Magnetic Inflation and Stellar Mass of M dwarf stars

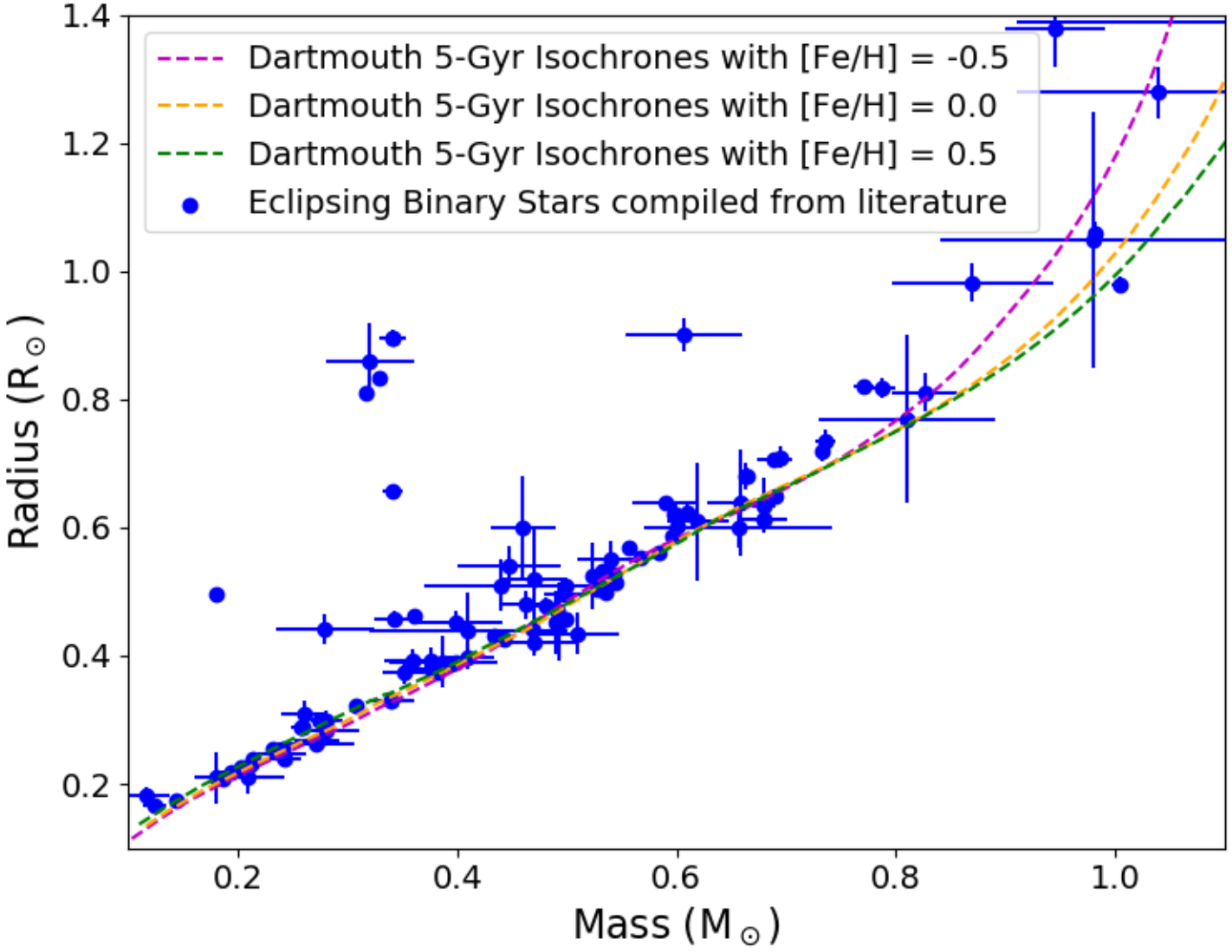
Eunkyu Han
Boston University

Collaborators:
Philip S. Muirhead, Jonathan J. Swift, Christoph Baranec, Nicholas M. Law, Reed Riddle, Dani Atkinson, Gregory N. Mace, Daniel DeFelippis

