

The Chemistry of Extrasolar Planetesimals

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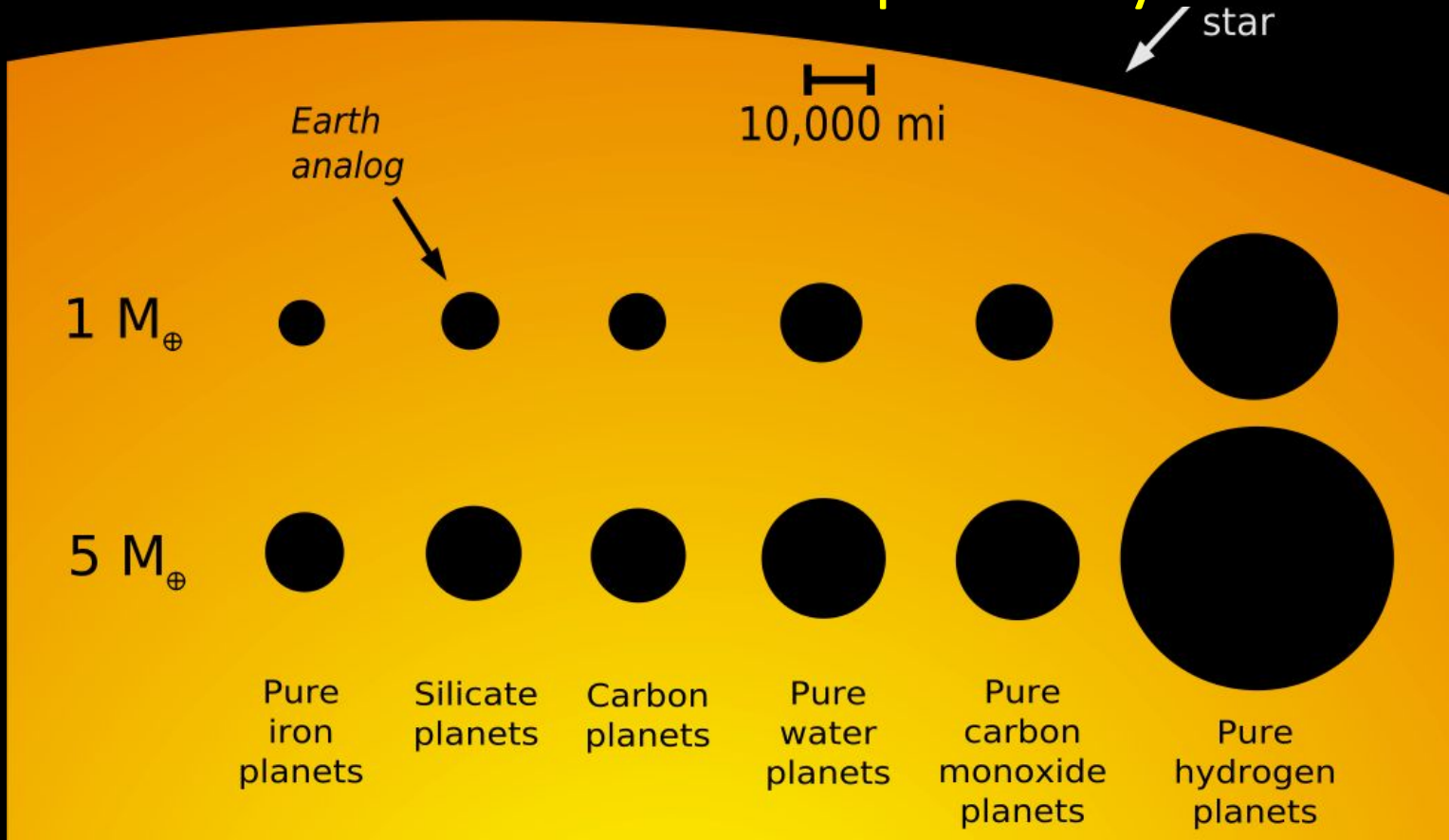
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The problem: rocky planet compositions cannot be measured at main sequence systems



