Wide binaries as co-eval probes of the rotational evolution of low-mass stars

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Abstract

Rotation plays an important role in the life of stars, and offers a potential diagnostic to infer their ages via gyrochronology. Currently, however, gyrochronology faces critical challenges. Recent results from cluster studies and asteroseismology have shown that stars deviate from a simple Skumanich-type spin-down, and rather follow a more complex evolution with stalling in their rotation rates, gaps in the period vs. temperature diagram, and weakened magnetic braking in stars more evolved than the Sun. A detailed understanding of these phenomena, however, is currently limited by the lack of calibrators at old ages. In this talk, I will demonstrate how wide-separation binaries identified by Gaia can help address these issues. The components of a given binary are co-eval and taken together they can provide exquisite gyrochronology assessments. Particularly, I will discuss the outstanding opportunity that main sequence-white dwarf binaries present for expanding the existing rotational constraints in unprecedented age (and metallicity) regimes. Systems with a white dwarf component can be age-dated through stellar evolution modeling, and this may be complemented with rotation period measurements for their main-sequence companions by using photometric data from space-based missions such as TESS and the upcoming PLATO. In this way, these systems will produce the unprecedented and much-needed age-rotation constraints that are necessary for a thorough understanding of the complex angular momentum evolution of low-mass stars. With the advent of the PLATO mission, this work sets up the stage for decisive spin-down assessments and gyrochronology calibrations in the era of ever-expanding space-based photometry and astrometry.

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