# How Galactic Chemical Evolution Influences the Distribution of Stellar Rotation Rates

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**Mentors**

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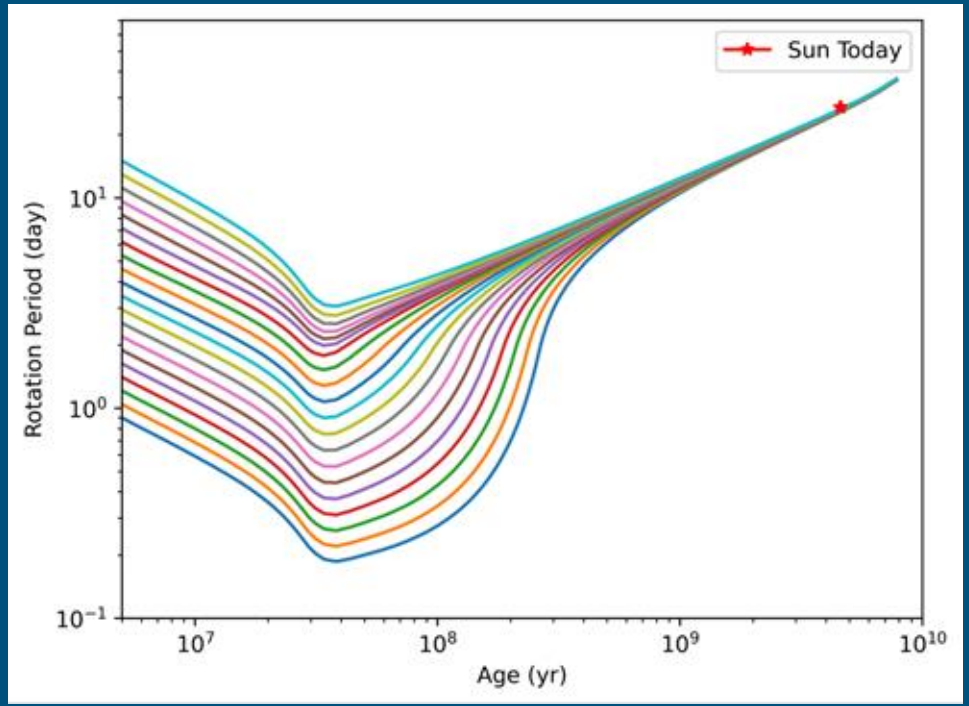
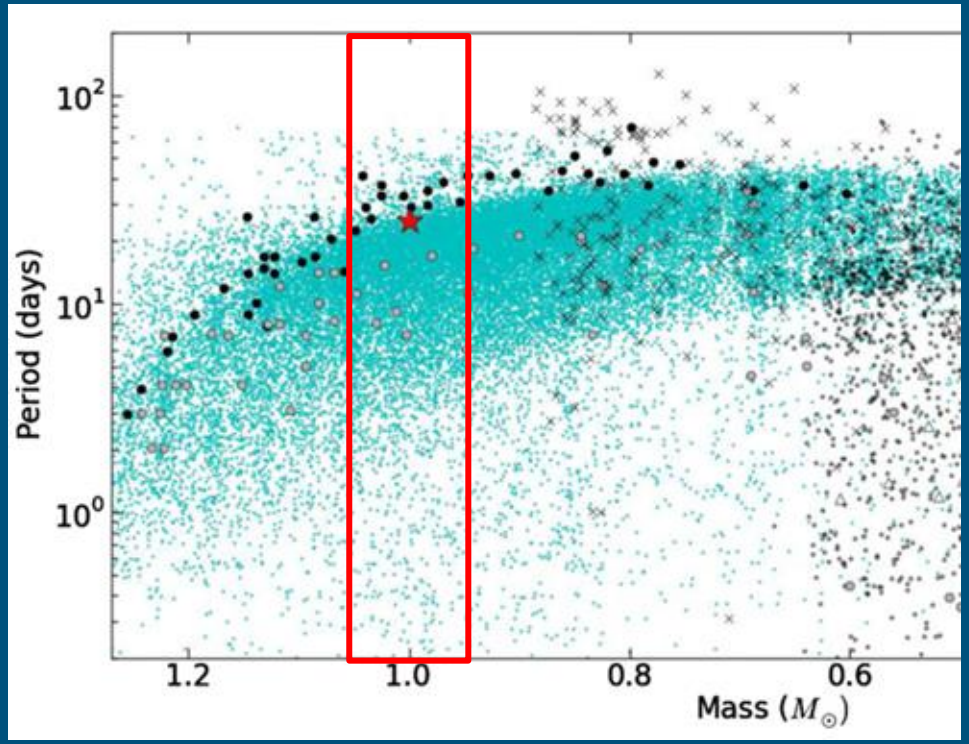
# Rotation of Stars

