

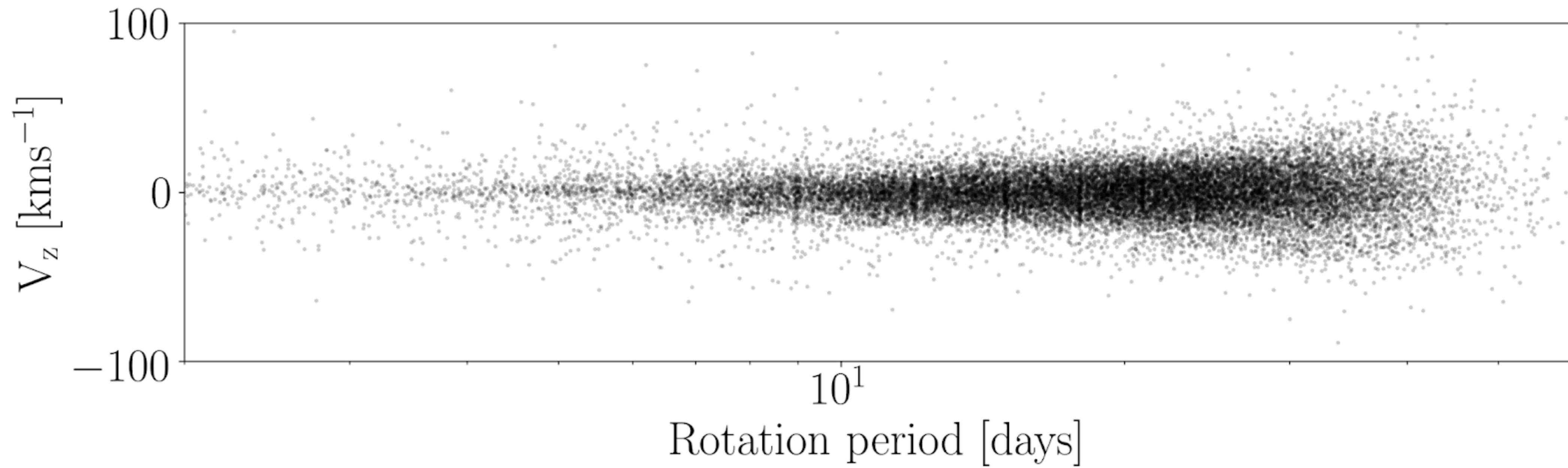
# Calibrating gyrochronology with Galactic kinematics

