Contribution ID: **4** Type: **not specified**

A census of OB stars within 1 kpc and the star formation and core collapse supernova rates of the Milky Way

Thursday 31 October 2024 10:40 (30 minutes)

O- and B-type stars constitute valuable tools across many areas of astronomy. They are significant sources of stellar feedback, through which they enrich the interstellar medium in new chemical elements, but also contribute to and hinder the emergence of future generations of stars. Being short-lived, they tend to remain near their birth environment, and thereby are vital tracers of the position and motion of the Milky Way spiral arms. Furthermore, they are crucial to study star formation and early evolution, as well as stellar multiplicity.

It is thus important to map out the distribution of OB stars across the Galaxy. Data from Gaia DR3 offers an opportunity to produce an updated census of their population. In this work, we have applied an improved, flexible SED fitting tool to identify and characterize OB stars in the solar neighborhood. With this tool we have identified about 25,000 O- and B-type stars (hotter than 10,000 K) within 1 kpc of the Sun, with a completeness of 90-95 % across all magnitudes. This list of OB stars typically include fainter stars non-included in similar catalogues, and reach higher completeness particularly in the solar neighborhood (< 300 pc).

Several overdensities on this map correspond to well-known regions such as Orion, Sco-Cen, Vela OB2, Cepheus and Circinus, hinting at the presence of OB associations and/or massive star clusters. These overdensities thereby constitute potential sources of stellar feedback, driving particle acceleration in the surrounding medium, and also future targets for detection of gravitational waves. Since we used our census of OB stars to provide a new estimation of the star formation and supernova rates within the local Milky Way, we have confirmed this by determining a rate of about 20 core-collapse supernova explosions per million year within 1 kpc.

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Session Classification: Population properties