

Reg. No: 2015/19/P/ST9/04010; Principal Investigator: dr Michal Jerzy Michalowski

Cosmic dust is a fascinating subject, because dust can be found in almost every galaxy, and because half of the energy ever emitted by stars has been absorbed by dust. I will study this intriguing missing (hidden by dust) half of the Universe to reach a new understanding of key properties of this cosmic dust.

When you look at the night sky during dark conditions (away from cities) you see a glowing band across the sky, which is the disk of our own Galaxy, Milky Way. In this glowing band one can recognise dark extended patches, which mark the existence of dust. These regions are darker because dust absorbs the optical light emitted by stars, heats up and emits in the infrared. Hence these optically-dark regions are very bright for infrared telescopes, which give astronomers a fascinating and unique possibility to study regions where new stars are being born (they are so dusty that they cannot be seen by optical telescopes). This also applies to stars and galaxies far away from our own Galaxy, for which I will investigate:

- 1) How has dust been formed? It is generally difficult to form dust in the Universe, because this requires high density and low temperature. These conditions are met in the atmospheres of evolved stars, in the material expelled by exploding massive stars, and in the more quiet regions containing enough matter that dust can slowly grow there. Using the information of how dust influences the optical emission of galaxies, I will determine the origin of this dust, because depending on the conditions in which dust forms, it has different optical properties. This will allow me to map the dust birth mechanism at various stages of the evolution of the Universe.
- 2) Out of which material has dust been formed? Stars and dust form when a dense and cold gas cloud starts collapsing, and usually it is assumed that this gas must be in a molecular form (two hydrogen atoms joined together). However, I have recently found evidence that stars and dust may form out of atomic gas (where all hydrogen atoms are separate) flowing directly from the space between galaxies. If I confirm this mechanism, then this will change our understanding of how galaxies obtain the fuel for formation of stars and dust.
- 3) By what mechanism and how quickly is dust destroyed? In order to see this I will look at older galaxies, which still have some dust, but which have not recently been forming any new dust. I have discovered that their dust content declines quite rapidly, allowing me to determine how fast dust is destroyed and how exactly this happens.