**Ruth Angus** AMNH/Flatiron/Columbia

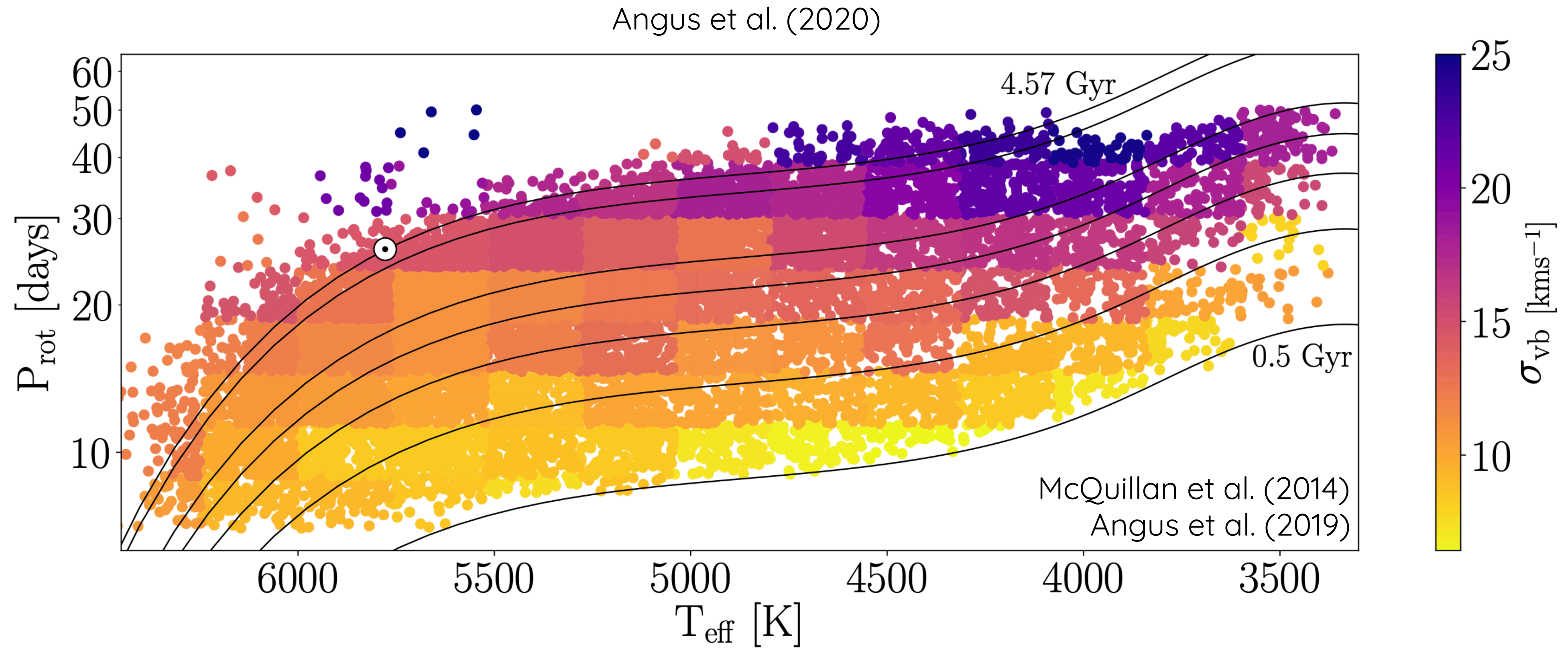


Yuxi (Lucy) Lu, Rocio Kiman, Angus Beane, Adrian Price-Whelan, **Elisabeth Newton**, Jason L. Curtis, **Travis Berger**, **Jennifer van Saders**, **Daniel Foreman-Mackey**, Lauren Anderson, Jacqueline K. Faherty, and others!

Velocity dispersion **increases** with rotation period  
(because both increase with age)

