Exoplanet populations in Milky-Way-like galaxy simulations and predictions for PLATO

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Abstract

The number of detected exoplanets increased significantly in the last decade, finally allowing us to study the exoplanet population from a Galactic point of view. To simulate a realistic Galactic exoplanet population, we combine a cosmological galaxy formation model tailored to the Milky Way with planetary formation models and our best knowledge of stellar and exoplanet statistics. We present the process we developed to generate a synthetic exoplanet population, from a galactic simulation to the creation of planetary systems, going through the creation of a synthetic stellar population. We considered the stellar multiplicity and the relation between exoplanet occurrence rates and host-star properties.
In order to test our generated exoplanet population, we simulate exoplanets in the Kepler field of view, reproducing the selection function of Kepler's exoplanet census. Comparing our simulated "detectable" planets and the exoplanets detected by Kepler, we find consistent results, both in the number of detected planets and physical properties (radius, period, etc). The remaining differences between our exoplanet population model and the Kepler sample (e.g. the absence of the observed radius gap) will be addressed in the future to obtain an even more realistic simulation.
We also generate exoplanet populations in different regions of the simulated Galaxy. Our results suggest that terrestrial planets, even if they are largely underrepresented in current detections, are extremely abundant in all regions of the Galaxy.
We apply the same exoplanet creation process to the future PLATO long-duration phase fields to estimate the number of detectable planets and compare our estimate with existing studies. We will give an insight into the current state of the project and present initial results.