# POPULAR ABSTRACT

## 1. Star formation

Even though we know about almost 1600 exoplanets, it is still unclear how such planets and their stars actually form. The problem seems to be in a large extent observational – the so-called protostars, the objects that in the future will start to generate energy in the nuclear fusion and will ultimately become the "true stars', form in dense condensations of dust and gas, which are invisible to the naked eye. In is thus necessary to observe those objects at longer wavelengths, preferably in the far-infrared where both the peak brightness of the dust and key molecular transitions are located. Those molecular transitions can be used to estimate the temperatures and densities of the gas in the immediate surrounding of a protostar. Unfortunately, the Earth's atmosphere blocks most of the infrared light and till recently the only available observations came from balloon experiments and small satellites of limited capabilities. The situation has much improved with the successful mission of the Space Observatory *Herschela* that operated in 2009-2013 and provided groundbreaking observations of star formation.

## 2. Sun-bathing around protostars

Observations from *Herschel* reveal many interesting dynamical phenomena in the surrounding of young stars. The most important ones are shock waves associated with jets and winds which create characteristic bipolar structures on the infrared maps. The large velocities of the ejected matter are seen in the profiles of emission lines. Furthermore, the cooling budget of the gas is comparable with existing shock models.

Interestingly, the same models fail completely to reproduce the abundances of various molecules (e.g. water and molecular oxygen) around protostars. In order to solve this problem, prof. Michael Kaufman from the USA has created new models that take into account the possible influence of ultraviolet radiation (UV) on the physics and chemistry of matter affected by the shock wave. First comparisons of such models with observations of protostars in the far-infrared show that they are surprisingly consistent and allow us to derive the strength of the UV radiation (Karska & Kaufman, in preparation).

## 3. Aims and significance of the project

The main aim of the project is to characterize the UV radiation around protostars in order to understand its significance for the process of star formation. Apart from the increase in the temperature, dramatic changes in the chemistry of the matter are expected. This is quite important given the fact that the same matter will eventually form planets similar to those found in our Solar System. Moreover, astronomers found out that much less stars are being born than inferred from the available material. Models of global star formation indicate that such situation may be due to the UV radiation - thus, its determination is fundamental to solve the problem of "missing" young stars.

## 4. Methods

In order to investigate the influence of UV radiation on protostellar environment, I will use two indirect methods because large amounts of dust prevent from direct measurements. In the first method, I will take advantage of the new generation of shock models with UV mentioned above. In the second method, which will provide the test to the first one, the observations of two molecules (HCN and CN) from the ground will be used to derive their relative amount (abundances) which scales directly with the strength of the UV radiation. Observations of protostars at those molecular lines were obtained using a 30 m telescope IRAM, which observes at wavelengths somewhat shorter than millimetre ones. This kind of measurements can be done from the ground during favorable weather conditions and at optimal location of the observatory - IRAM is actually located in the Sierra Nevada mountains in Spain at altitude almost 3000 meters above the sea level.

## 5. Summary

Our knowledge about the formation of stars and planets constantly increases which helps us to imagine the distant history of our own planet. Various aspects of the processes leading to star and planet formation are still poorly understood, but luckily there are currently a number of ground-based and space-based instruments that tackle those problems. As part of this project, it will be possible to understand the role of UV radiation, which up until know was hard to capture, and perhaps also shed a new light on some of the fundamental mysteries related to star formation.