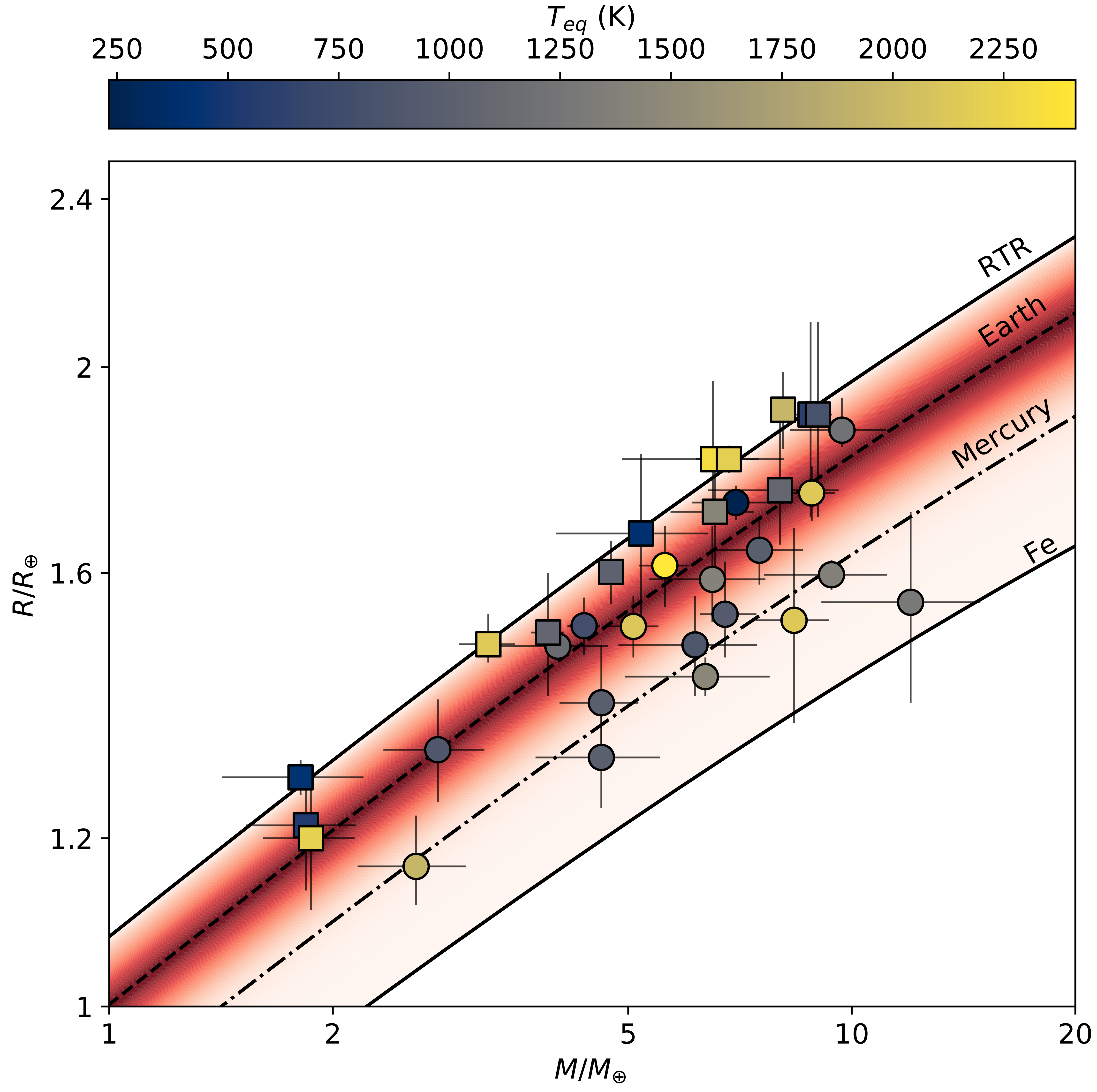
Chemical Fingerprints of formation in Rocky Super-Earths' Data

