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A WEAVE radial velocity survey to unravel the Milky Way spiral arms nature

Maria Monguió[1], MaCarme Pujol[2], Francesca Figueras[2]

[1] *Departamento de Física, Ingeniería de Sistemas y Teoría de la Señal. Escuela Politécnica Superior, Universidad de Alicante, Apdo. 99, 03080 Alicante, Spain*
[2] *Departament d'Astronomia i Meteorologia and IEEC-ICC-UB, Universitat de Barcelona, Martí i Franquès, 1, E-08028 Barcelona, Spain*

Abstract

The nature of the spiral arms of the Galaxy is a matter of debate nowadays. Different theories have been suggested for the formation and evolution of these structures (density waves, swing amplification, invariant manifolds, ...). In order to disentangle between different theories we plan to study the kinematic perturbation due to the presence of the arm through individual radial velocity measurements in the anticenter direction. The stellar overdensity associated with the Perseus arm in this direction has been detected at 1.6 kpc using a Strömgren photometric survey (Monguió et al. 2013, 2014, and 2015). At l=180°, the component of the galactic rotation is negligible, so it is feasible to detect such a perturbation, if Tight-Winding Approximation is valid, combining the radial velocities with the available photometric distances (or Gaia parallaxes in the future). However, if invariant manifold theory stands, then only proper motions from Gaia will be able to trace the kinematic perturbation due to the arms at l=180°. In other directions, the combination of both, Gaia data -parallaxes and proper motions- together with on-ground radial velocities will be needed for that purpose. WEAVE is optimal to undertake this study since it gives good radial velocity accuracies even for faint stars, plus a good multiplexing. Here we develop a study to prove that the fiber distribution, resolution, wavelength ranges, and other instrument characteristics fit our scientific target.