Credits: NASA/JPL-Caltech/Tim Pyle

Supported by NASA XRP

Empirical measurements of EBs have large scatter



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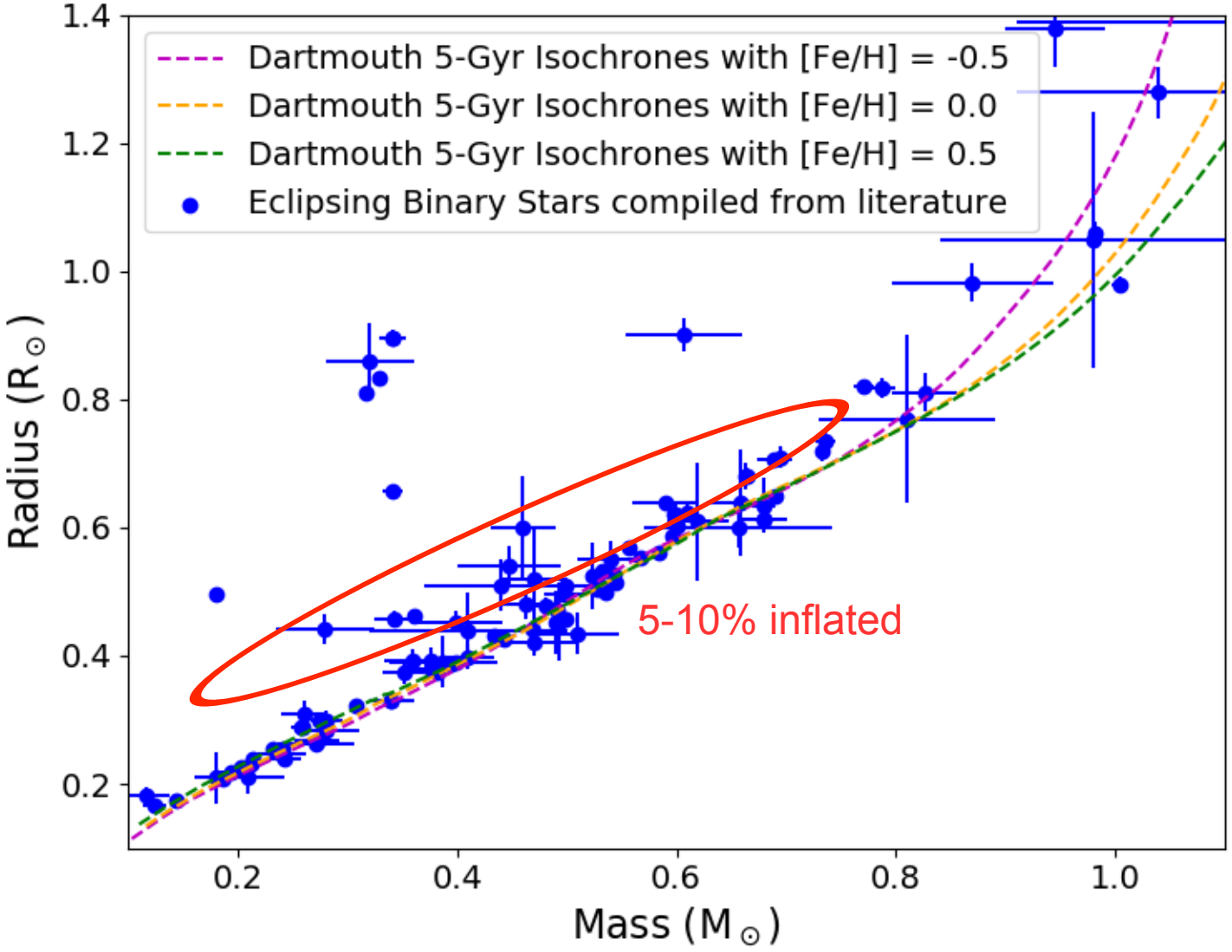

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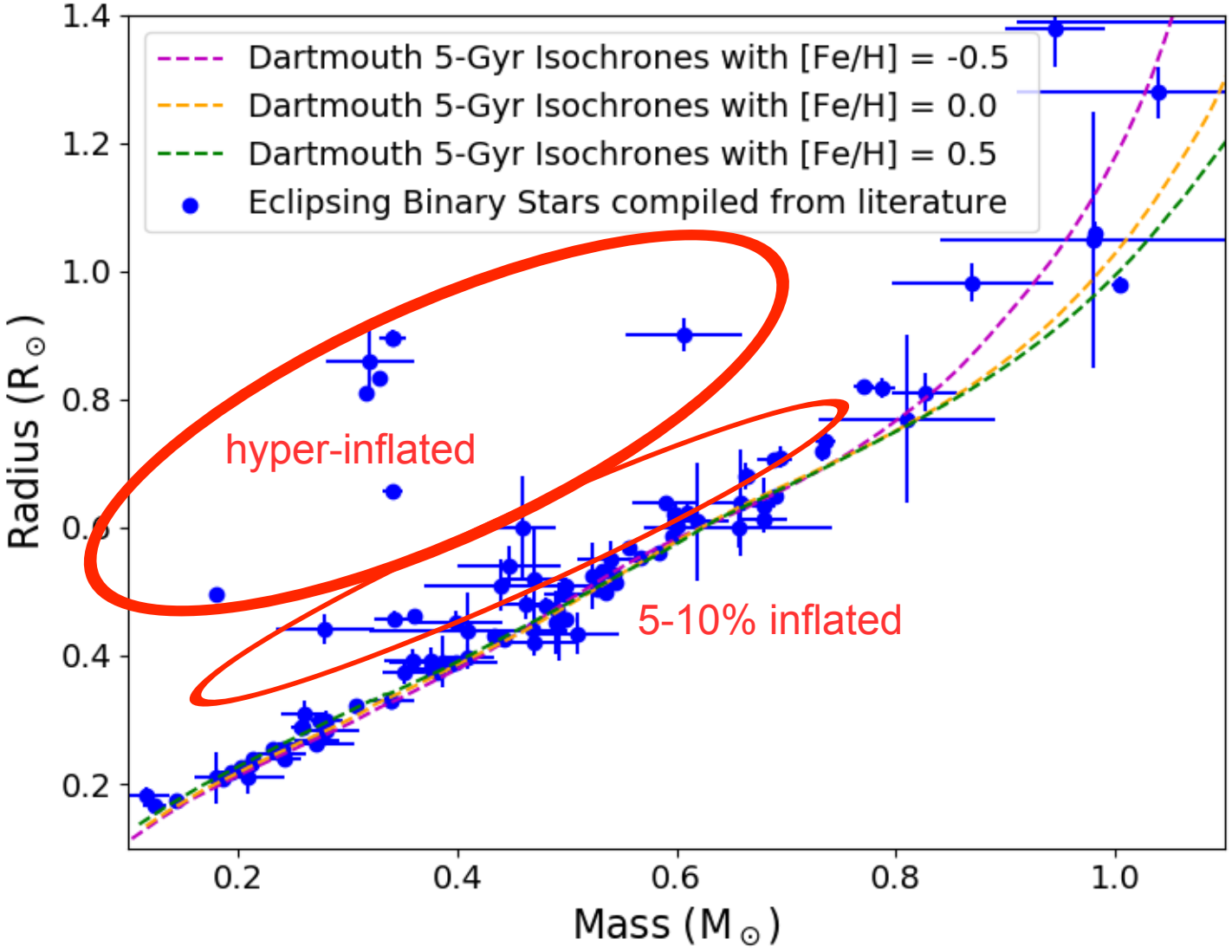
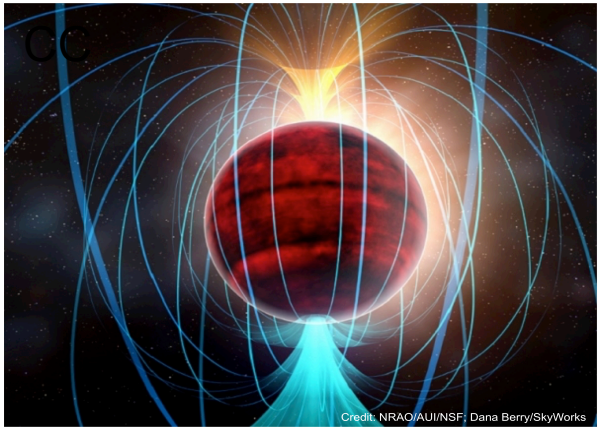