Mykhaylo Plotnykov & Diana Valencia

Aug 27, 2020 — KITP: Exostar Redux

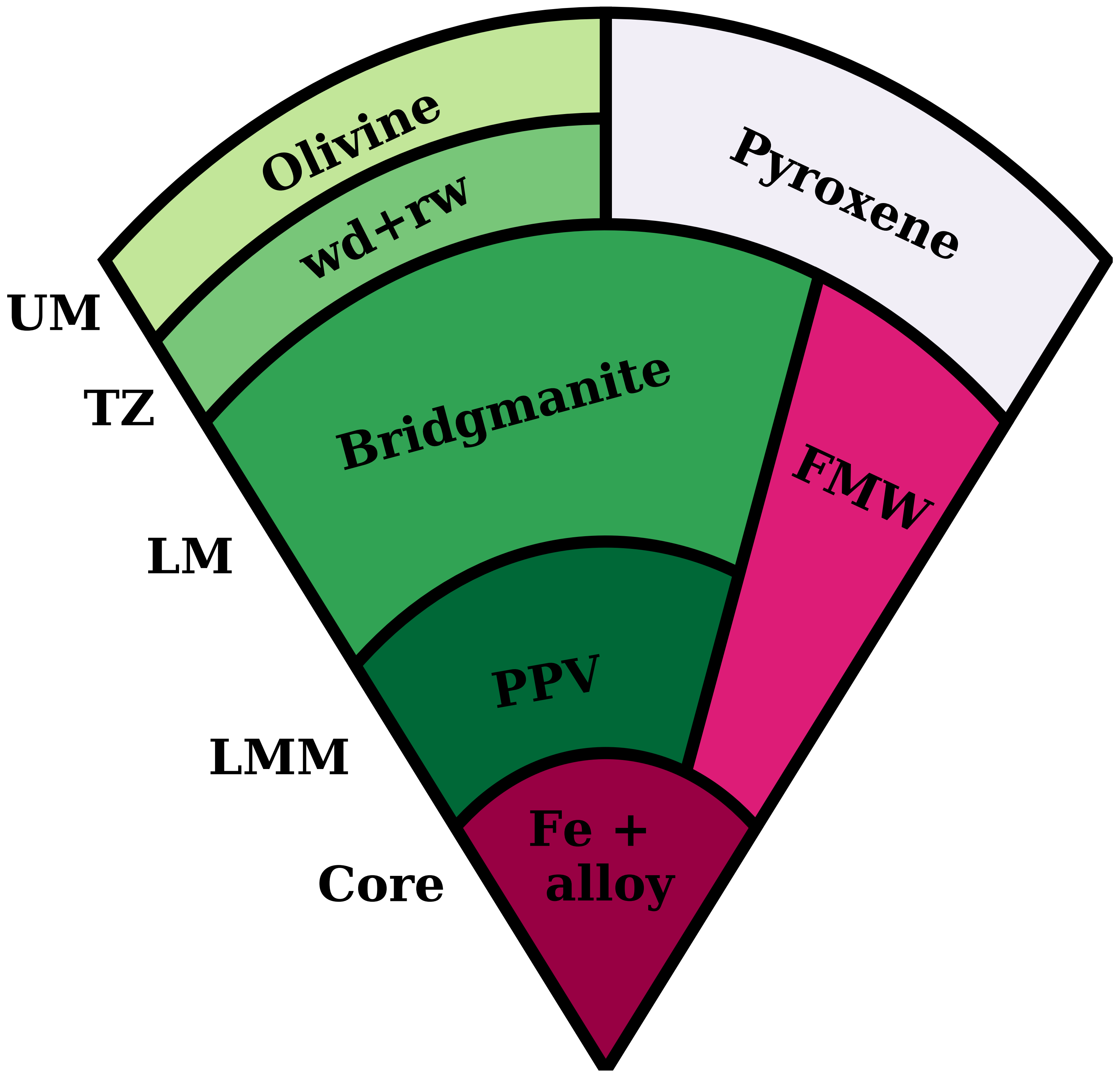
