Measuring Ages of Stars Through Their Angular Momentum
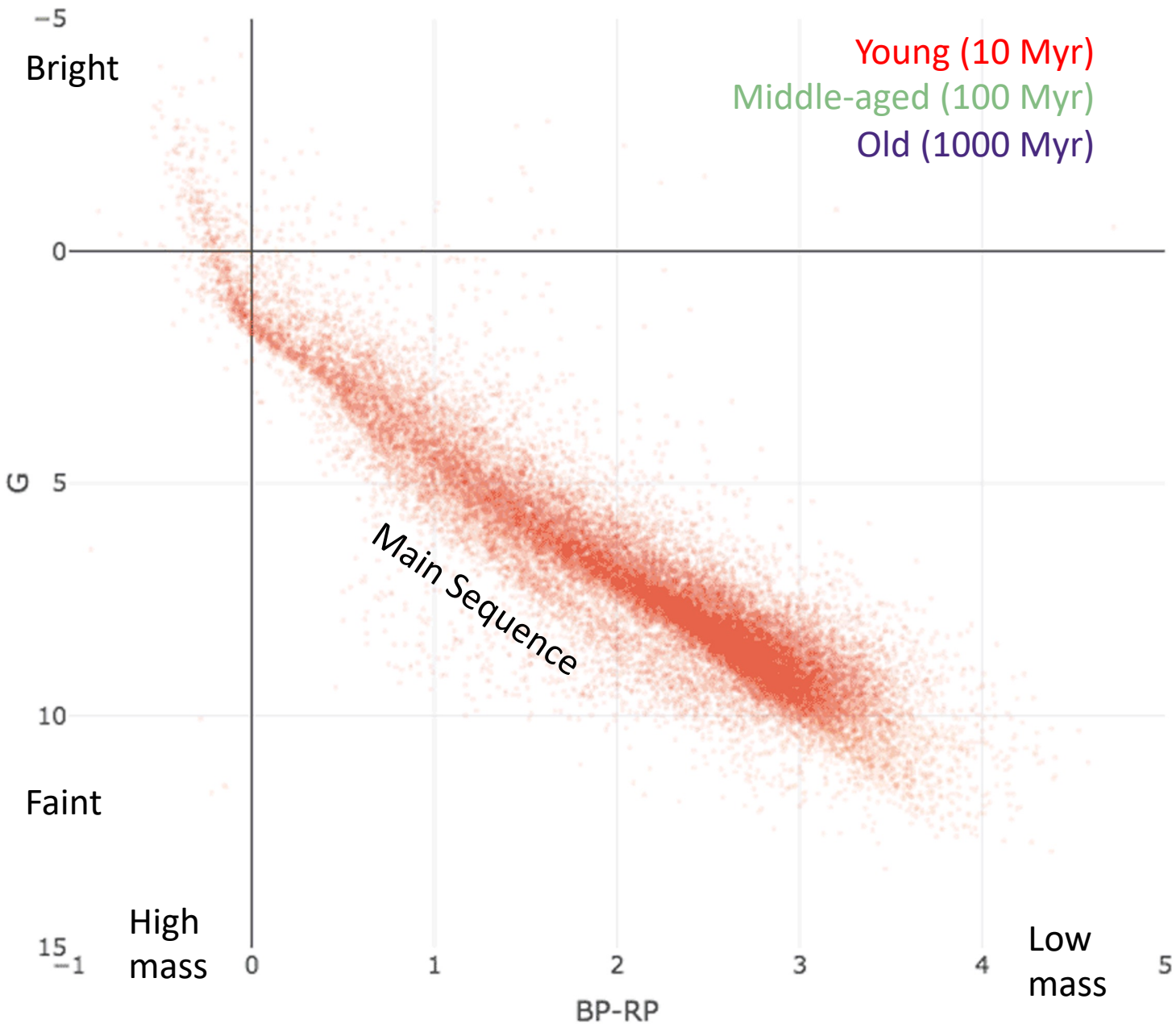
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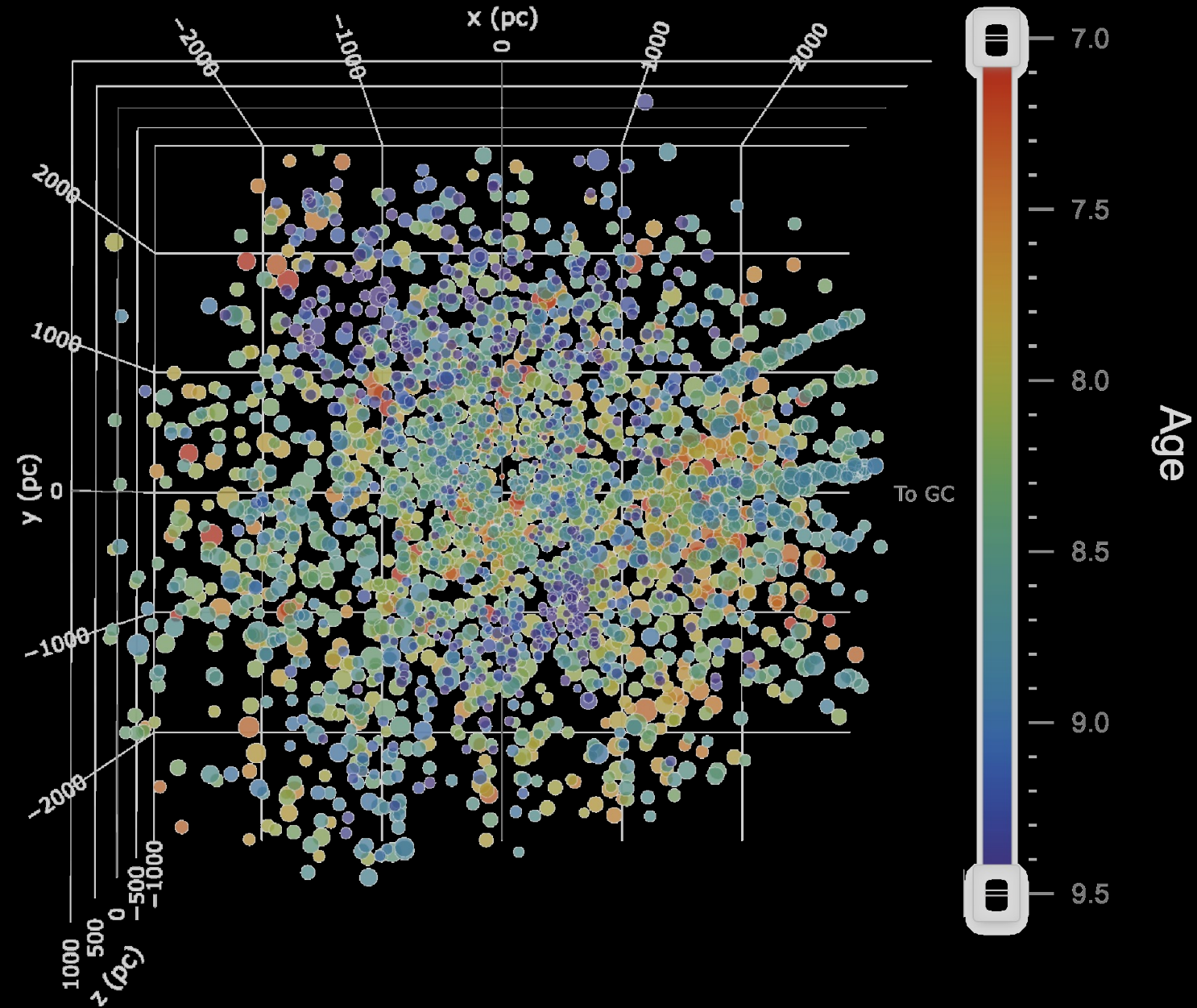
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Star clusters as a standard of stellar ages