Strong magnetic fields can lead to an increase in the radius of a low-mass star

1. Through the inhibition of the convective heat transfer



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Gough & Tayler 1965

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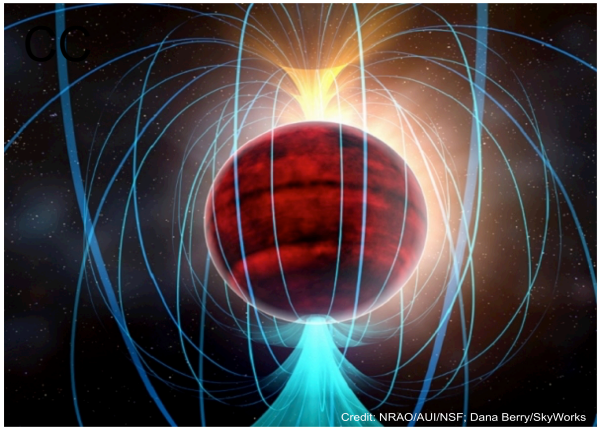

$$\nabla > \nabla_{ad} + \delta \qquad \text{where} \qquad \nabla = \frac{\partial \log T}{\partial \log P}$$

$$\delta = \frac{B_v^2}{B_v^2 + 4\pi\gamma P_{gas}}$$

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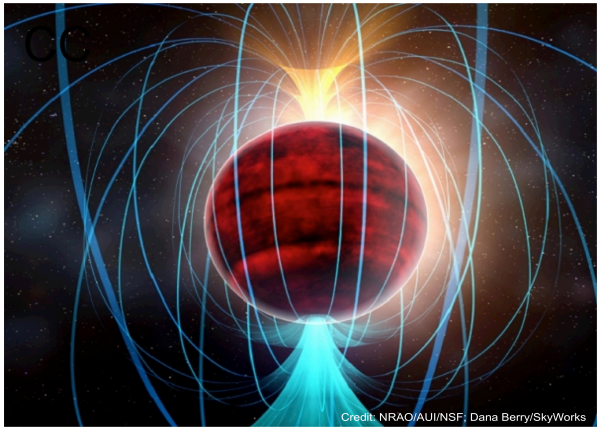

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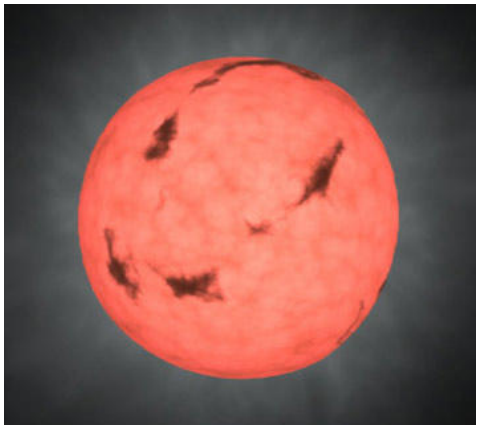
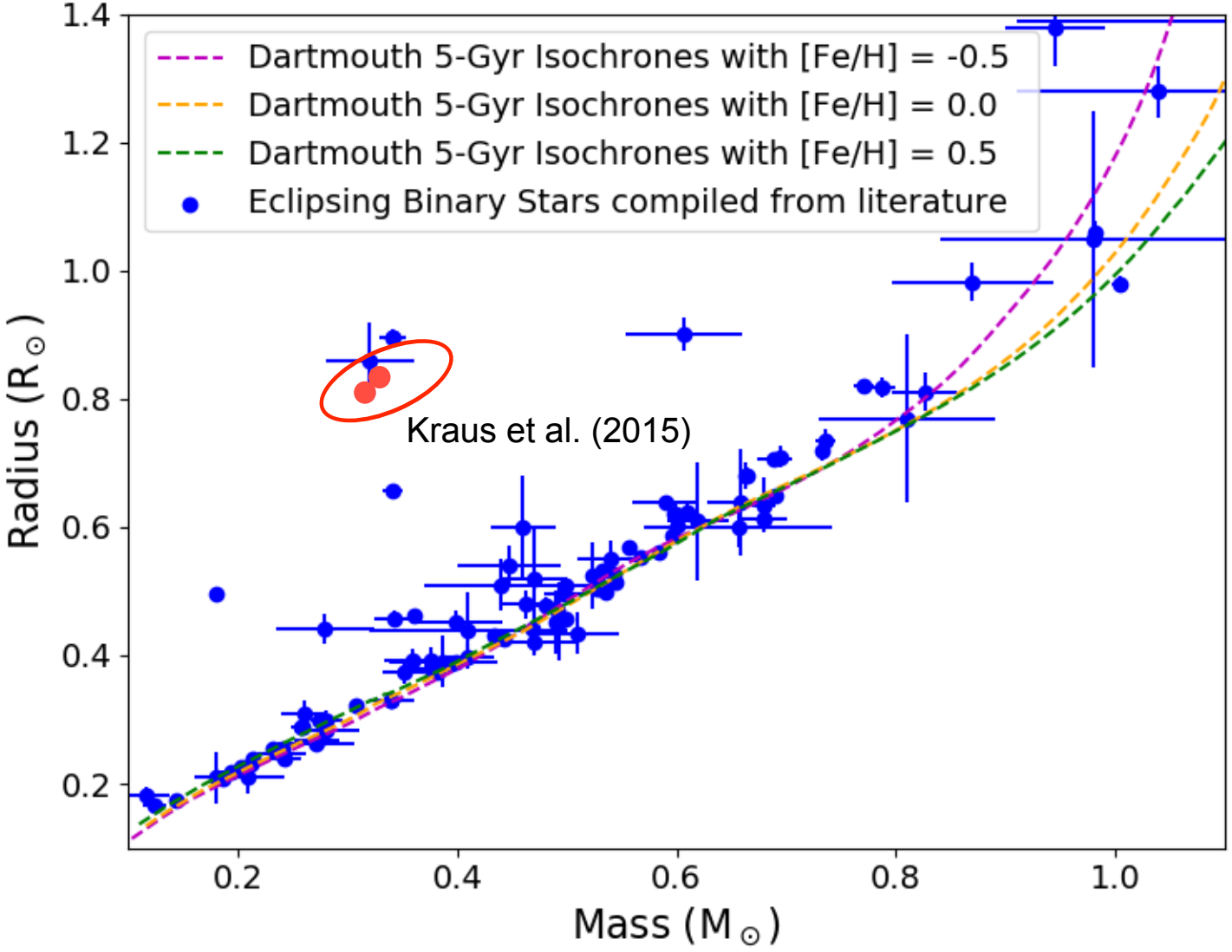
2. Through the the generation of dark spots on the stellar surface