- Stars rotate at different angular velocities which change over time
- During formation, rotation period decreases due to contraction
- During a star's life, rotation period increases due to stellar winds



# The Problem: Missing Slow Rotators

- Sun is about halfway through its lifetime
- Half the stars should be older and thus rotating more slowly
- Where are the slow rotators?



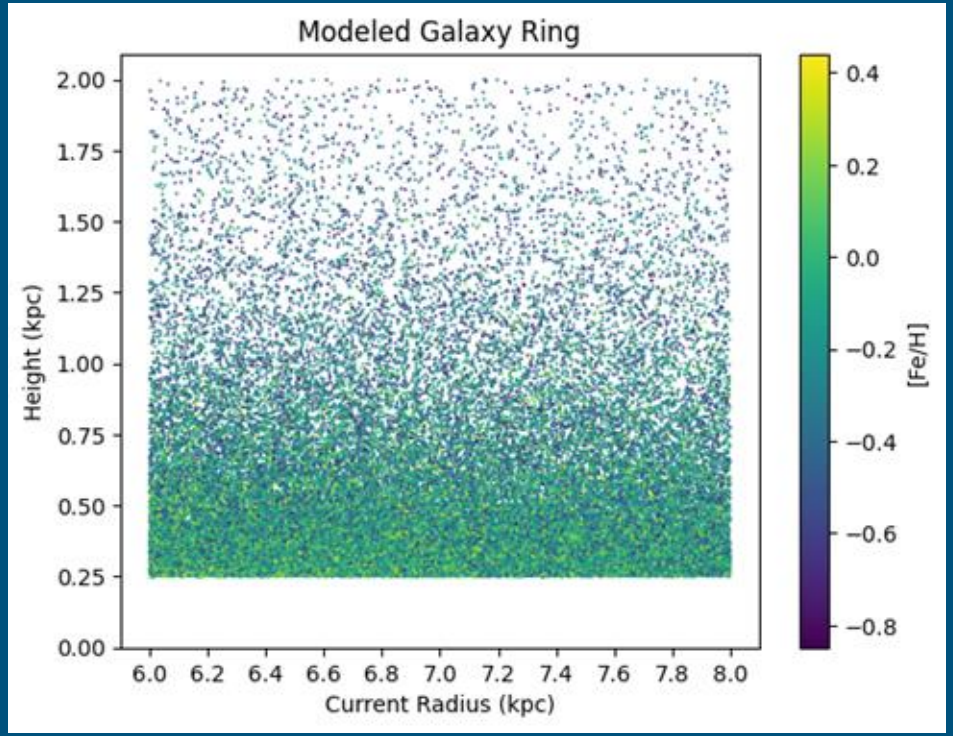

From Mcquillan et al., 2014
Red star is the Sun

# Potential Solution: Metal Content

- Models predict that metal-rich stars spin down more effectively than metal-poor stars
- Stars create metals through nuclear fusion near the end of their lives
- Created metals enrich gas clouds that birth new stars
- Thus, younger stars are more metal rich and thus have spun down much more than older stars