- All stars within a cluster form at the same time
- Stars of different masses evolve at different rates
- Directly probes the age of a cluster

Kounkel+19

Era of clusters

- We identified thousands of new clusters using Gaia

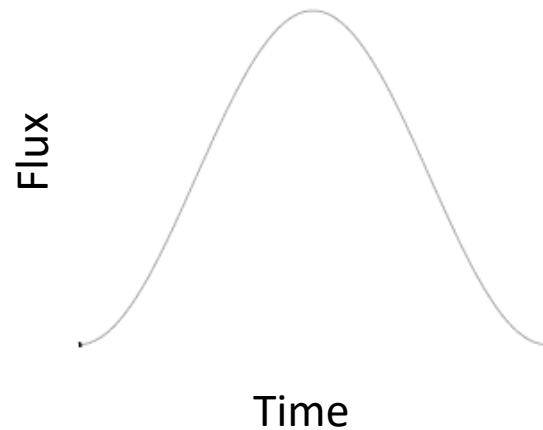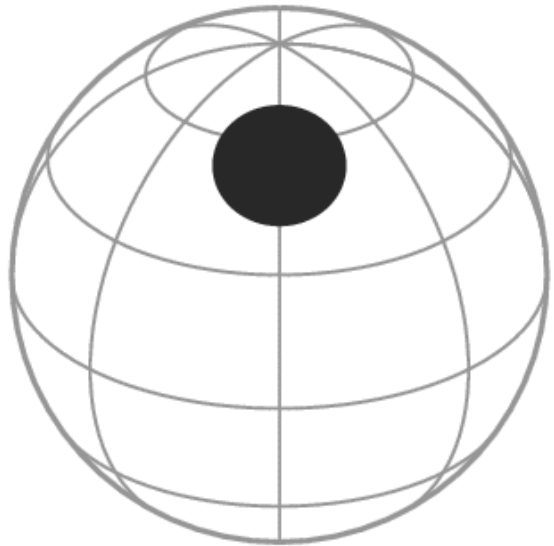- Ages have been measured for ~1 million stars