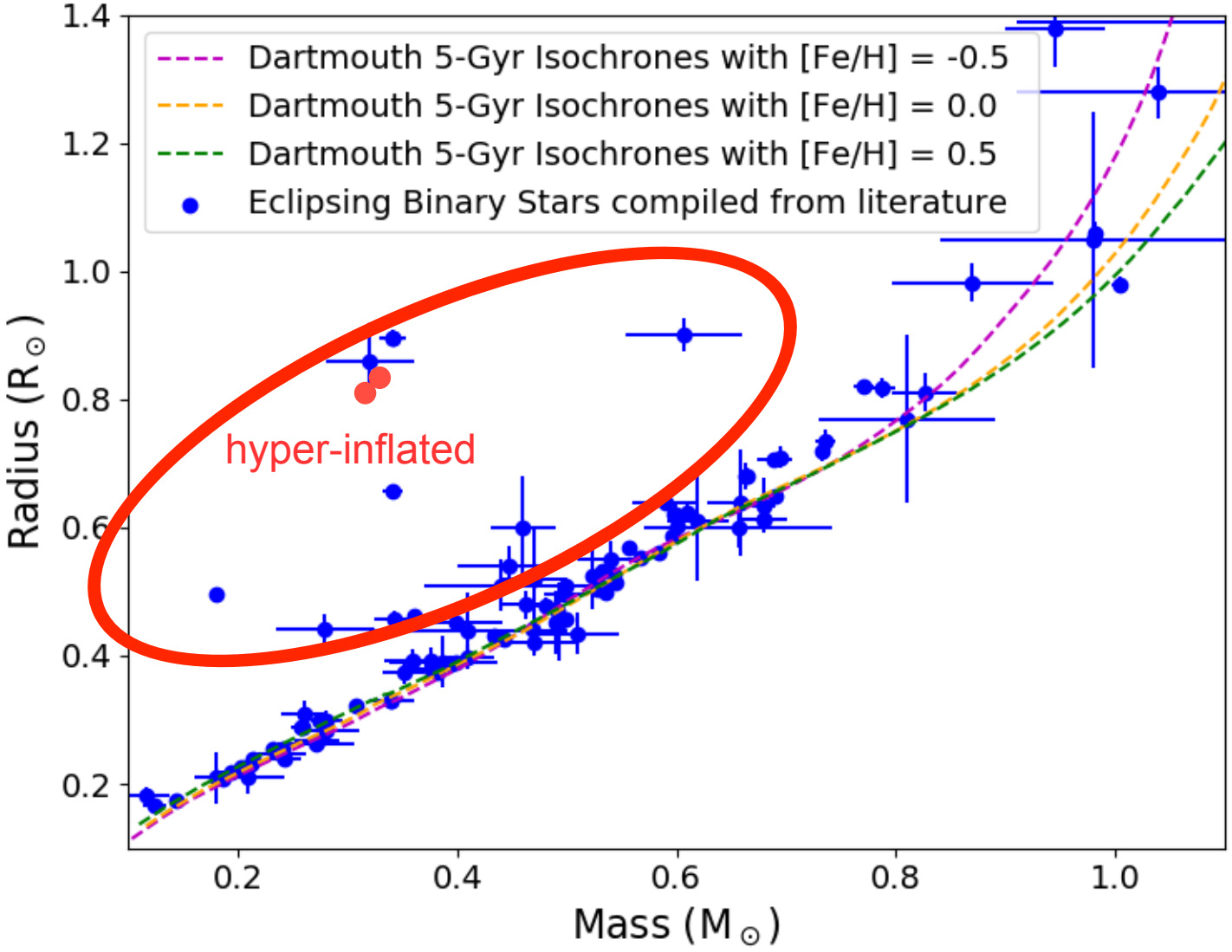
$$L = 4\pi R^2 \sigma \left[(1 - f_s) T_{star}^4 + f_s T_{spot}^4 \right]$$