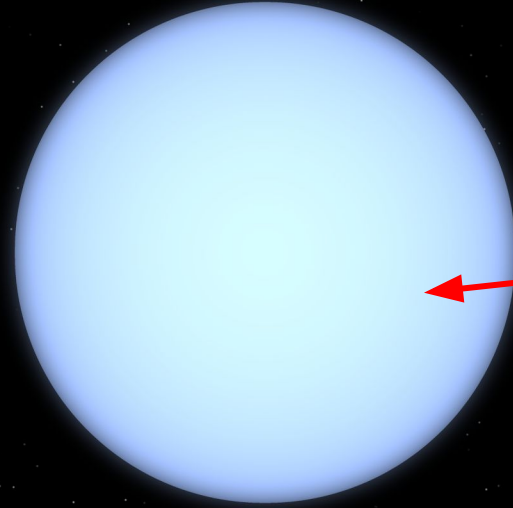
Measuring compositions in the Solar system



White dwarfs



$g=980 \text{ cm s}^{-2}$



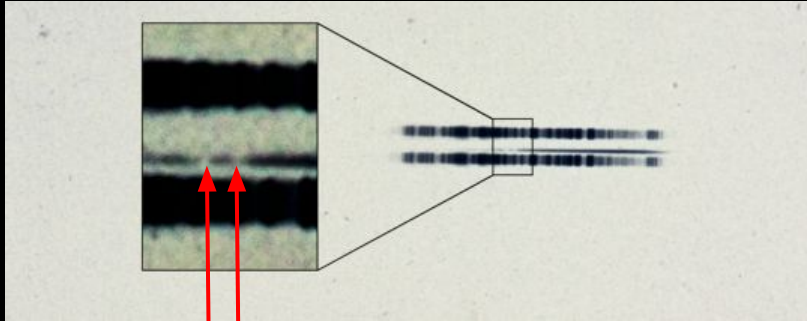
$g=10^8 \text{ cm s}^{-2}$!

$R \approx 1.1 R_{\text{Earth}}$

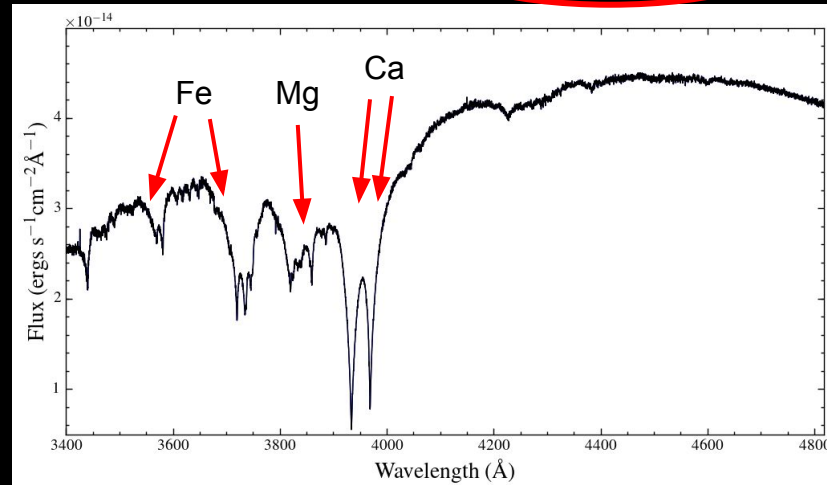
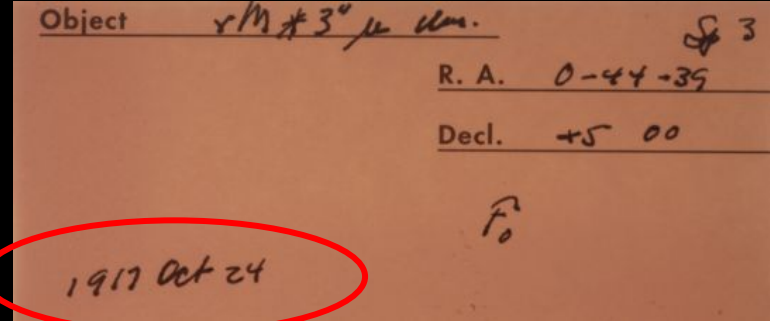
$M \approx 0.6 M_{\text{Sun}}$

