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Observing Spin-Orbit Misalignment In Early-Type Systems

Spin-orbit misalignment -- the angle between a star's rotation plane and a planet's orbital plane -- appears common for planets orbiting early-type stars. In fact, observations of Hot Jupiters orbiting high-mass stars suggest that misaligned configurations may be the default orbital state in these systems. Several hypotheses have been put forth to explain this phenomenon, but the underlying causes of spin-orbit misalignment are still largely unknown. Something must torque these systems out of alignment, whether it be the planets, the primordial disk, or the star itself that tilts. I aim to test existing hypotheses of this phenomenon by performing a spin-orbit misalignment survey for A-F stars. To that end, I develop a technique for measuring spin-orbit misalignment from transit light curves that overcomes the two most common physical challenges of observing early-type stars. The first challenge is asteroseismic activity, for which I apply second-order rotational splitting. The second challenge is rapid stellar rotation, which I model with gravity-darkening theory. My technique combines these effects to obtain two independent measurements of the system's orbit geometry, yeilding a robust determination of the system's spin-orbit misalignment. I plan to apply this technique to ~30 systems and test my findings against existing misalignment hypotheses.