Kounkel+20

Limitations of clusters

- Most stars don't remain in their parent clusters

- *Billions* of main sequence stars in the field

- Another method of measuring ages is need

Pelupessy+13

Effect of spots

- Stars vary in brightness on timescales of a rotational period
- Amplitude of variability correlates with the spot size

Davenport+15

Transiting Exoplanet Survey Satellite

- Monitors brightness of stars over time

- We examined light curves for 100,000 stars with known ages (from clusters)

- Measured variability amplitudes, rotational periods
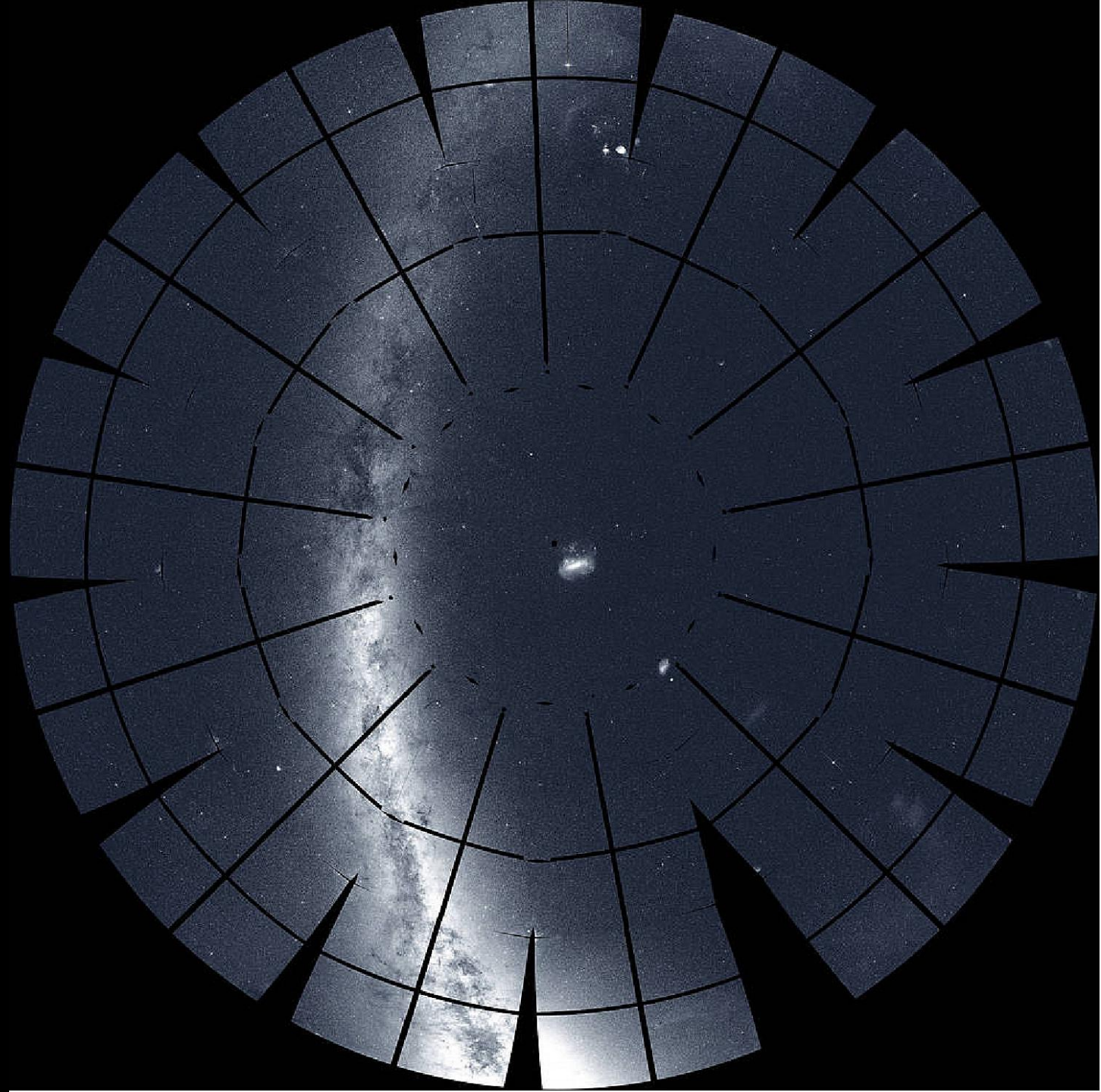
Spot sizes are age dependent