Pure H/He photosphere

Van Maanen 2



Calcium lines



~30 % of white dwarfs show evidence for planetary systems

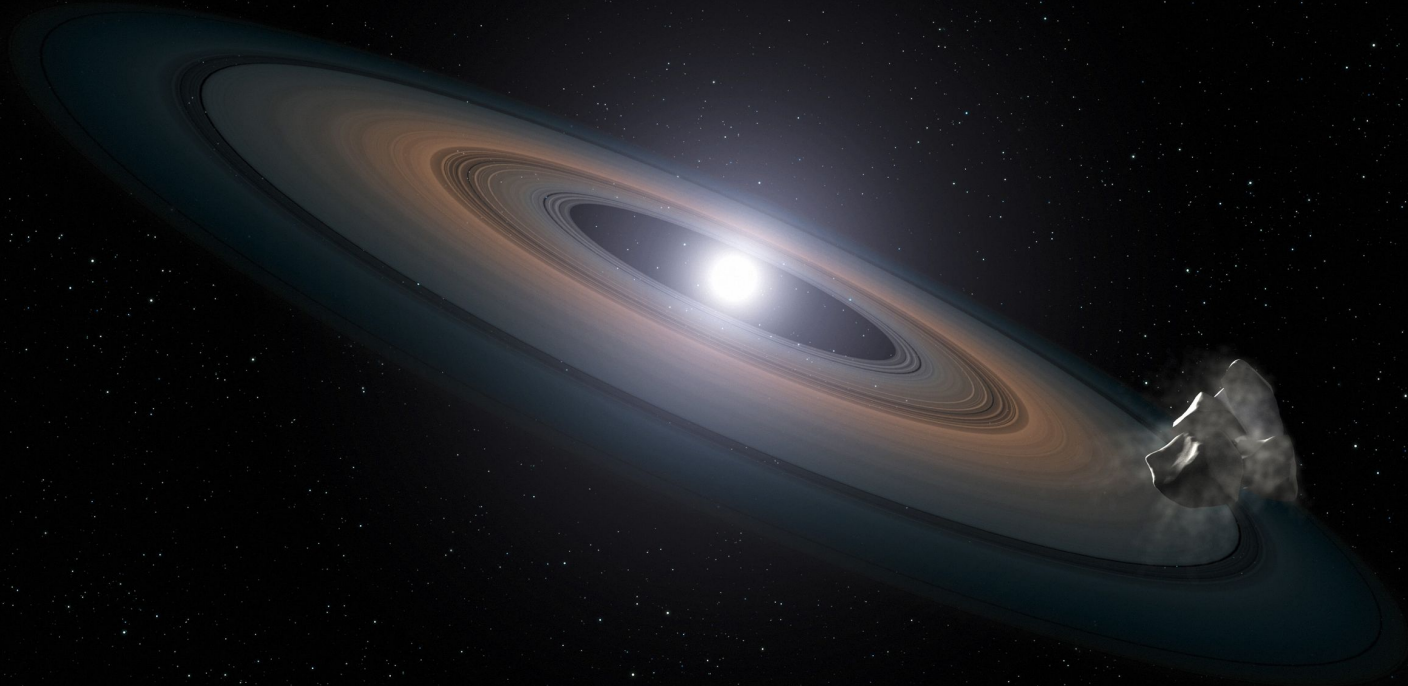
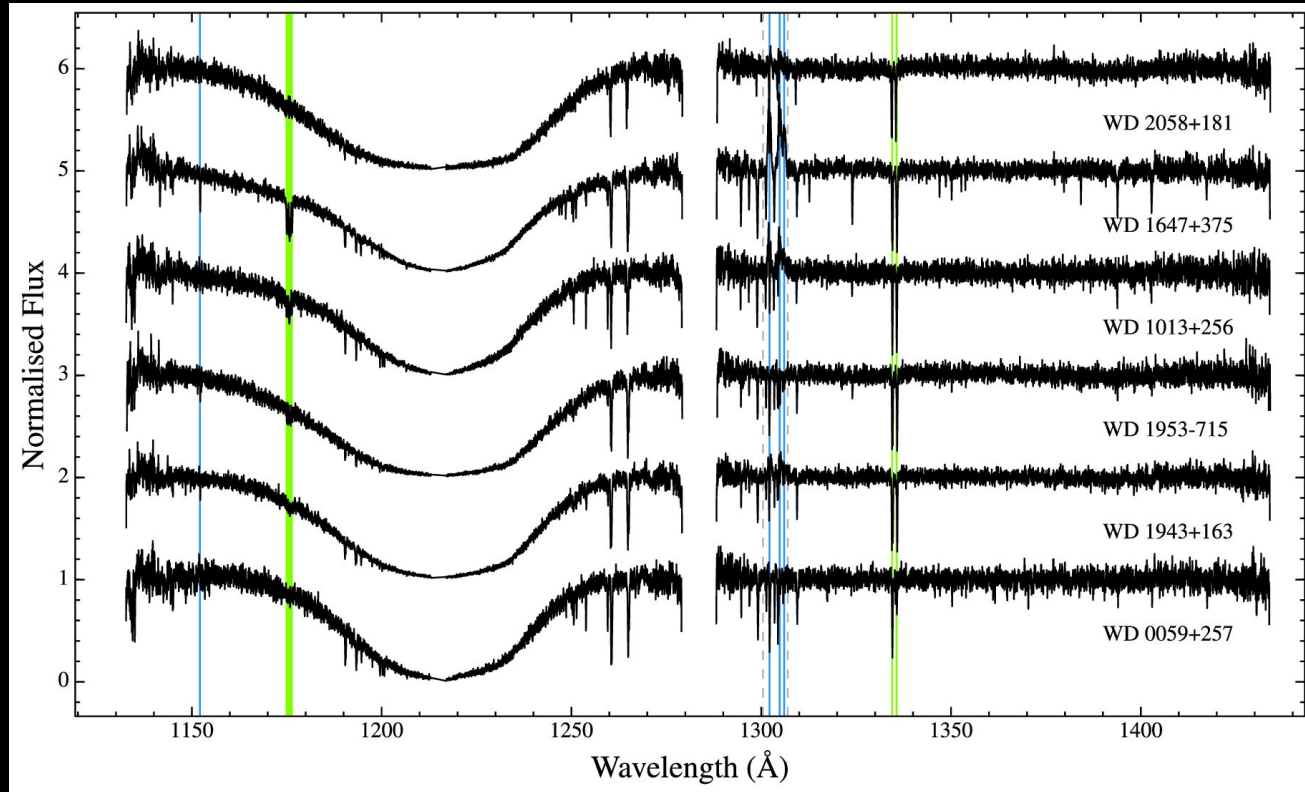
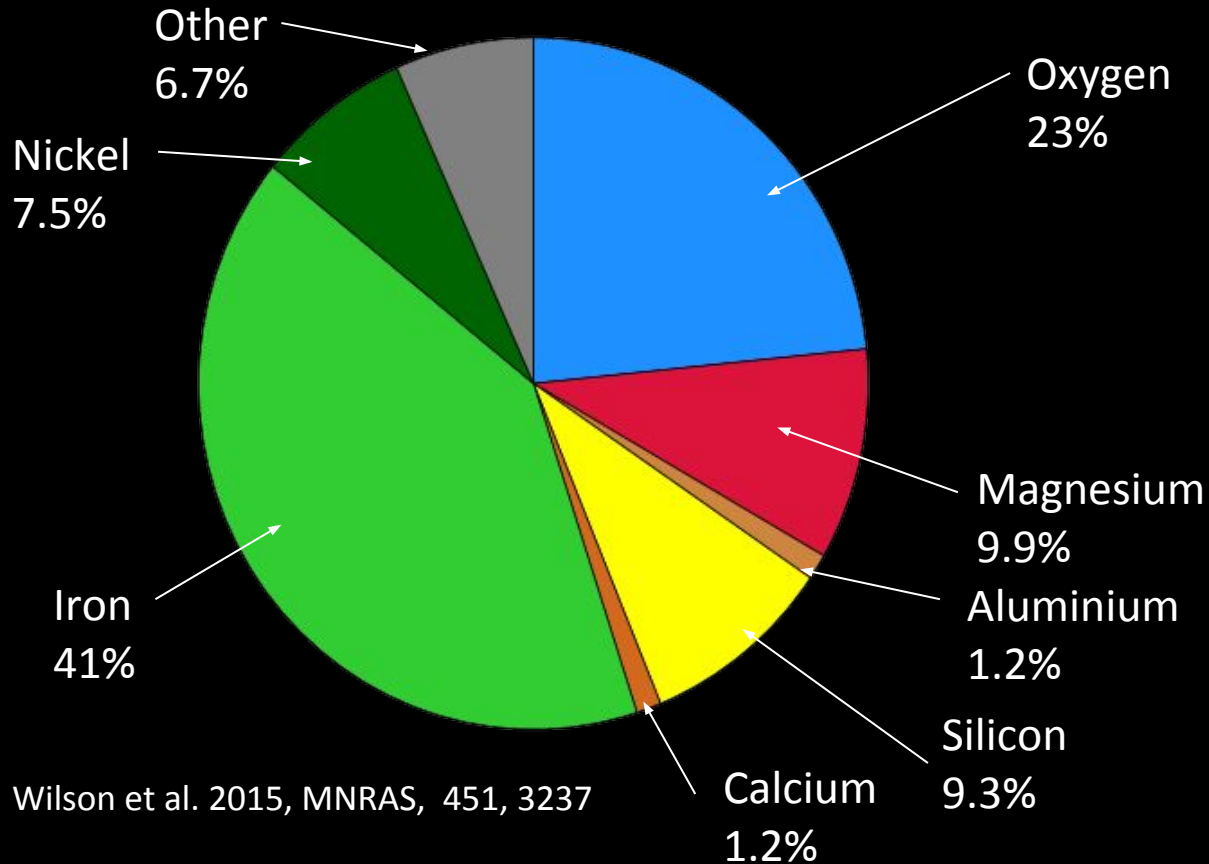