$$f_s = fractional\ spot\ coverage$$

Young EBs and their inflated radii

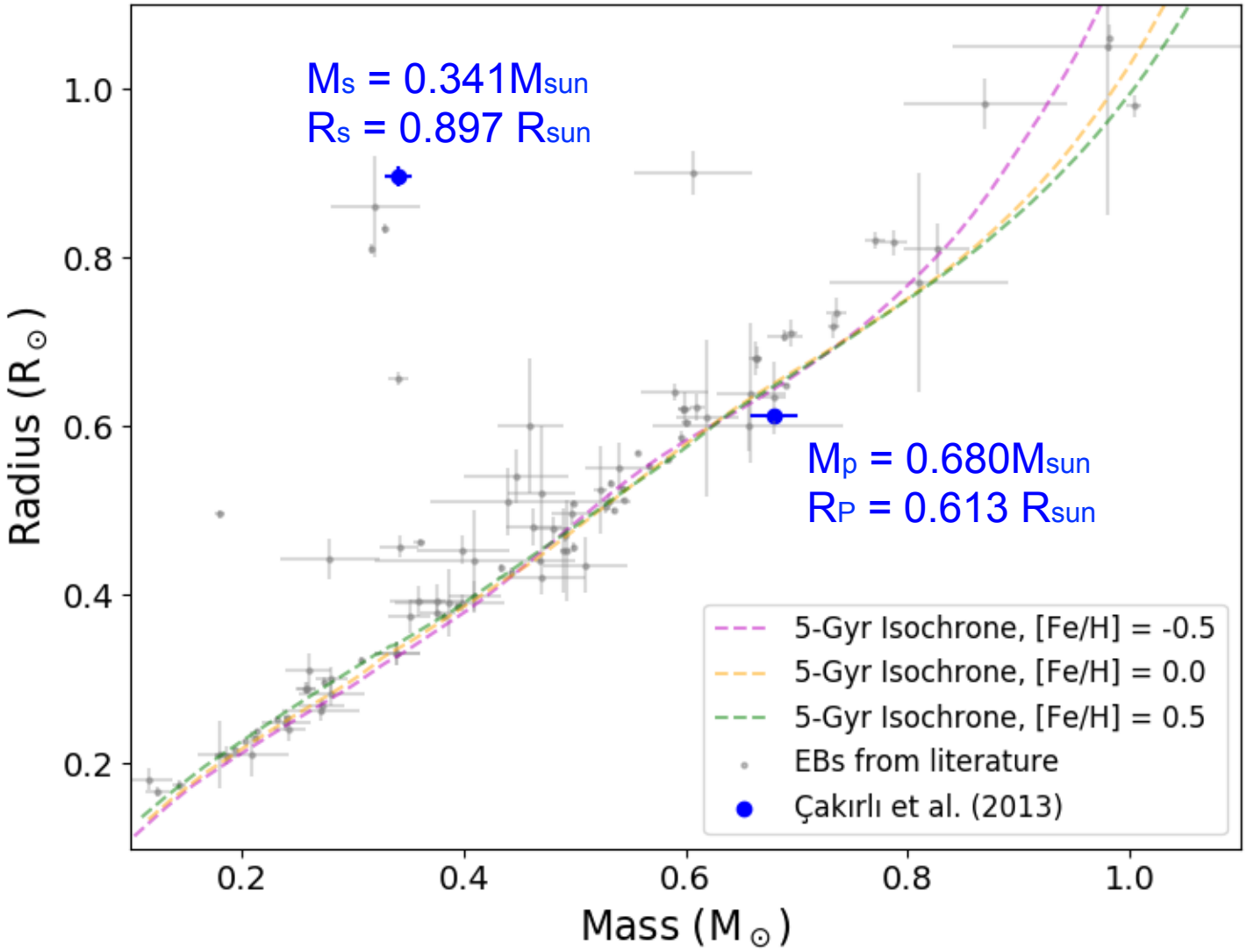


Are the hyper inflated M dwarfs real?



