
Gaia and the Gould Belt

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The solar neighborhood (up to ~500 pc) contains several giant molecular clouds, which are the sites of star formation (e.g. Orion, Taurus, Lupus). These regions have been widely observed in various spectral domains, particularly at millimeter wavelengths, infrared, or X-rays, in order to study their young populations.

However, our knowledge of the morphology and evolution of these star forming regions remains very partial. Some of these clouds and their associated stellar population seem to form a coherent structure around the Sun called the Gould Belt ([1], [2]). Its exact shape, its evolution, even its existence are still being debated. Is it an expanding ring from a supernova explosion several million years ago, a disk, or structures connecting two spiral arms called spurs?

This project aims to exploit recent data from the Gaia satellite, which provides new information to better constrain our knowledge of the 3D distribution of stars: parallaxes (i.e. distances) and proper motions.

The pre-main sequence objects have the property of having a strong X-ray emission that decreases during the star lifetime. By combining the Gaia measurements with X-ray data, we can build a sample of young stars and study their distribution and dynamics.

The cross-identification of large and heterogeneous catalogs with a very different spatial resolution and object density is challenging. This step will benefit from the Centre de Données de Strasbourg (CDS) experience and tools.

This work comes in a context where several 3D interstellar medium maps are available (extinction maps tracing the dust distribution in our Galaxy, e.g. [3]) which will allow us to compare the distribution of young stars with that of molecular clouds and, in the longer term, to compare their respective dynamics. A very recent study [4] questions the Gould Belt model and describes the local cloud distribution as a damped sinusoidal wave on the plane of the Milky Way. Our analysis of the young stellar population in the Sun neighborhood becomes even more exciting.

[1] C. A. Perrot and I. A. Grenier, *A&A* **404**, 519 (2003)

[2] P. Guillout, M. Sterzik, M. F. Schmitt, et al., *A&A* **337**, 113 (1998).

[3] R. Lallement, C. Babusiaux, J.-L. Vergely, et al., *A&A* **625**, 135 (2019).

[4] J. Alves, C. Zucker, A. A. Goodman, et al., *Nature* **578**, 237 (2020).