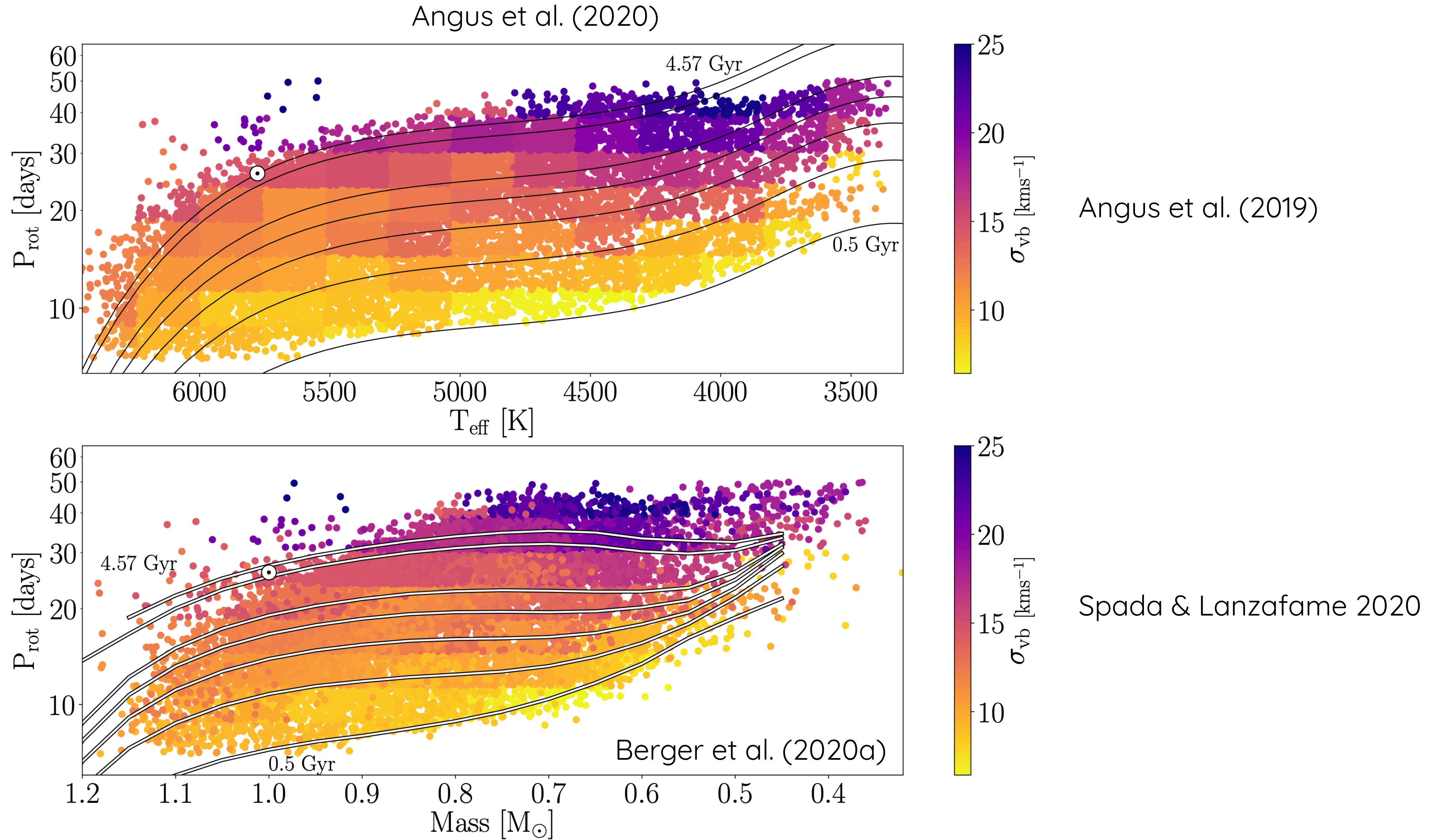


# Velocity dispersion indicates **age** across the $P_{\text{rot}}-T_{\text{eff}}$ diagram