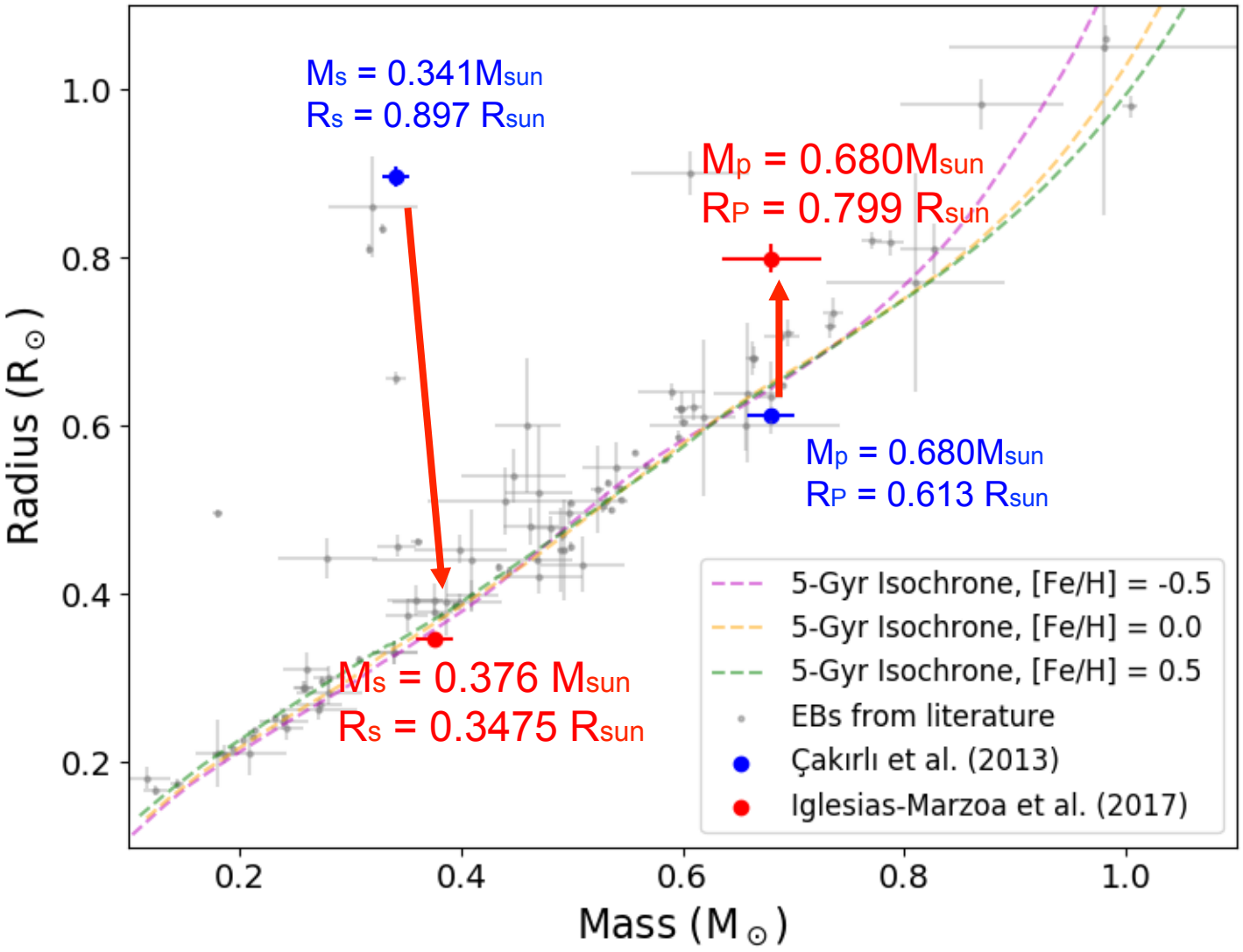
Case study I: KIC 10935310

From Cakirli et al. (2013)



Case study I: KIC 10935310

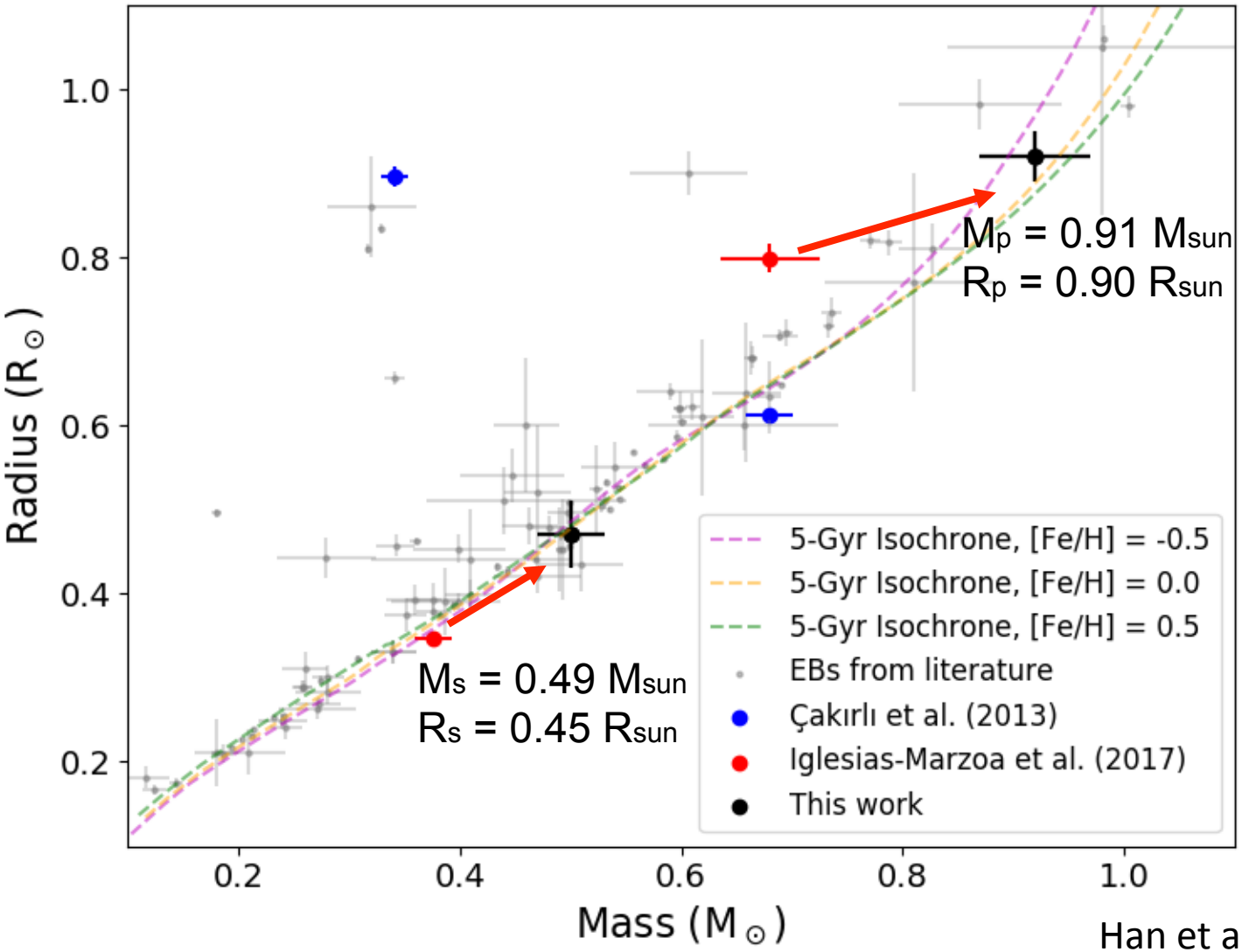
From Iglesias et al. (2017)



