Spin Down in Subgiant Stars: Tests of Physics and Main Sequence Braking Models

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Background

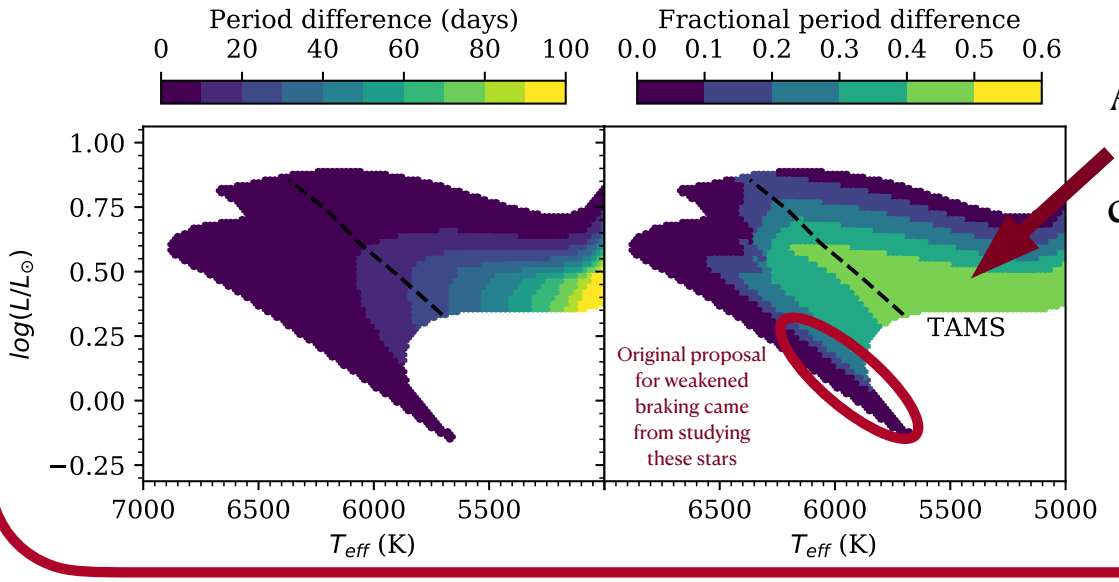
van Saders et al. 2016 proposed that cool main sequence stars cease to undergo efficient angular momentum loss in the latter half of the main sequence (when the Rossby number exceeds Ro = Ro_{crit}~ 2). If true, it would alter the efficacy of period-age relations in old stars, and may signal a fundamental shift in the magnetic behavior of old objects (Metcalfe et al. 2017).

The Challenge

Braking timescales during the second half of the main sequence are long, and thus the difference between "standard" spin-down scenarios and weakened braking is subtle: of order 20% in period or less.

A Test!

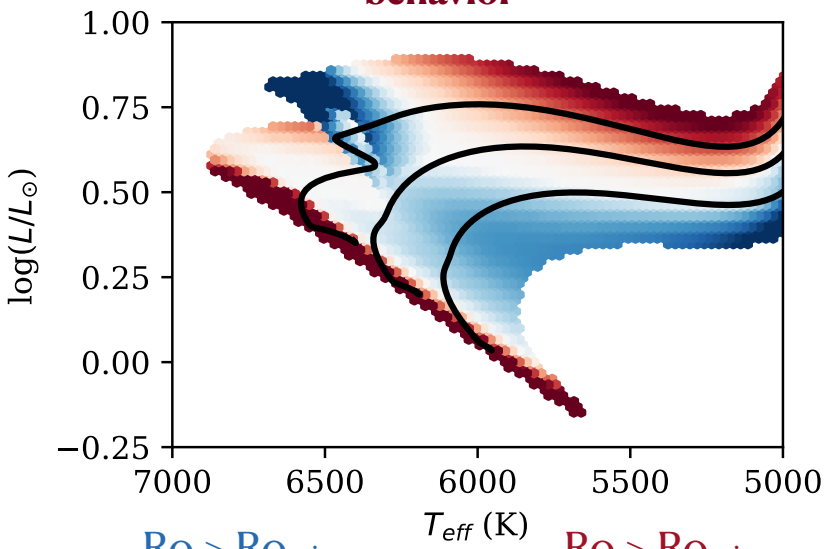
Compare predicted periods from standard and weakened braking models in subgiants



Adding weakened braking can change the period predicted for the subgiant branch by ~50%

(see also Metcalfe, van Saders et al. 2020)

Strong patterns predicted in the spin down behavior



Ro > Ro_{crit}
No magnetic braking

Ro > Ro_{crit}
Normal magnetic braking

Things to keep in mind

+ The most obvious signature of weakened braking may be on the subgiant branch
+ Subgiants are easy to study, with ages and physical properties well-constrained by HRD position. Observational tests will be easier to come by.
− Unclear whether extrapolation of MS braking models to the subgiant branch is appropriate
− Differential rotation, and modeling choices such as mixing length have a larger impact on model predictions of periods.