

Stars are seldom found alone in the universe. They are formed and live out their lives together with other stars in massive associations known as galaxies. Optical telescopes show that our Universe is full of such islands. But the visible light is not the best source of information about galaxies and the structures inside them. Massive stars can emit in visible wavelengths such amount of energy that they seem to be disproportionately more significant than they really are. In the infrared this imbalance is less extreme, so we can get a more representative view of how the structure of the galaxy looks like, and how stars are actually distributed. Additionally, many galaxies are also filled with dust clouds that obscure our view of the overall structure of the galaxy. But thanks to the characteristic of dust, which become more transparent towards longer wavelengths, and in some ranges – it re-emits the ultraviolet light emitted by young stars, galaxies observed in infrared light shows all the inaccessible in visible light structures of the galaxy. All those reasons cause that observation of galaxies in infrared range allows uncovering of areas inaccessible for optical observations.

Infrared radiation of the dust which surrounds star-forming regions in galaxies is tightly related with a characteristic of young, massive stars. Newborn stars emit brightly in the ultraviolet range. Dust grains absorb or scatter photons emitted by stars and re-emit the energy over the full IR range. The characteristic of this radiation is related to the chemical composition of dust and stars and the amount of dust and stars in the galaxy.

The best way to characterise physical properties of galaxies is to take advantage of the full electromagnetic spectra. But it is not enough to have it – the most challenging part is to interpret the information. Modelling of the spectral energy distribution of galaxy, from ultraviolet, through optical to infrared and even radio allows to estimate the main physical properties. The broad view can help us to connect all the information coming from different elements of the galaxy: properties of young, massive stars (ultraviolet range), older stars (optical light) and the dust particles (infrared wavelengths). Generally, the fitting process consists in a compare modelled galaxy SEDs to observed ones, with preserving the energy balance between the dust-absorbed stellar emission and its re-emission in the IR.

Stars and dust in galaxies are mutually evolving, and their properties depend on each other. Because the radiation we observe depends on the dust properties and the properties of the stars, simultaneously modelling their properties at the same time is not an easy matter. This complex relationship reflects the law of attenuation or quenching the intensity of the galaxy's radiation in a given band. Ignorance of the exact shape of the damping curve limits the interpretation of the fundamental properties of galaxies, such as age, mass and rate of star formation.

The main goal of the ASTROdust project is to statistically investigate the attenuation of dust in galaxies and its dependence on the types of galaxies in different space ages. We will use a unique sample of one million galaxies observed in the infrared by the Herschel satellite. We plan to construct the correct attenuation curves for different types of galaxies and to examine how they have evolved over the past 10 billion years. This will lead to a re-evaluation of the basic physical properties of star-forming galaxies and will provide new tools to astronomers who occupy themselves with these fascinating objects.