Super-Earth Sample



Model

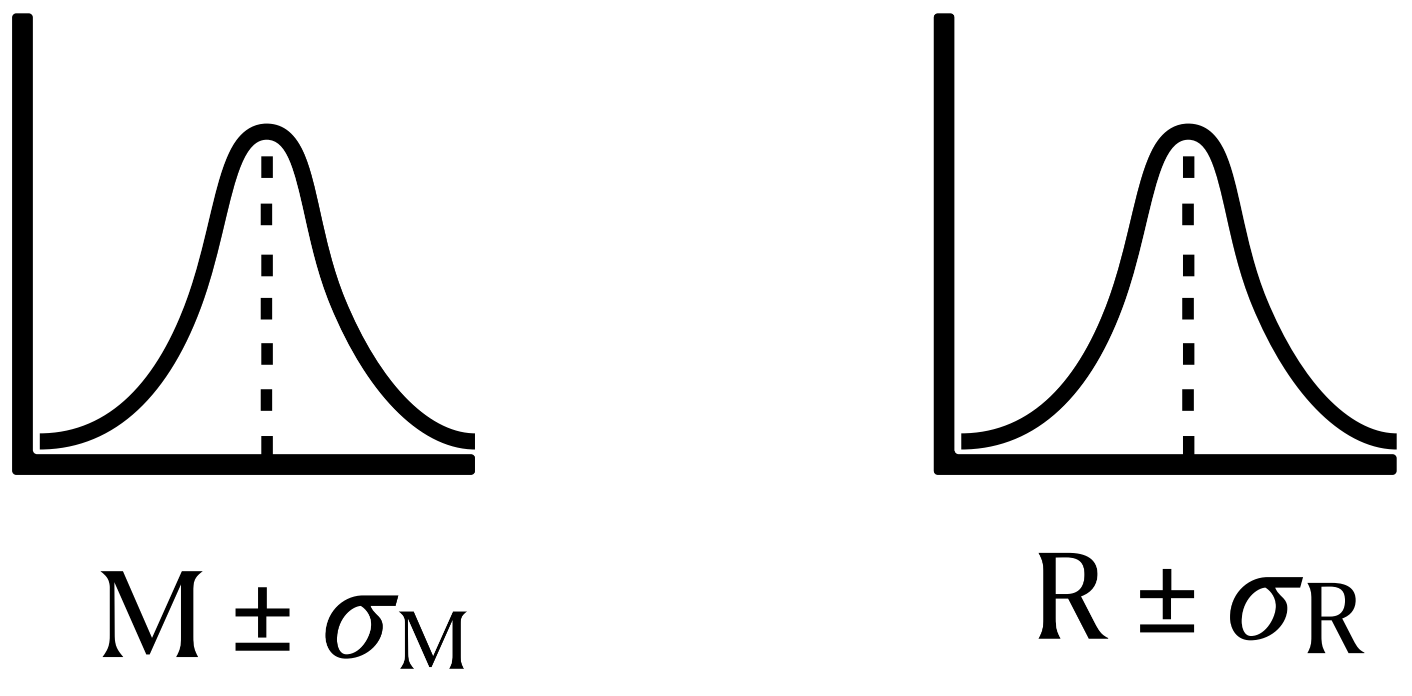
Internal Structure Model

$R = R\ (M;\ cmf,\ x_{Fe},\ x_{Si})$



+

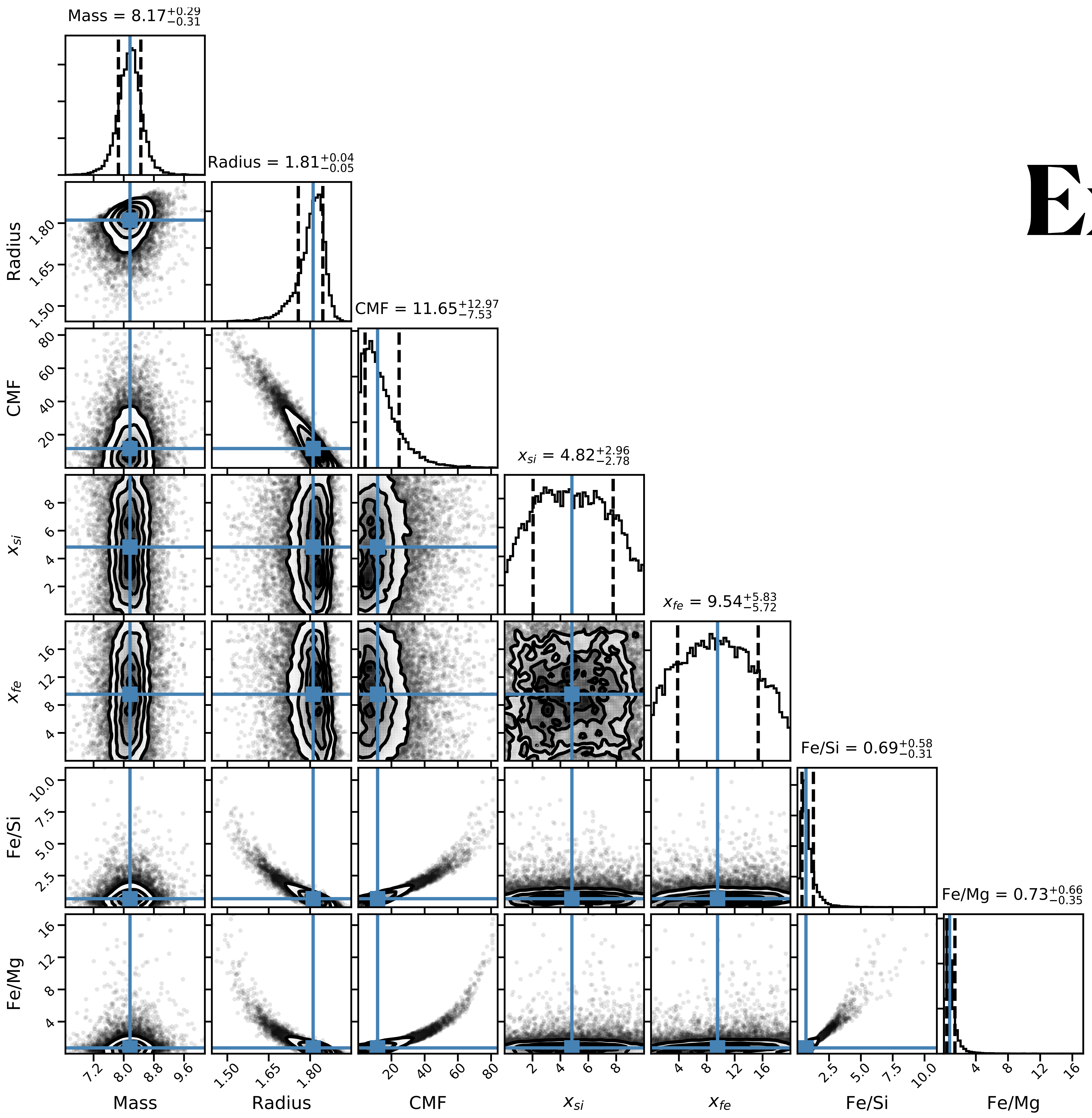
With MCMC



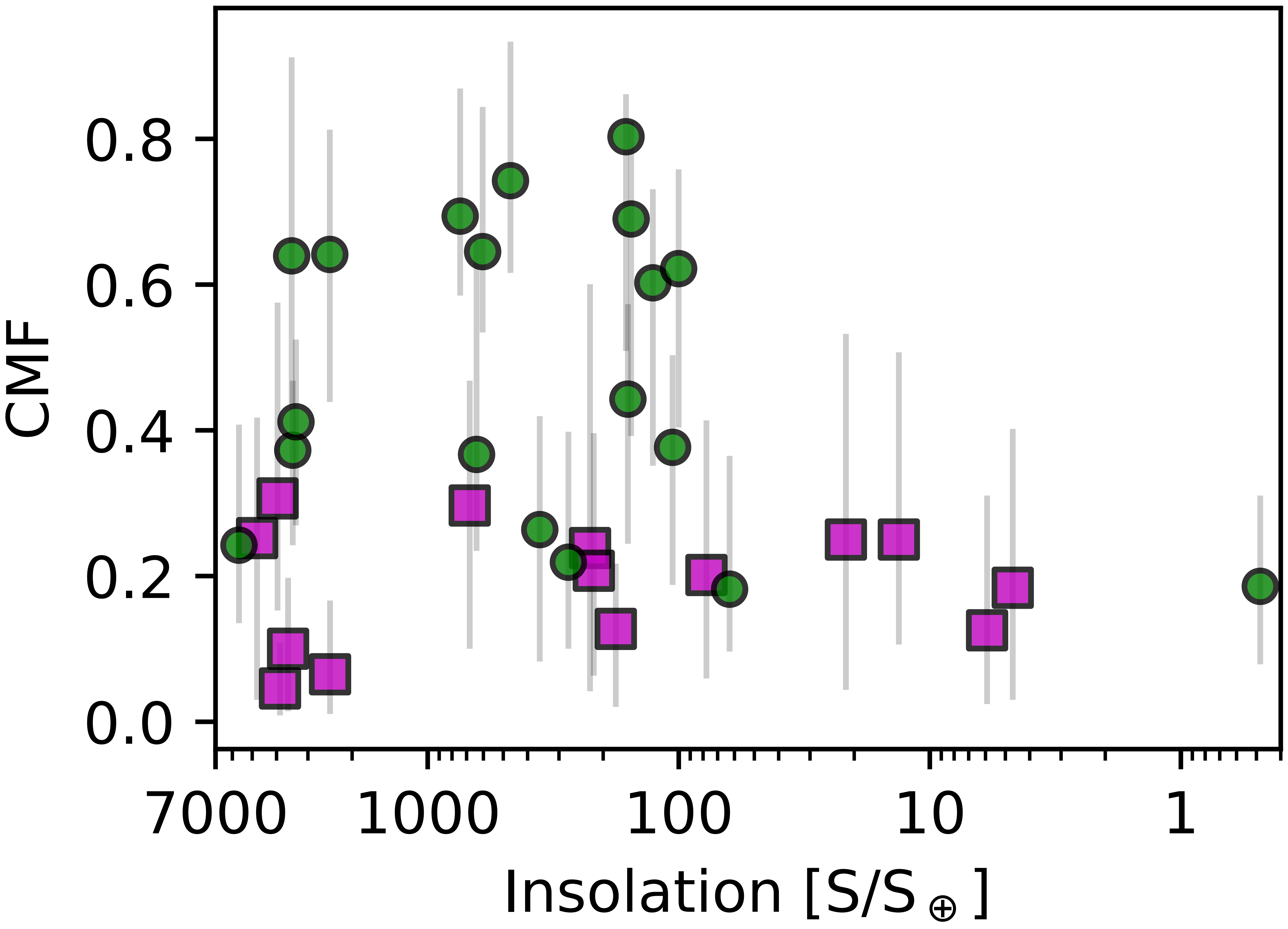