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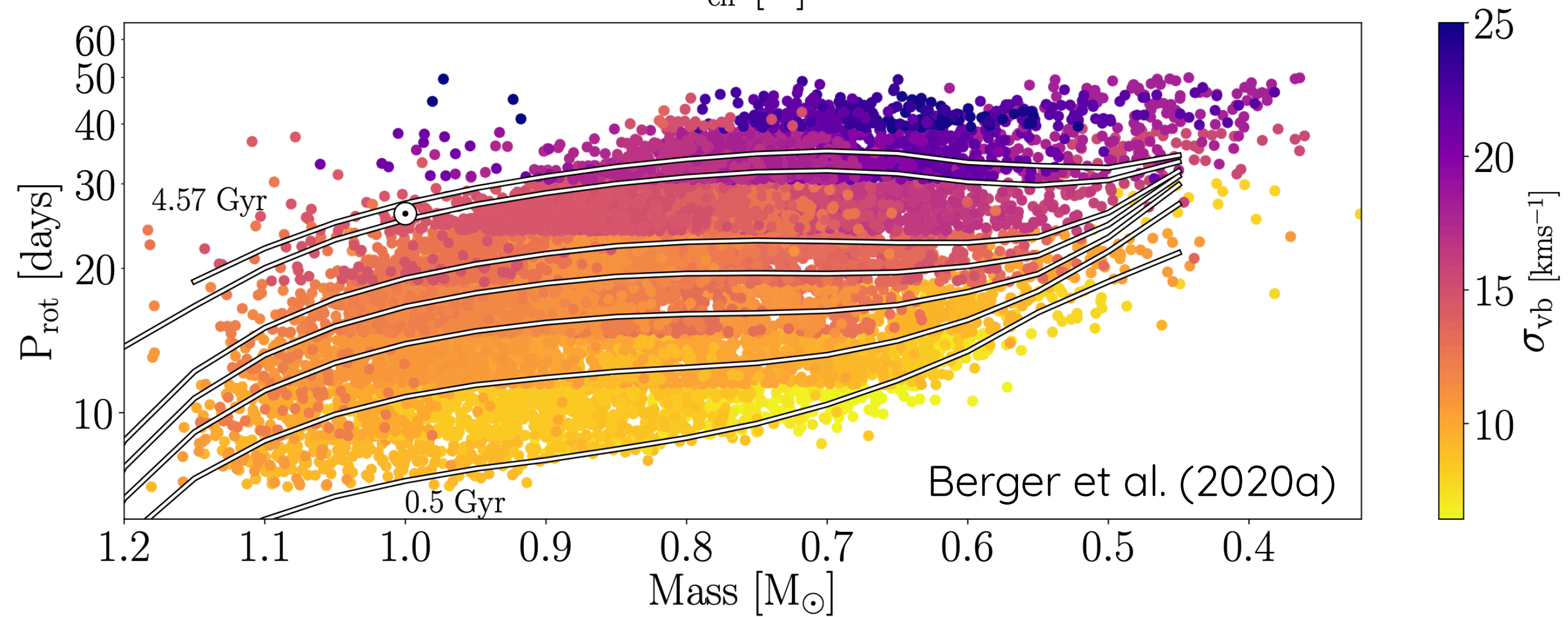
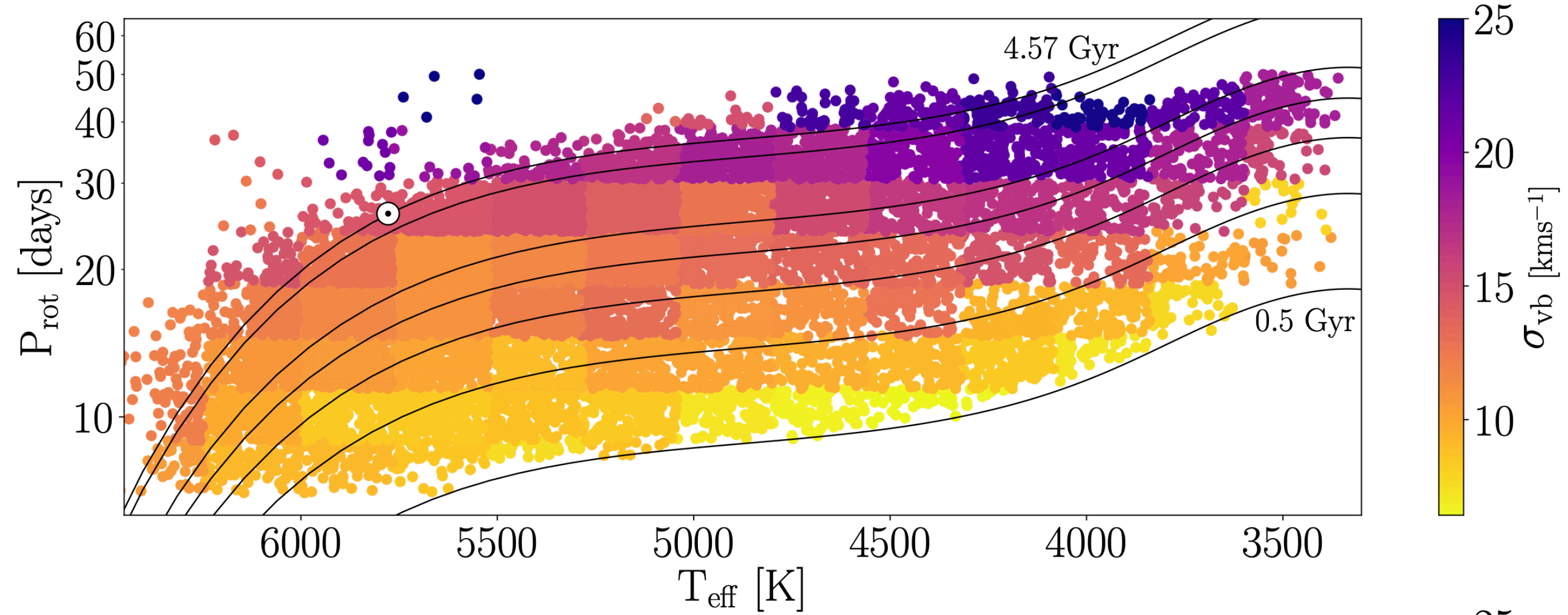