Image: NASA

Polluted white dwarfs \longrightarrow planetesimal composition

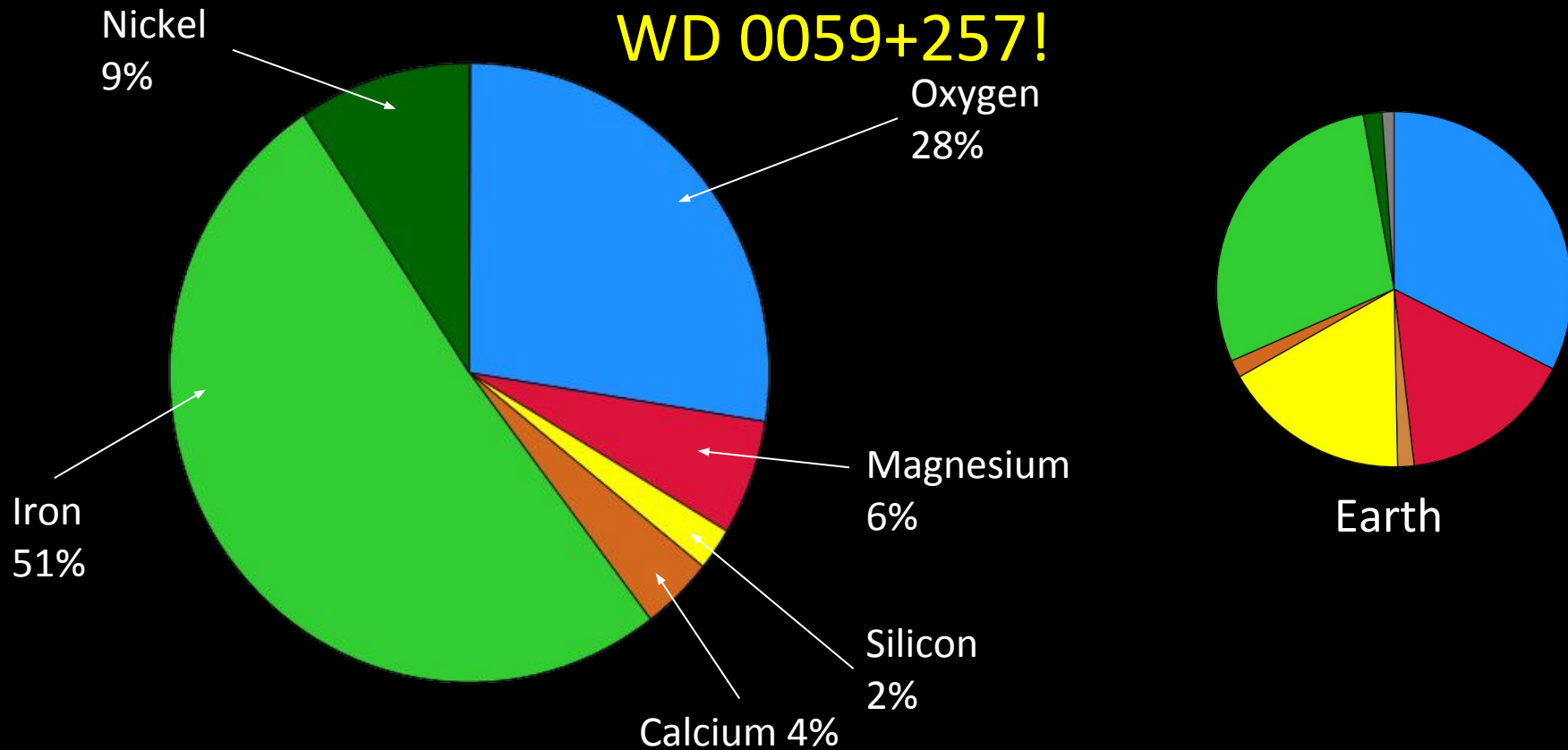


