The Factory and The Beehive I. Rotation Periods For Low-Mass Stars in Praesepe

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Stellar rotation periods measured from single-age populations are critical for investigating how stellar angular momentum content evolves over time, how that evolution depends on mass, and how rotation influences the stellar dynamo and the magnetically heated chromosphere and corona. We report rotation periods for 40 late-K to mid-M stars members of the nearby, rich, intermediate-age (~600 Myr) open cluster Praesepe. These rotation periods were derived from ~200 observations taken by the Palomar Transient Factory of four cluster fields from 2010 February to May. Our measurements indicate that Praesepe's mass-period relation transitions from a well-defined singular relation to a more scattered distribution of both fast and slow rotators at ~0.6 Msun. The location of this transition is broadly consistent with expectations based on observations of younger clusters and the assumption that stellar-spin down is the dominant mechanism influencing angular momentum evolution at 600 Myr. However, a comparison to data recently published for the Hyades, assumed to be coeval to Praesepe, indicates that the divergence from a singular mass-period relation occurs at different characteristic masses, strengthening the finding that Praesepe is the younger of the two clusters. We also use previously published relations describing the evolution of rotation periods as a function of color and mass to evolve the sample of Praesepe periods in time. Comparing the resulting predictions to periods measured in M35 and NGC 2516 (~150 Myr) and for kinematically selected young and old field star populations suggests that stellar spin-down may progress more slowly than described by these relations.

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