Case study I: KIC 10935310

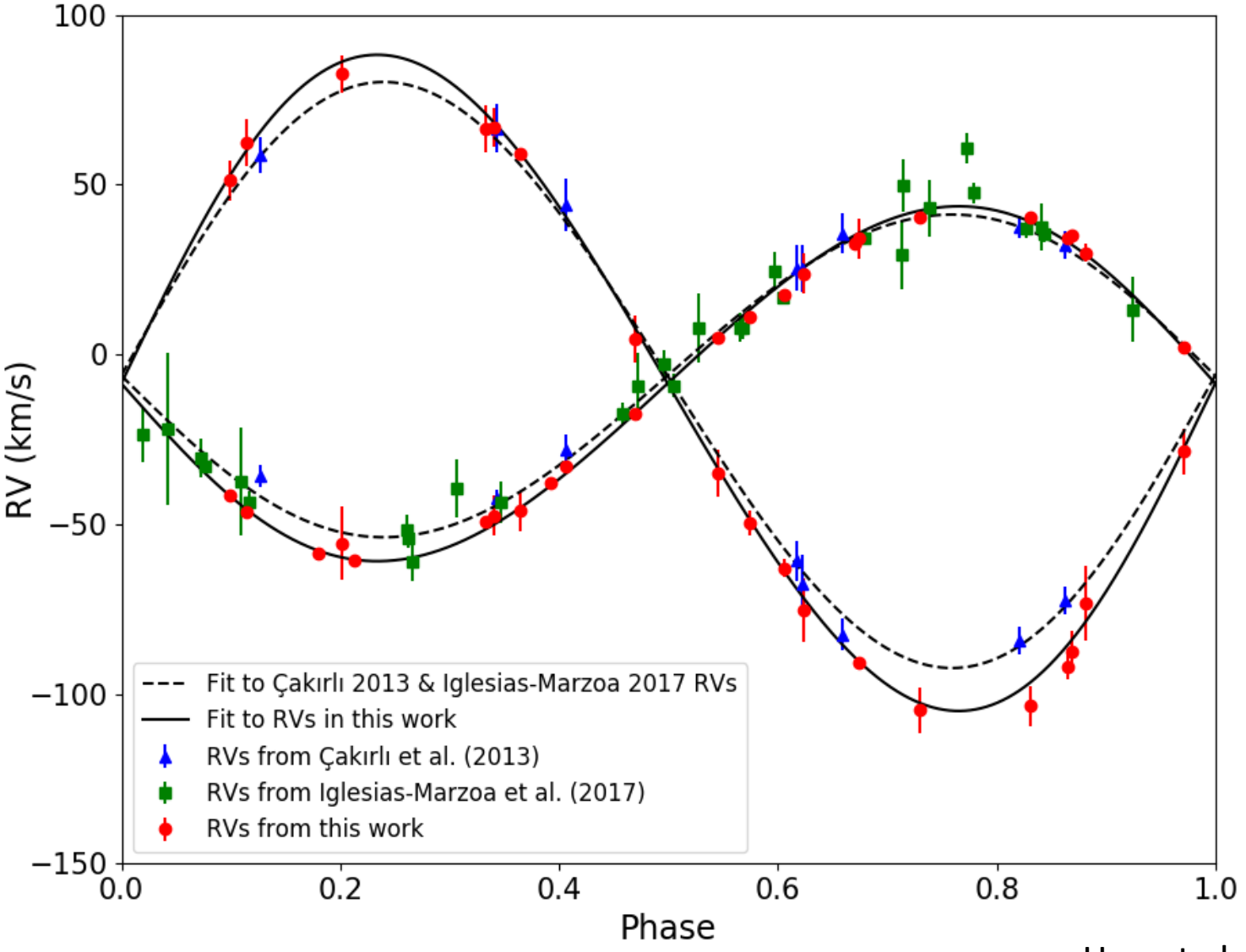
From Han et al. (2017)

Neither of the components are inflated



Han et al. (2017)

High-resolution near-infrared SB2 spectroscopy is the key



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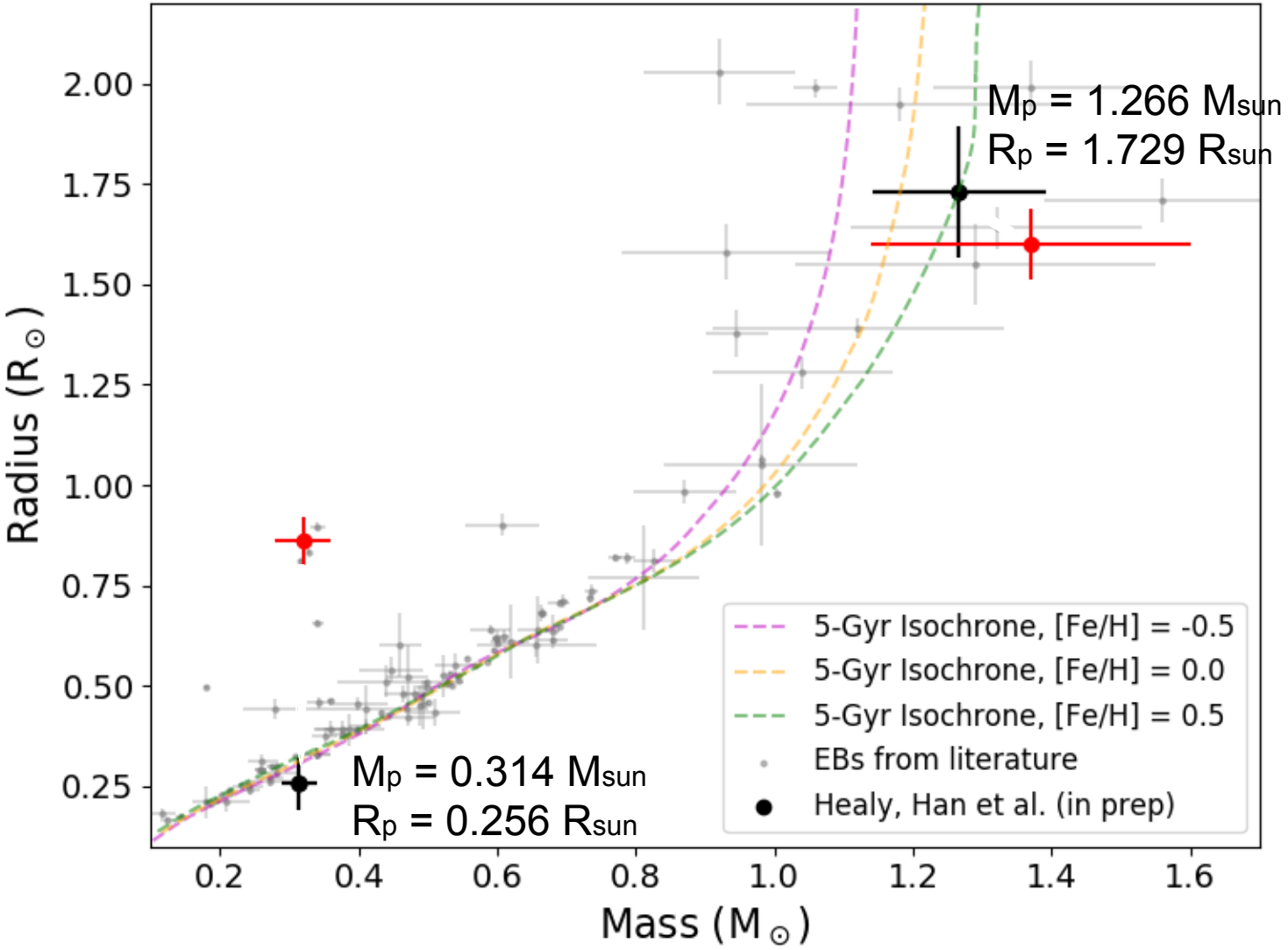
Case study II: T-Lyr0-08070