A differentiated exo-planetesimal at SDSS J0845+2257

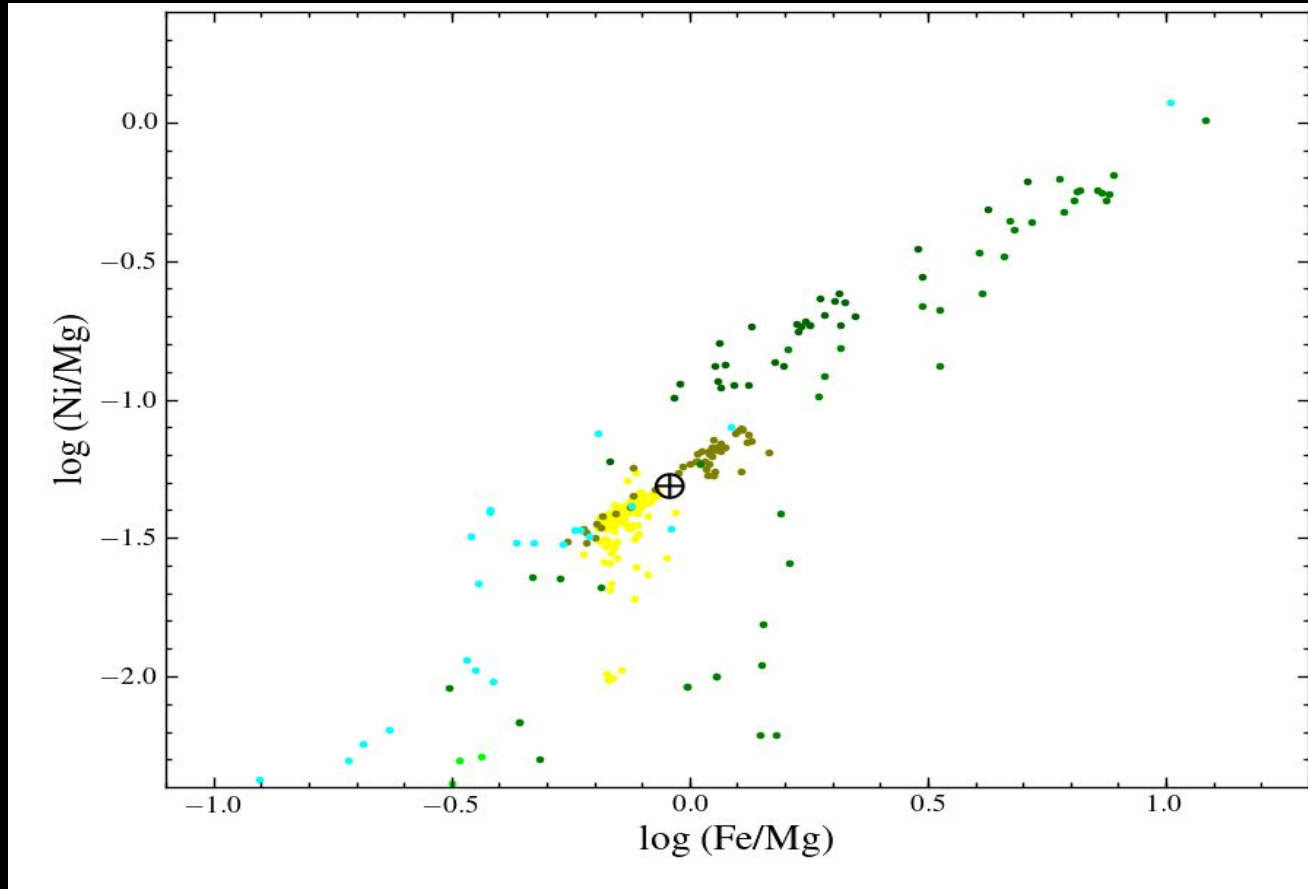


Wilson et al. 