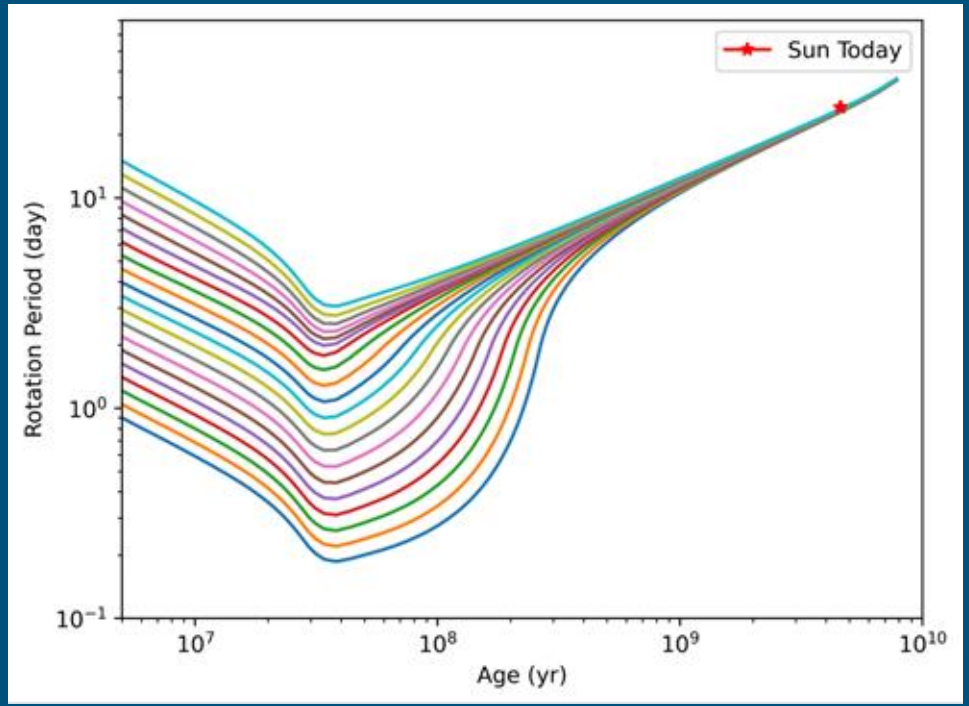
# Kepler Field

- Observed by the Kepler Space Telescope
- Radius of 6 - 8 kpc from galactic center
- Height of +/- (0.25 - 2) kpc from galactic plane
- Negative heights included to have more data



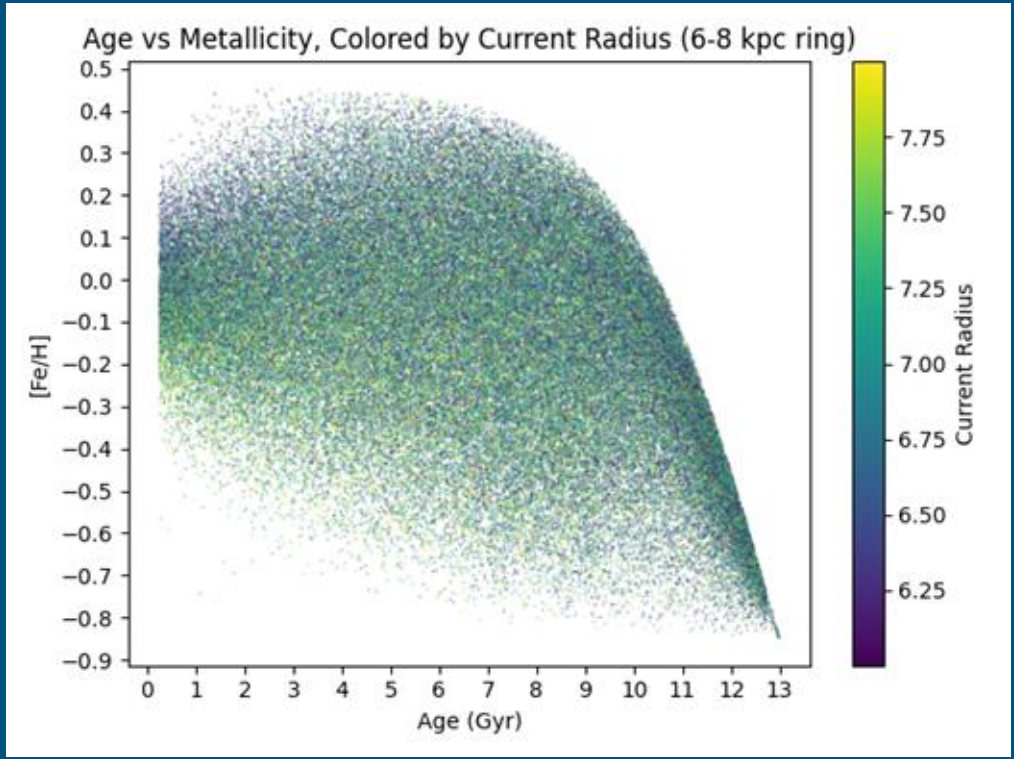
# Stellar Evolution Model: Dizzystars

- Shows how stars evolve over time at specific points
- Only seven metallicity values and a set of ages and **rotation periods** for each metallicity