# Field stars show further evidence for core-envelope decoupling

Curtis et al. (2019), Spada & Lanzafame 2020

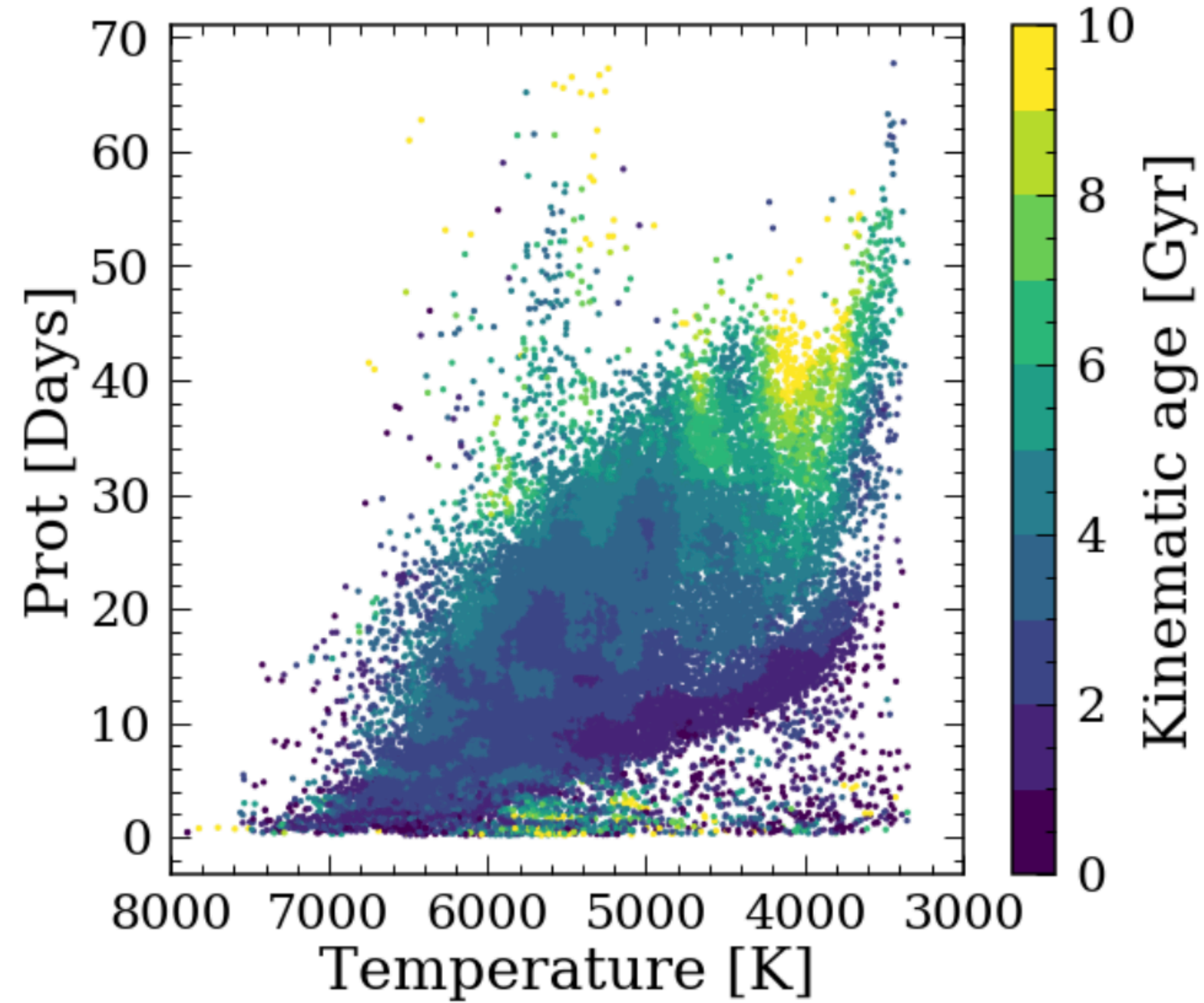
Angus et al. (2020)



Berger et al. (2020a)

# 'Gyro-kinematic' ages – binning in 2D

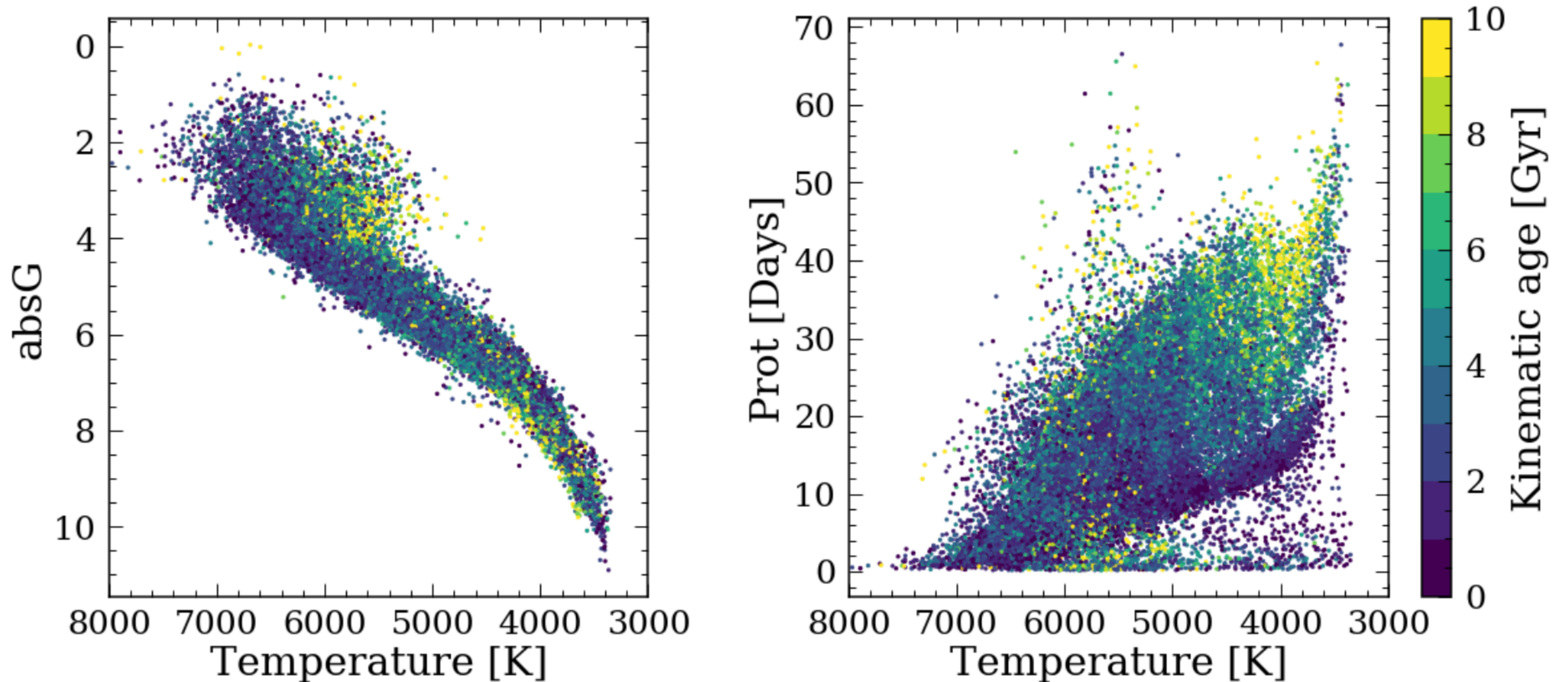
Lu et al. (in prep)