Obtain: cmf, x_{Fe}, x_{Si} with errors

Derived: Fe/Si, Fe/Mg

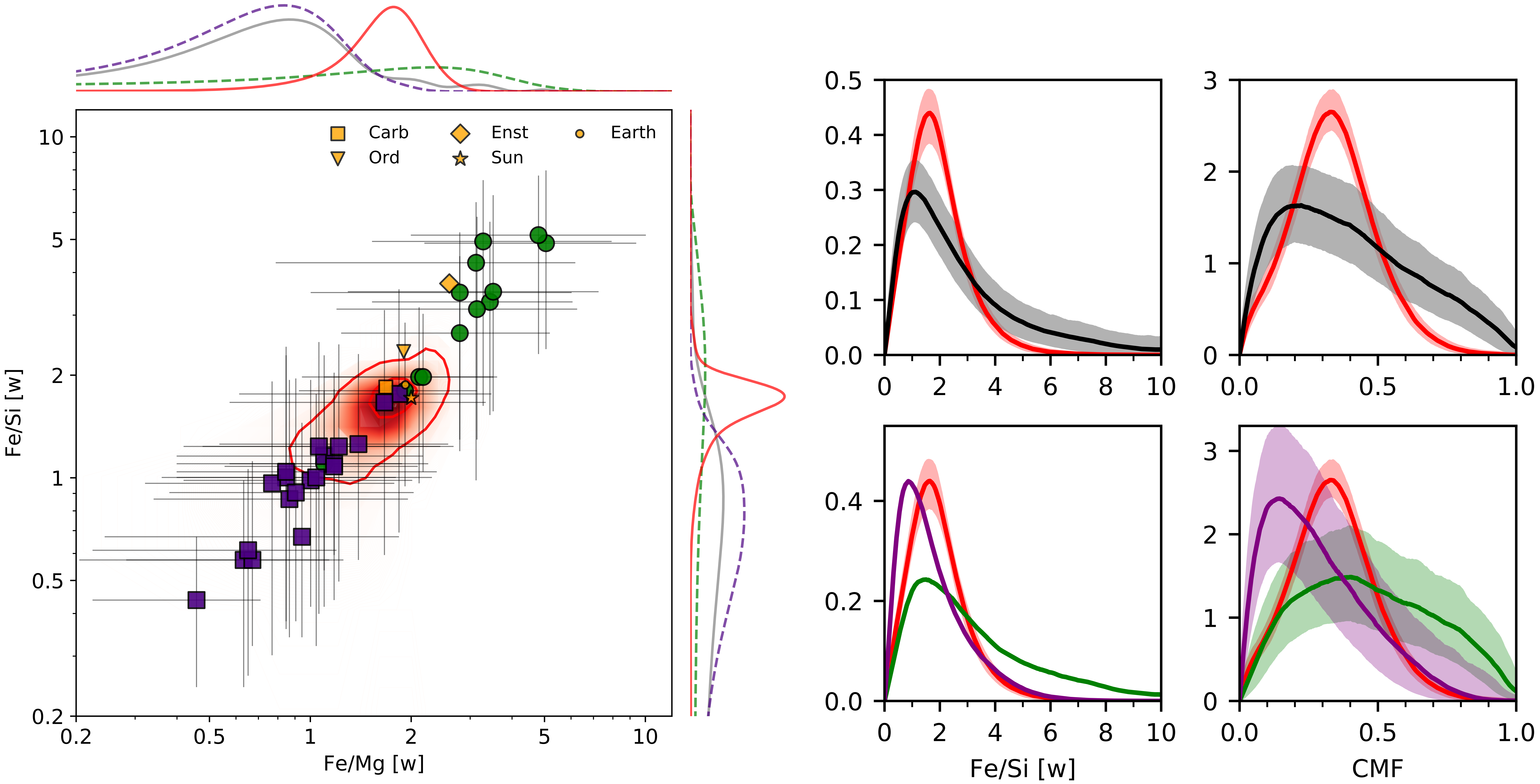