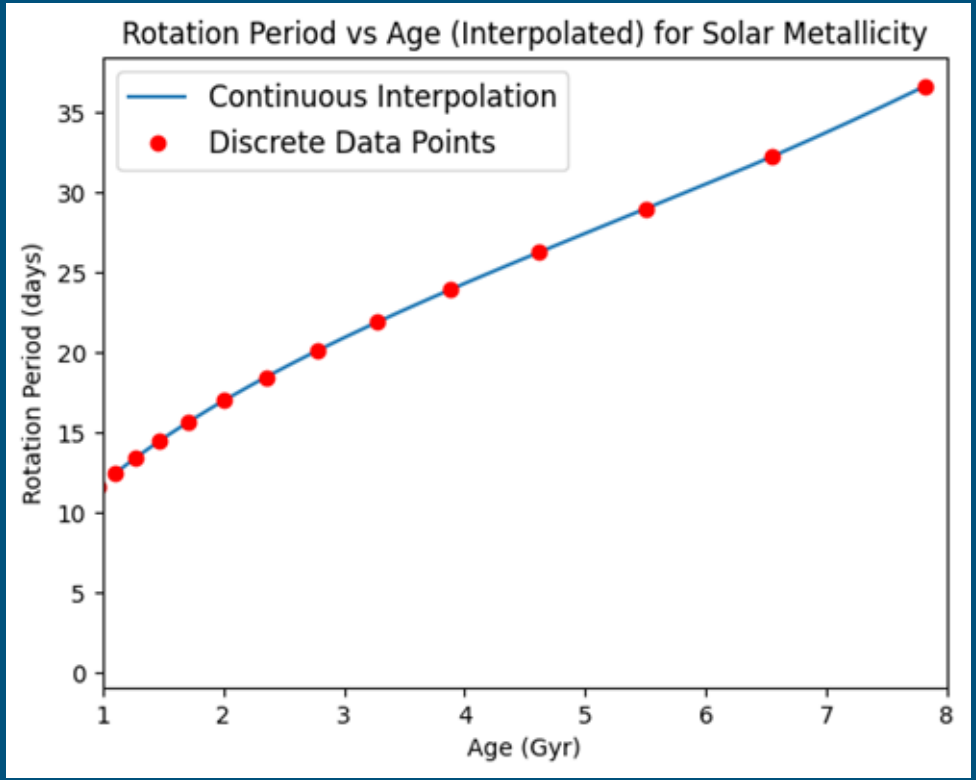
# Galactic Model

- Model of the Milky Way provided by Dr. Hayden
- Contains 1 million stars
- Includes important information like ages and metallicities
- **Did not include rotation periods**