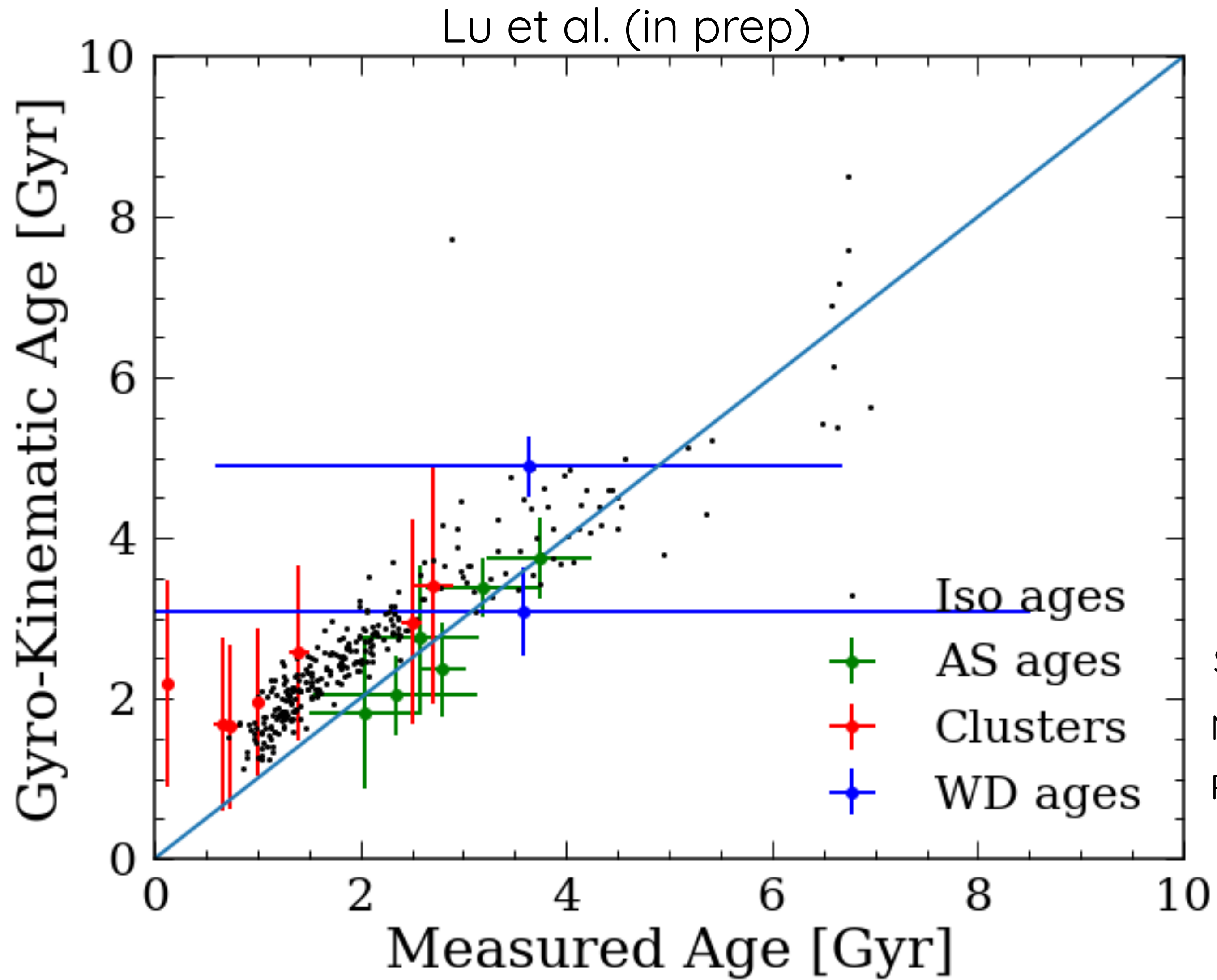


# 'Gyro-kinematic' ages — binning in 3D

Lu et al. (in prep)