- Young & low mass stars are most heavily spotted
- Old higher mass stars (like the Sun!) have only a few small spots

Kounkel+22
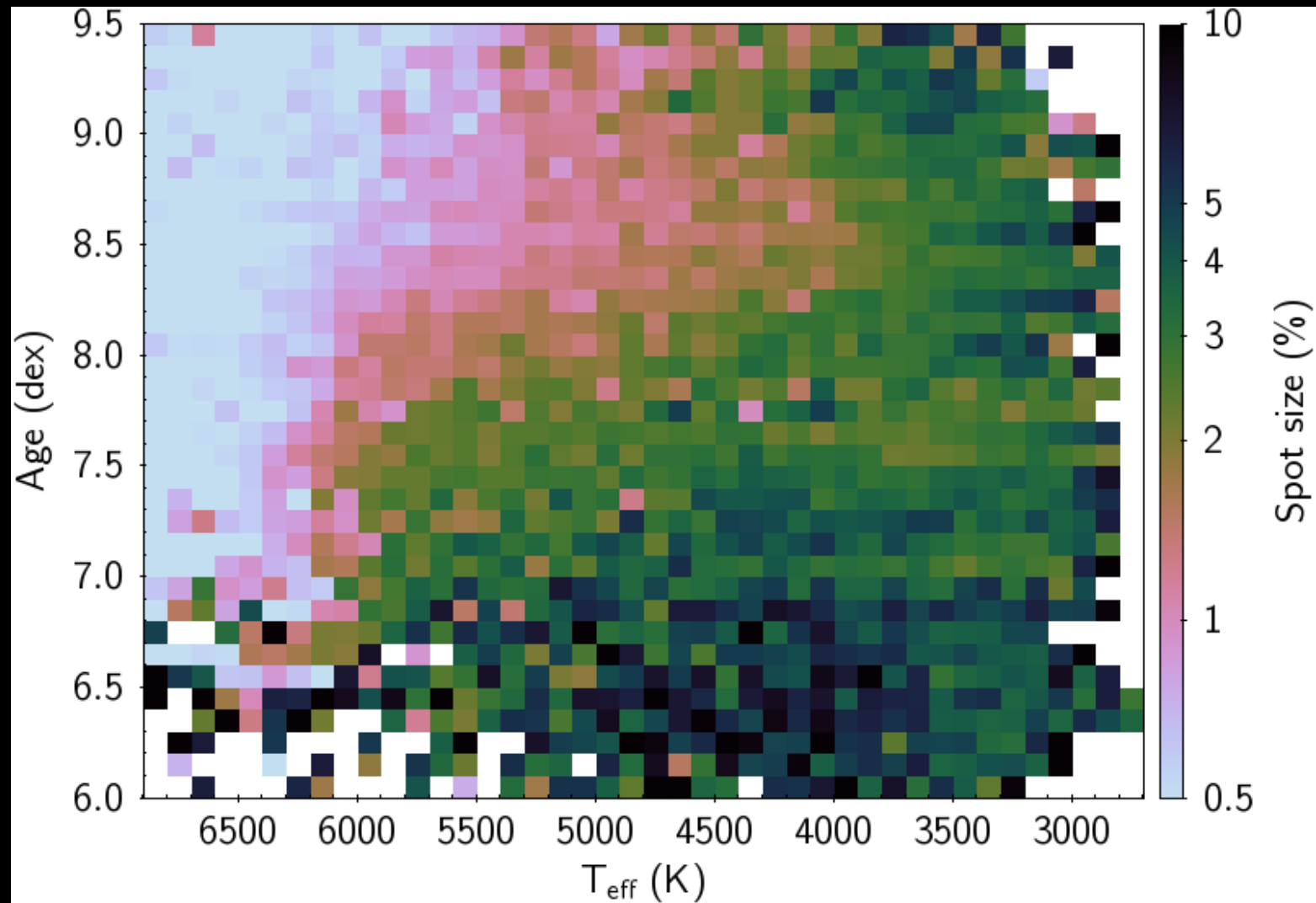
Gyrochronology

- Largest sample of stars with a continuous age distribution

- Stars incrementally spin down, losing angular momentum

