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Title: An observational correlation between stellar brightness variations and surface gravity
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Instinctively familiar to even the most amateur layperson, the most fundamentally observable property of a star is its brightness. This brightness is a variable dictated by the physics of the stellar interiors as the star evolves throughout its life. There are several factors driving the brightness variations of Sun-like stars. These include granulation, a process by which hot gas ascends to the stellar surface by convection and cool gas descends in lanes between the hot gas (see Mathur et al. 2011), as well as acoustic oscillations, rotation, and electromagnetism.

As a Sun-like star progresses through its life cycle, it goes from a smaller main-sequence dwarf to a bloated red giant. During this process, the factors which dictate stellar variability also evolve. The notable quantity defining these phases of stellar evolution is *surface gravity* (denoted g), where a star earlier in its life is more compact, thus higher g, with g decreasing as the star inflates to a giant.

In their 2013 Nature article, Bastien et al. argue a correlation between stellar surface gravity to brightness variations, a daunting statement given the potential for confounding variables to the measurement. This correlation is fairly intuitive: as g decreases, rotation slows, magnetic activity weakens, and oscillation and granulation timescales increase, all of which impact the brightness variation.

Using 30 minute light curves from NASA's Kepler Mission, Bastien et al. identify correlations of evolutionary stellar properties with three different measures of stellar variability: the range of the variability, the number of zero crossings of the light curve, and the slightly more jargon-y root mean square on time scales shorter than 8 hours, which they refer to as an 8 hour flicker. Relating these to g determined from Kepler, they note some interesting features of stellar evolution.

Seen in Bastien's Figure 2 (Figure 1 here), there is a strong correlation between surface gravity and stellar brightness variations, despite the threat of other variables confounding the data. Bastien et al. continue the argument saying that Sun-like stars begin as main sequence dwarfs with large variability ranges and few zero crossings, and the stars evolve to have longer rotation periods and smaller variability ranges. Suddenly, they become more complex as they reach the 'flicker floor', the sequence shown in Bastien's Figure 1 (Figure 2 here) where we see a leveling in the variability range.

The next step in this study will be to differentiate between stars with similar surface gravities but different internal structures. Bastien et al. propose that this may be done by applying a varying timescale of the flicker as a function of g, which would indicate the changing timescales of granulation. This study could yield information about how stellar behavior on the 'flicker floor' have radial velocity 'jitters' which hampers exoplanet detections.

Throughout this argument, Bastien et al. use Kepler photometric measurements to show that the most instinctive measurement of a star, its brightness, varies in a nuanced but predictable manner. This question is important to a wider audience than just stellar astronomy, with implications in radial velocity detections of exoplanets.

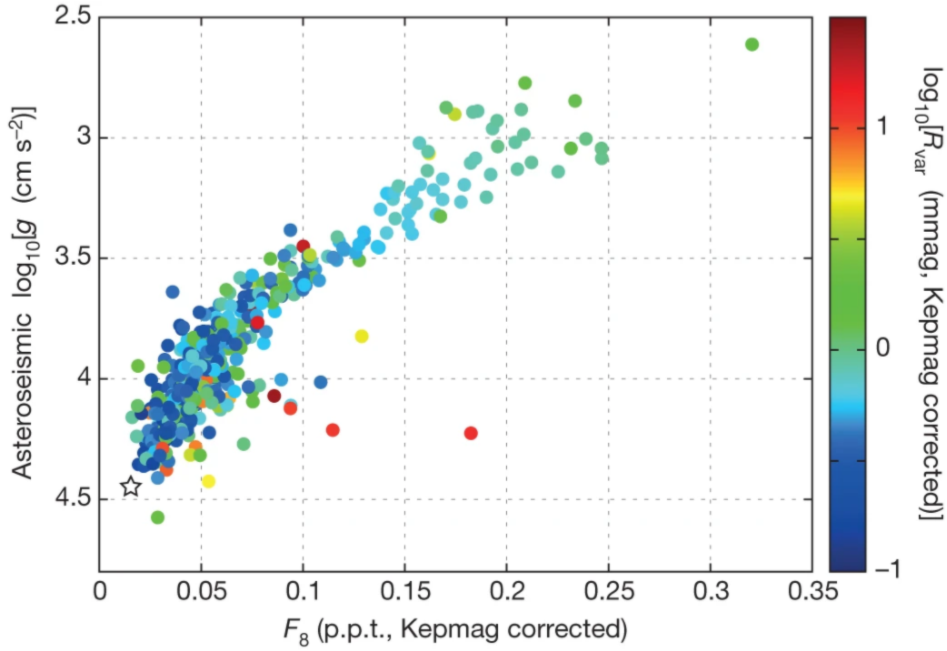

Figure 1: Fig. 2 from Bastien et al. 2013. Surface gravity is shown to correlate with two different measures of surface gravity, the 8 hour flicker (F_8) and the range of brightness variations R_{var}. The Sun is plotted as a hollow black star. The outliers tend to have large R_{var}, and excluding these outliers a cubic fit yields a median absolute deviation of 0.06 dex, indicating a strong correlation between g and brightness variations.

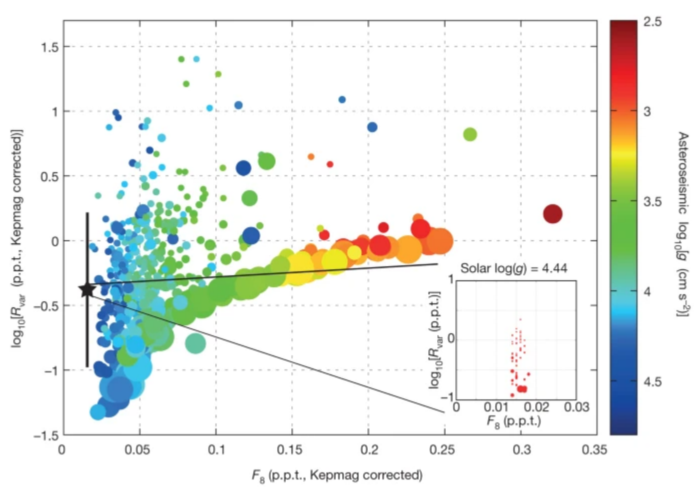

Figure 2: Fig. 1 from Bastien et al. 2013. Note that we see this 'flicker floor', the sequence where the stellar brightness variability range is minimum for that F_8.