Results
Example 55 Cnc-e



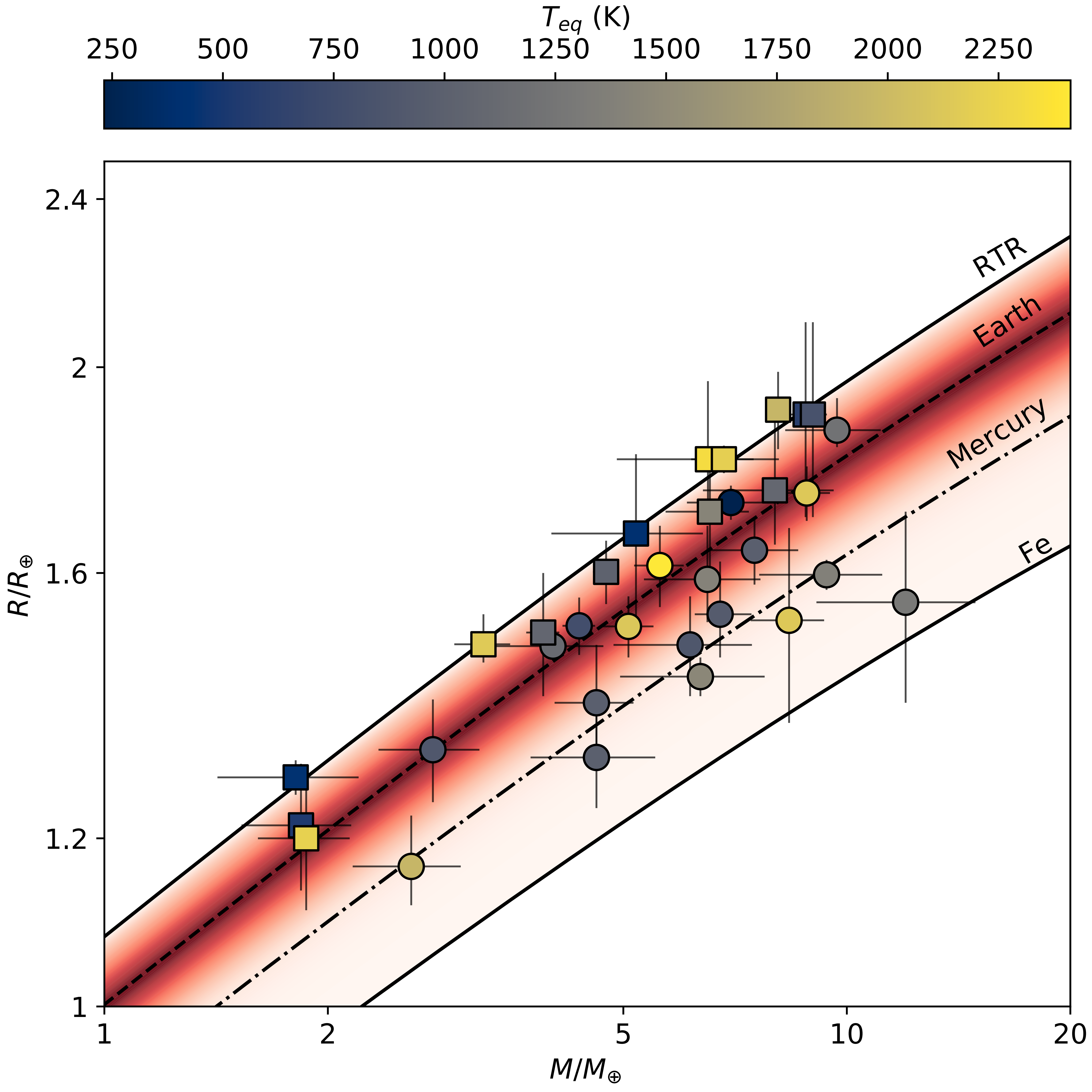
Trend of Core-Mass Fraction with Insolation



