavelengths is expected from cold molecular clouds and protostellar objects located in them. However, the radiation in the Rayleigh-Jeans wing from hot sources like the circumstellar shells of the pre-main-sequence and late-type stars can be significant.

According to current concepts, the interstellar and circumstellar dust grains are composed from silicate and carbon materials (amorphous or/and crystalline) and their sizes are of several tenths of micron or smaller. But the presence of very large grains (millimeter size or more) was declared several times in the case of protostellar sources, protoplanetary discs, interplanetary and cometary dust particles. The interaction of radiation and small particles is the most efficient in the case when the particle size and the radiation wavelength are close. So, it is the far-infrared and submillimeter region that gives the information about very large grains.

Exceptional information is related with the observations of polarization. At far-infrared and submillimeter wavelengths, the polarized emission from non-spherical dust grains aligned by magnetic fields is observed. Modern state of such investigations is restricted by ground observations of several sources. Therefore, *any polarimetric observations in this spectral region will have an exceptional significance.*

Many interesting problems are also related with the examination of dust located in planetary rings, Kuiper belt and Oort cloud. The far-infrared and submillimeter observations can be used for an understanding of the origin of Solar system as well as the planetary systems around other stars.

Expected results

The full-sky survey and special observations of selected objects are expected to yield the following results.

- Catalogue of point sources (more than 10^5 objects) including stars, protostars, cores of molecular clouds, galaxies and galactic nuclei.

- Catalogue of fast moving sources (more than 10^4 objects located in the Solar system) including asteroids, protocomets, clumps of interplanetary and circumplanetary dust.
- Discovery of several comets per year and the unique possibility to investigate their nuclei.
- Estimates of dust properties (chemical composition, sizes) in circumstellar shells and interstellar clouds from observed fluxes at different wavelengths.
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- Large-scale structure of magnetic fields in the dense parts of the Galaxy found from polarimetric observations.
- Structure of magnetic fields in dark interstellar clouds.
- Estimates of grain alignment mechanisms from the values of observed polarization.
- Spectral energy distribution for variable stars of different types at the far-infrared and submillimeter wavelengths.
- The far-infrared and submillimeter properties of protoplanetary dusty discs around Vega-like stars.
- Distribution of the far-infrared and submillimeter diffuse radiation related to interplanetary and galactic dust as well as extragalactic background radiation.

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