2015, MNRAS, 451, 3237

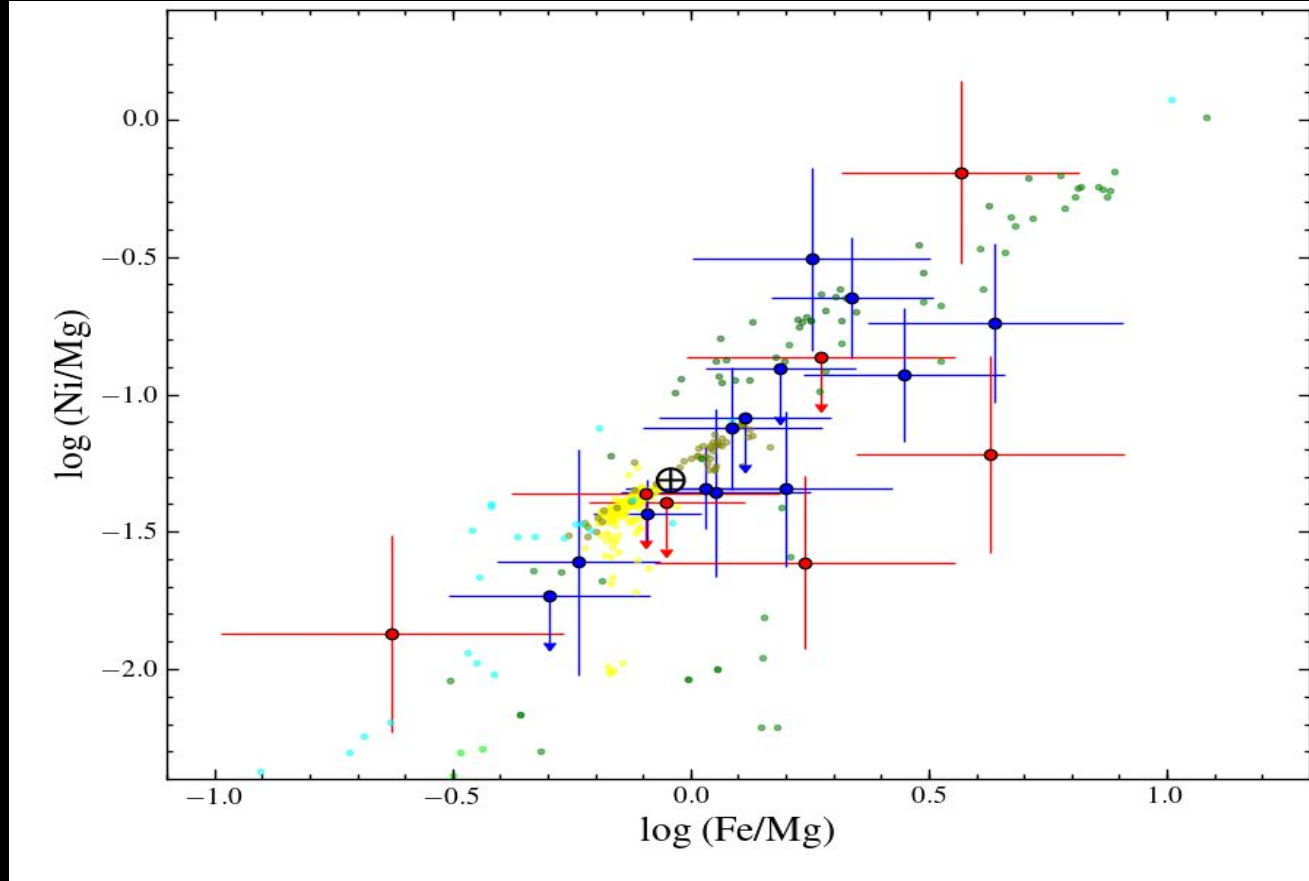
Another differentiated exo-planetesimal at WD 0059+257!