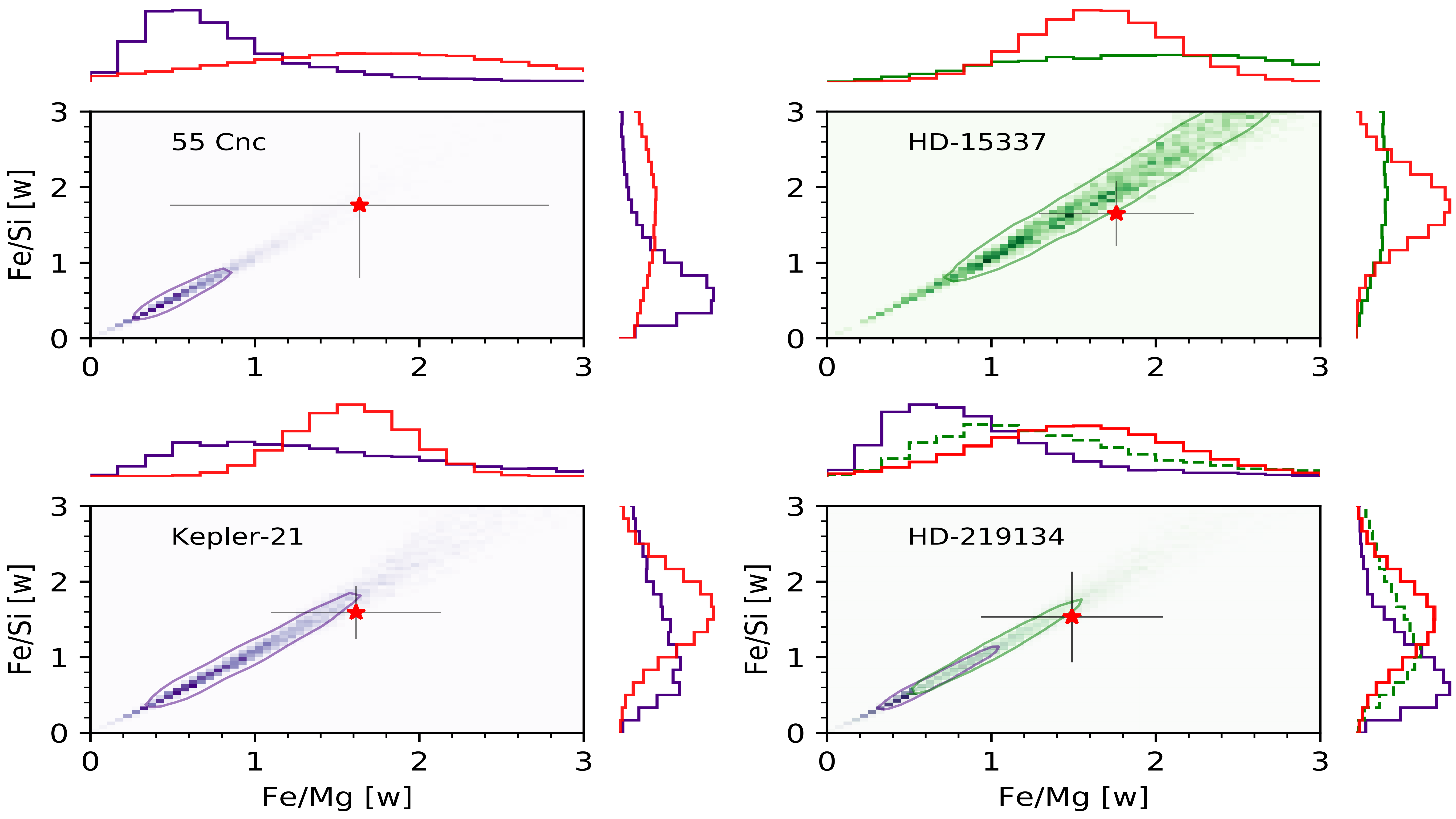
Star-Planet Chemical Comparison

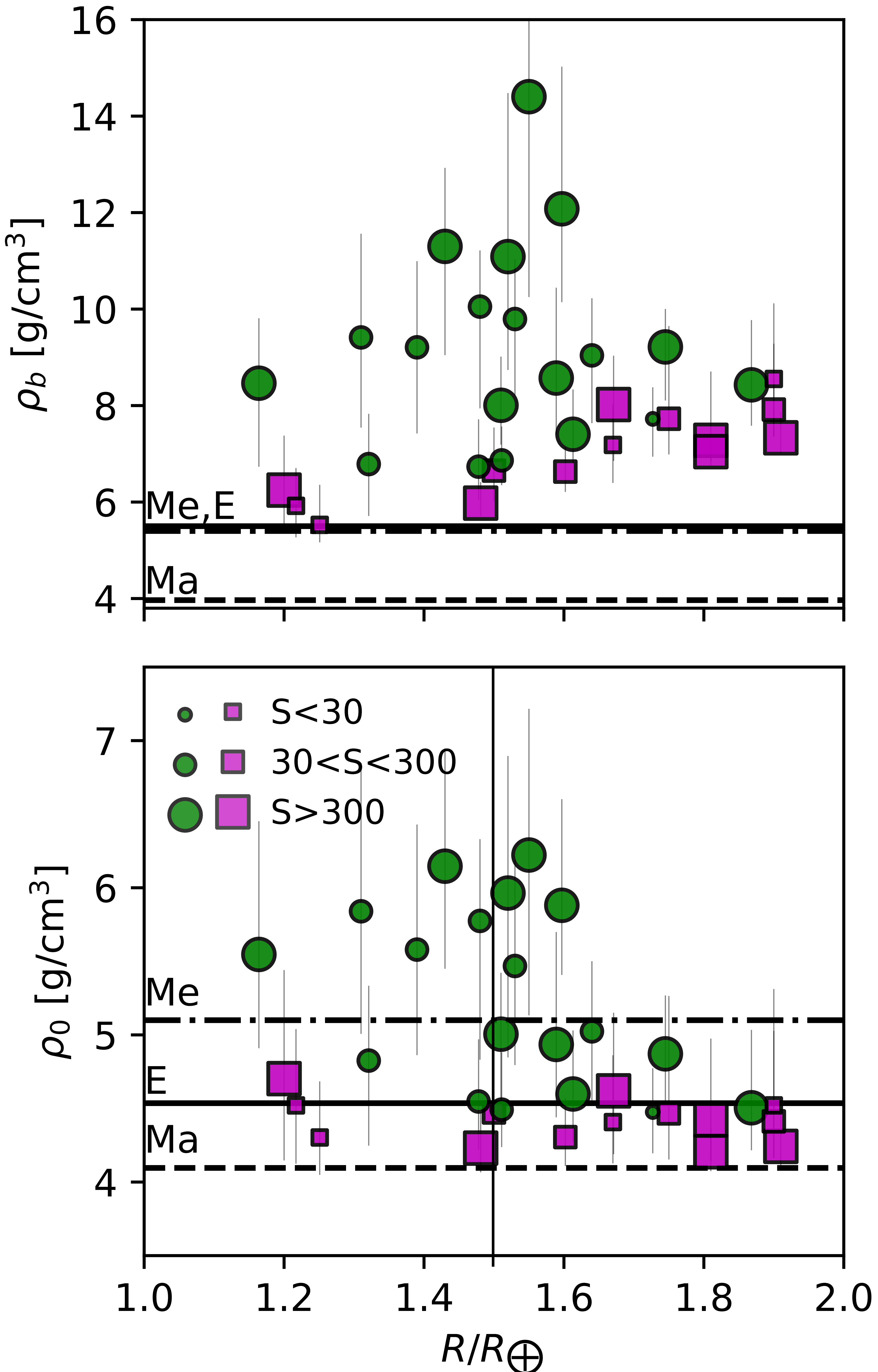


Super-Earth Sample



One-to-One Comparison





Uncompressed Density

Observations biased towards high uncompressed density for a **given** radius.

Lack of planets at large radius and high uncompressed density.

Maximum iron enrichment ~ 6 g/cc

Highly irradiated planets exhibit a large range of compositions. If these planets are the result of atmospheric evaporation, iron enrichment and perhaps depletion must happen before gas dispersal.

Summary

There is a larger chemical refractory spread in planets that in stars.

Many planets, if rocky, would be 2 fold depleted in iron with respect to the stars. So far, we don't have a theory to explain formation if iron-depleted planets.

When performing one-to-one comparisons, mass errors preclude us from making definite conclusions.

There seems to be an upper limit to the uncompressed density (iron enrichment) from formation of 6 g/cc

There is some indication that if atmospheric evaporation has shaped the super-Earth-Mini-Neptune population, iron-enrichment and depletion has to happen before gas dispersal