- Can be used to predict ages of the field stars

Kounkel+22
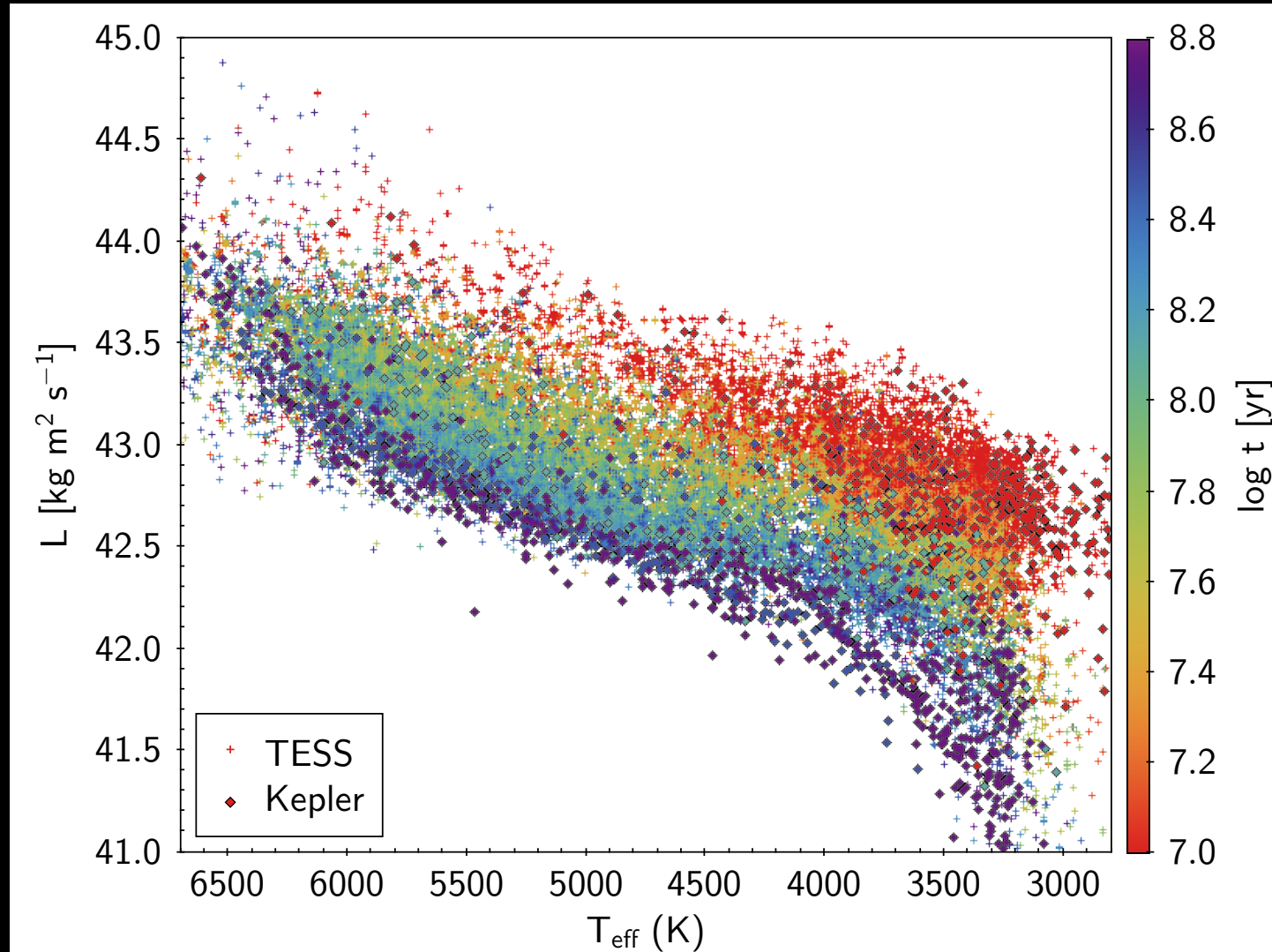
Summary

- New empirical grid to determine ages of stars through gyrochronology

- Rotational periods will enable increasing census of stars with know ages by *an order of magnitude*