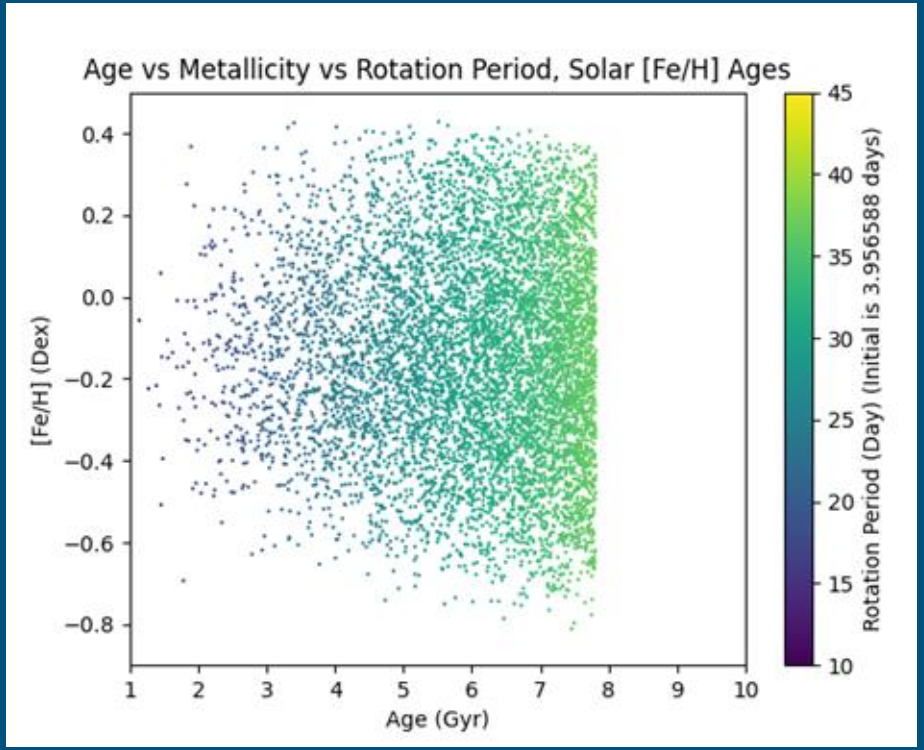
# Interpolation

- Draws lines between discrete data points
- Calculates rotation periods for the galactic model based on dizzystars



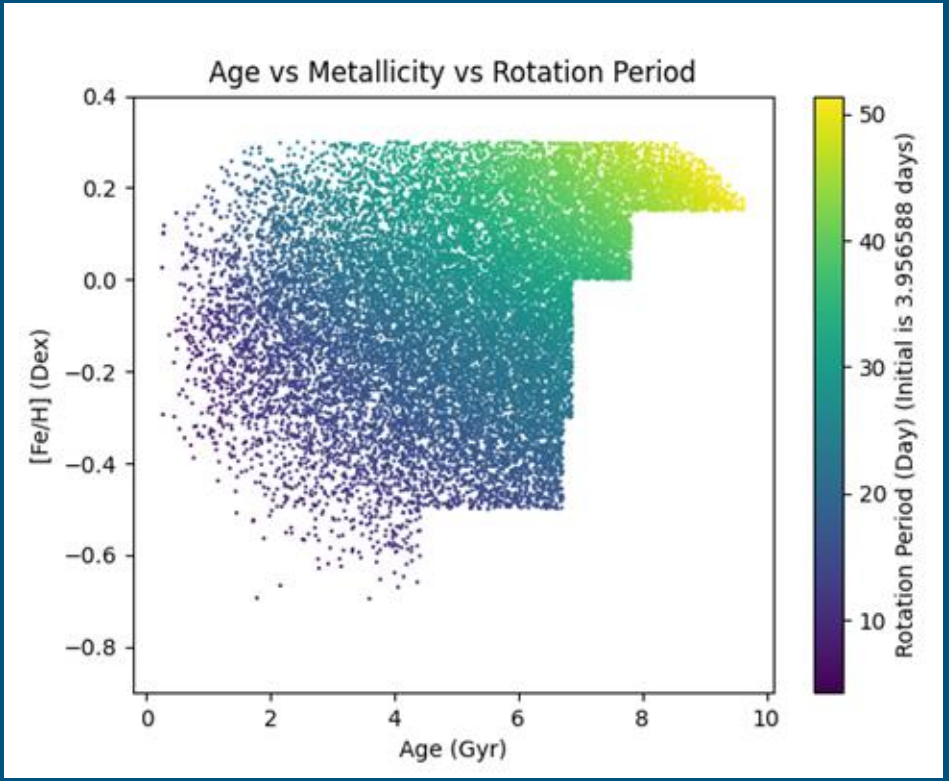
# Age Interpolation

- Interpolates between dizzystars ages for each metallicity to estimate galactic model rotation periods
- Solar metallicity serves as an excellent control case