Healy, Han et al. (in prep)

Conclusion

1. Magnetic hyper inflation of M dwarfs may not be real
   → Neither of KIC 10935310's components are inflated (Han et al. 2017)
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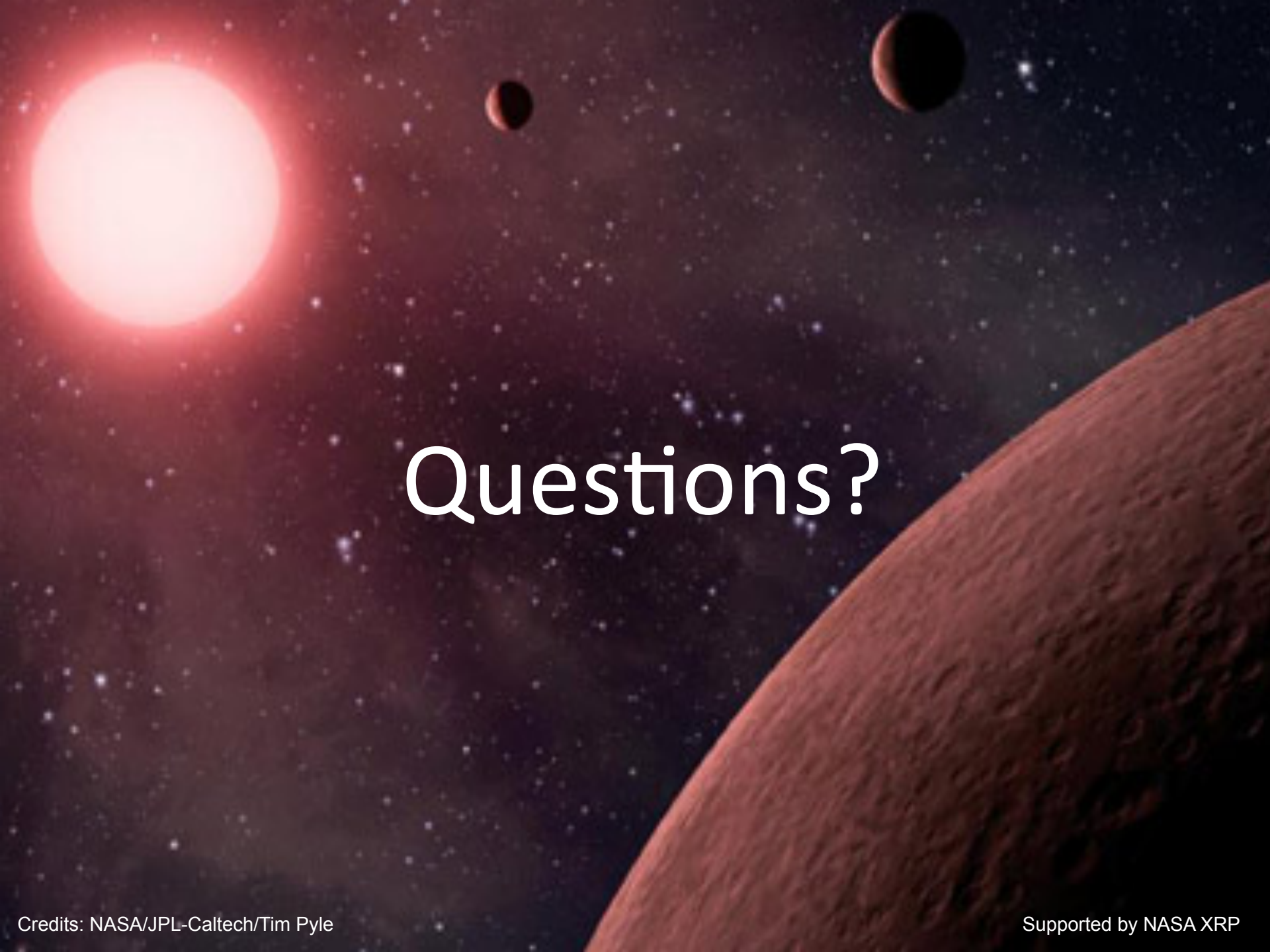
3. Care must be taken when analyzing EB data



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