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Towards a relationship between stellar radial differential rotation and age

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Gyrochronology is an empirical relationship that describes the spin down of a star as it ages.This spin-down may occur through angular momentum loss via the stellar wind. Stellar dynamos drive this wind, and in Sun-like stars the rotational shear at the base of the convection zone is a candidate for the driver of the dynamo. We show that the asteroseismic signatures of rotation and rotation periods from surface variability of five Sun-like stars observed by Kepler agree within the uncertainties. This suggests that in these stars radial differential rotation is weak, similar to the Sun. Using these rotation periods, we also find significant discrepancies between ages from asteroseismology and gyrochronology relations, suggesting that stellar age estimation is problematic even for Sun-like stars. A more physical relationship may exist between the radial differential rotation gradient and the age of the star, however this is difficult to measure for individual Sun-like stars. We explore the prospect of constraining the radial differential rotation gradient using an ensemble of Sun-like stars. We find that with observations from the future PLATO mission we may be able to measure differences in the radial differential rotation gradient in ensembles of stars across the main sequence provided radial differential rotation gradient differ by more than twice that of the Sun.

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