Master's thesis project in Space, earth and environment

Determining physical properties of young gas clouds with the help of machine vision.

Background

Our home galaxy—the Milky Way—constantly produces new stars from its gas reservoir. Our understanding of how this happens is still greatly lacking; studying the process of how gas is converted into new stars is one of the most active fields in modern astrophysics.

This Thesis project aims at deriving basic physical properties of a large number of young gas clouds in the Milky Way that are the future birthplaces of new stars. These properties—masses, sizes, and densities—are the starting point of any analyses that describe how gas collapses into new stars. One fundamental problem in doing this is that it is not straightforward to determine distances to gas clouds in the Milky Way. The project aims at determining distances for a large number of clouds identified from a novel Galactic plane mapping survey. Once obtained, the distances will be used to determine the physical properties of the clouds.

Task description

The student will gather and analyze data from several Galactic plane mapping surveys to obtain parameters needed to determine distances towards gas clouds. The work includes deriving distance estimates from CO molecular line observations and/or from the modeling of the observed stellar density. The key problem in doing this is how to match molecular clouds identified from 2-dimensional maps with complex, 3-dimensional (position-position-velocity) CO data. The aim of the project is to explore the use of machine vision-based algorithms for the purpose. Once the matching is accomplished, the work leads to distance estimates for the clouds. With the distances in hand, the student will describe the Galactic distribution and basic physical properties of the clouds.

Required education and potential course requirements

"Interstellar Medium and Star Formation" (RRY041) is highly recommended. Any course in image analysis is useful.

Computational skills with some common programming/scripting language are required (e.g., Python, Matlab, C++). The analysis includes developing automated routines to deal with relatively large data sets.

Credits

30 or 60 credits

Starting time: Any time.

Contact information to supervisor

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