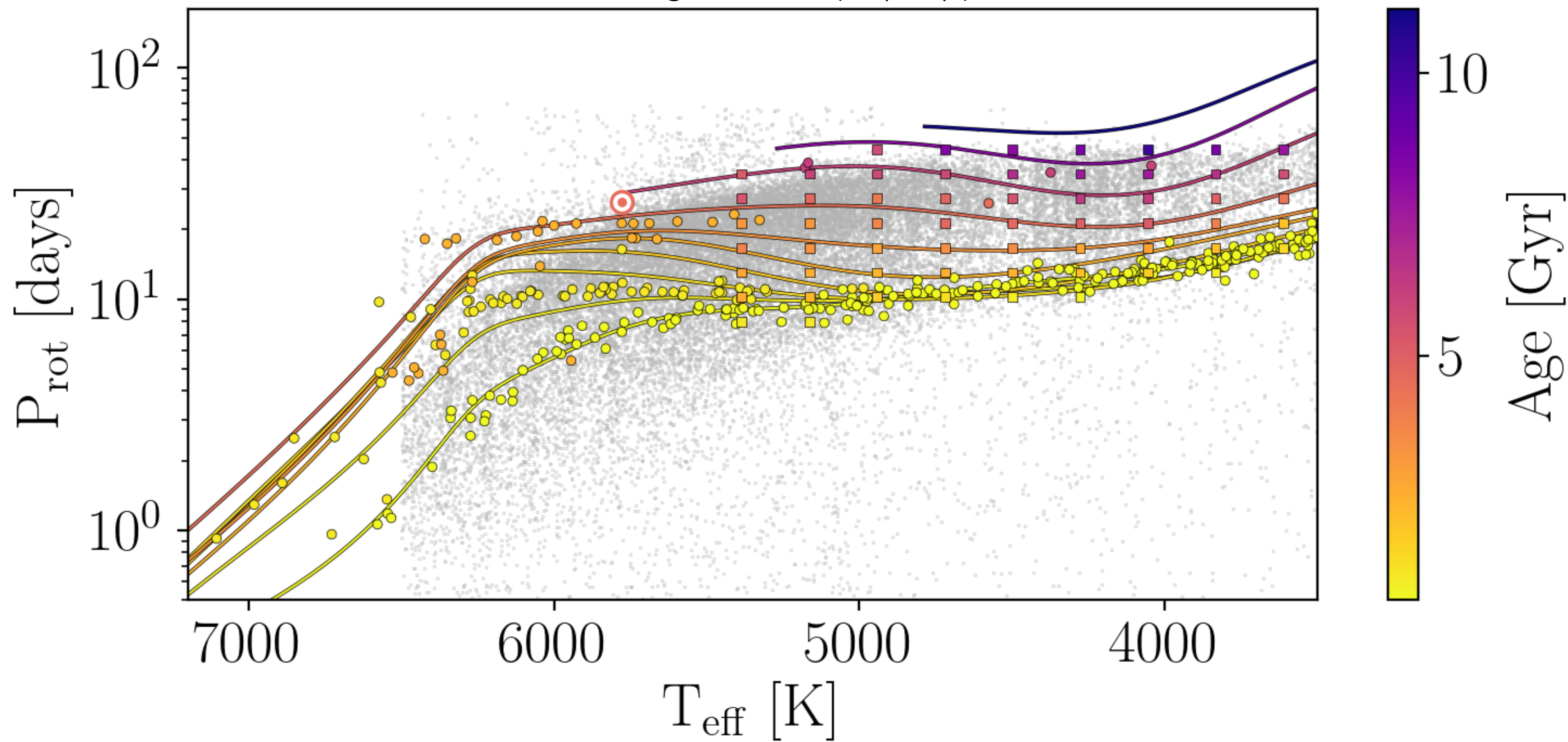
# Gyro-kinematic ages are accurate





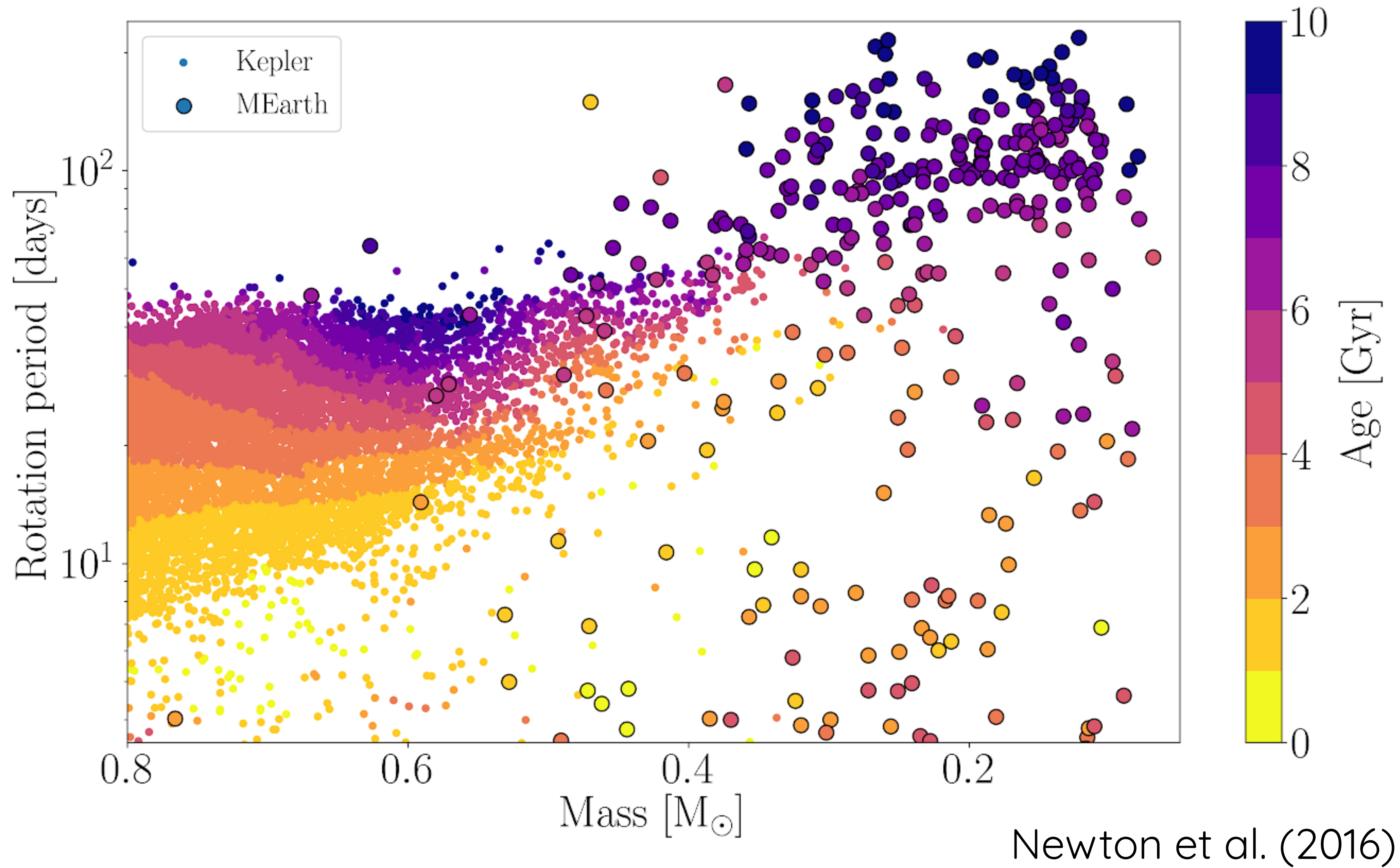
# Calibrating a Gaussian process gyrochronology relation

Angus et al. (in prep)





# Can we extend gyro to M dwarfs?





# Calibrating gyrochronology with Galactic kinematics

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