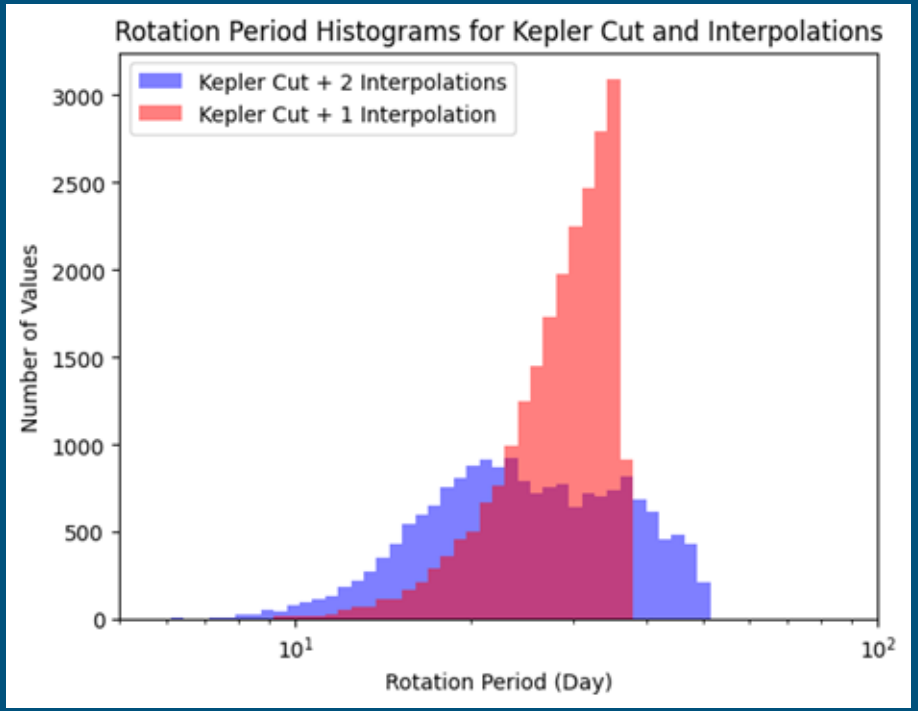


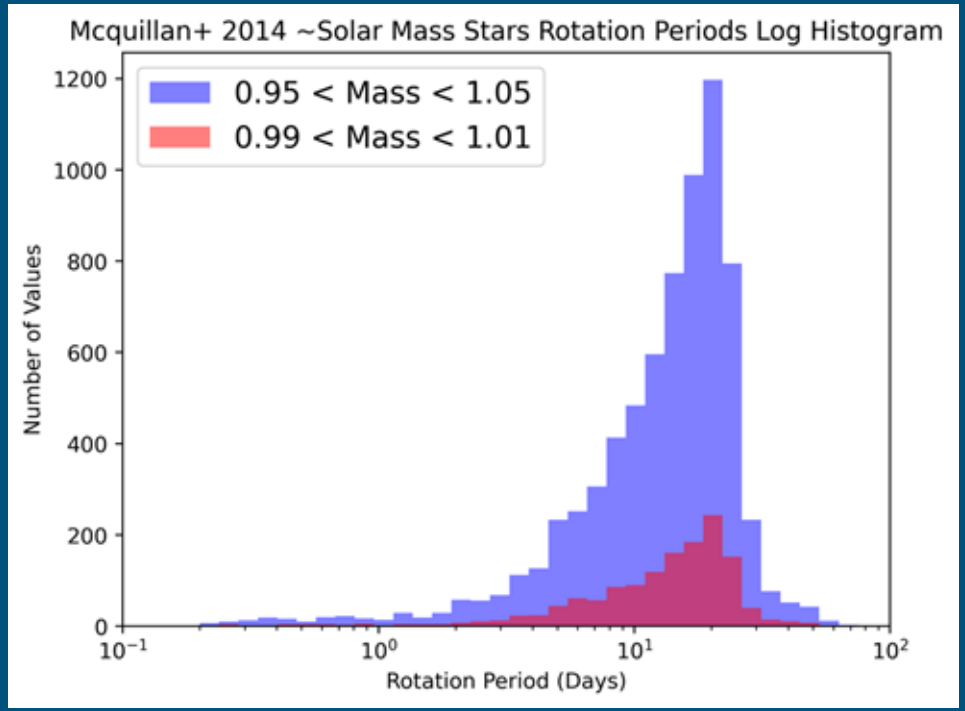
# Metallicity Interpolation

- Takes the 7 results from the first interpolation in age and interpolates again in metallicity
- Final rotation period estimates based on metallicity effects



# Model Data vs Observed Data



# Possible Strategies Going Forward

- Refine the Kepler Cut
- Analyze lower mass stars to see if dead stars are affecting the pattern
- Look at other areas of the galaxy
- Maybe the hypothesis about metallicity affecting rotation periods was incorrect

# Questions?