Project name: **A database of open clusters based on space-based data**

Supervisor: **doc. Ernst Paunzen, Dr.rer.nat**

Field of study: **Astrophysics and Informatics**

Keywords: **star clusters, space-based data, programming, database**

Student requirements and responsibilities:

The student should have basic knowledge of Astrophysics (baccalaureate level) and programming skills (Python preferred). We are a team of students of all levels and post-docs who will provide the best possible support during the internship. The applicant should be willing to work in a team and to communicate in an open-minded way. The responsibilities are manifold from the quality control of the database, including new data, testing already existing algorithms, and making a sound statistical analysis of the new data.

Description of the project:

Open clusters are regarded as an excellent tool in astrophysics. They almost always form in the galactic disks and follow the galactic rotation -- this distinguishes them from the globular clusters, which belong to the population of the galactic halo (or the bulge). The ages of the constituent stars are usually taken to be the same since an open cluster is formed within about a few million years after the start of the collapse of the giant molecular cloud. If we consider that all of the member stars were born from the same material, we can expect that the metallicity must be almost the same for each and every one of them. Moreover, cluster diameters are usually much smaller than their distances from us, so we need to evaluate the distance from only one of the members. Finally, the cluster's extinction can also be assumed to be the same for all its stars.

So any stellar astrophysical phenomenon can be studied for members of star clusters in correlation with age, mass and metallicity.

For a thorough, solid astrophysical study, it is essential to have a homogeneous set of observational data of stars and star clusters. For the analysis of stellar clusters in the Milky Way, currently, the only valuable database is WEBDA (http://webda.physics.muni.cz). About four million individual measurements of objects in more than 1100 Galactic star clusters are already included in the database. Finally, a whole set of bibliographic references allows the community to quickly locate each cluster's relevant publications. Around 100 individual worldwide accesses and data retrievals per day and about 700 publications referring to WEBDA within the last ten years demonstrate the acceptance of the database within the

scientific community. The PI of this project has been maintaining and developing the WEBDA database since 2005.

Gaia is a space observatory of the European Space Agency (ESA), launched in 2013. The spacecraft is designed for astrometry: measuring stars' positions, distances, and motions with unprecedented precision. It is the most important satellite mission connected with the study of open clusters in the Milky Way.

During this project, the current content of WEBDA should be synchronised and updated with the newest data release of the Gaia mission. This will be a big step forward in star cluster research, in general. We have already developed tools for this purpose that need to be tested and applied. Most important is the quality control, which will be the applicant's responsibility under the guidance of the PI. With this update of WEBDA, the whole astronomical community will enormously benefit and trigger a significant number of new papers.

During the internship, at least one peer-reviewed paper similar to this work should be written and published: https://ui.adsabs.harvard.edu/abs/2003A%26A...410..511M/abstract