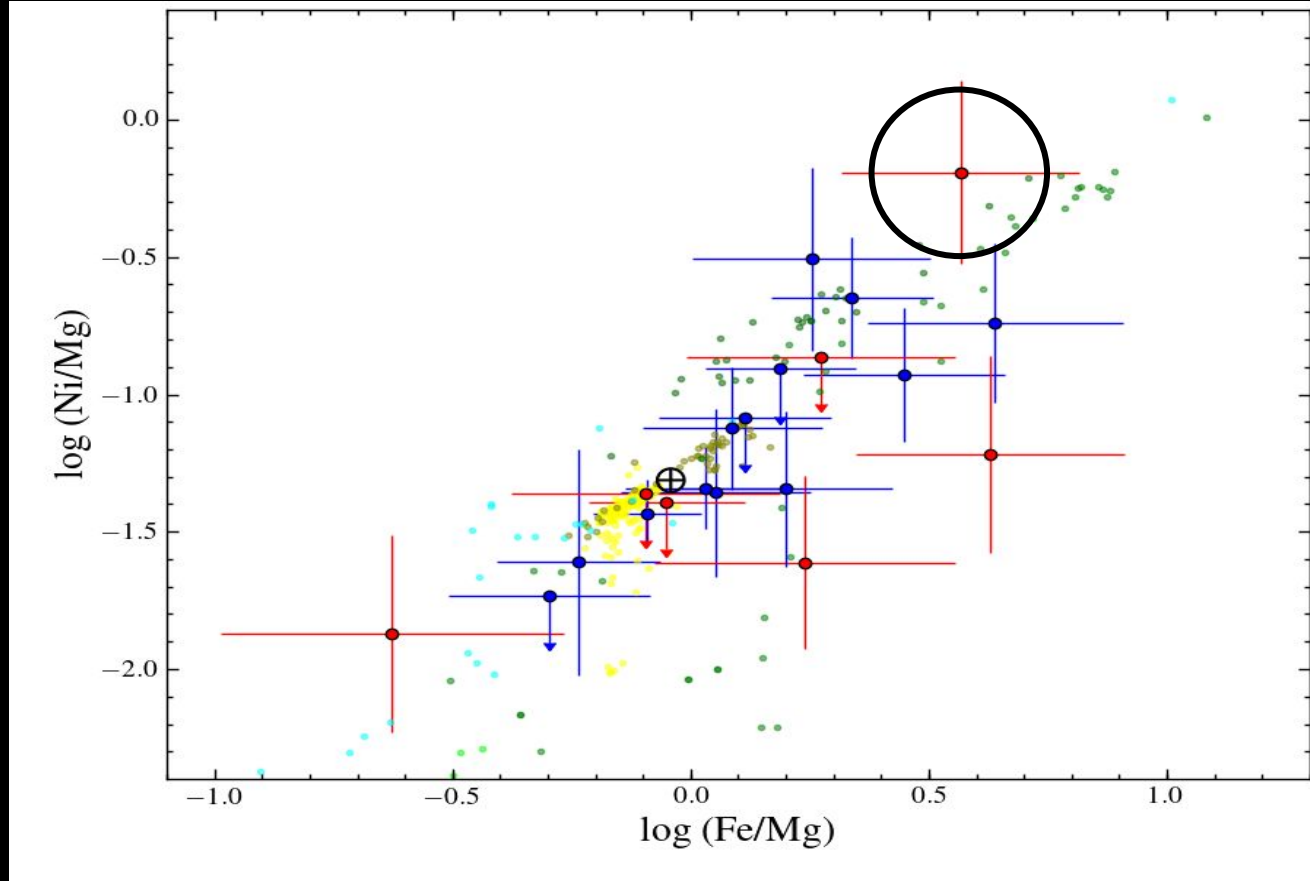
Fe/Ni follows Solar system values



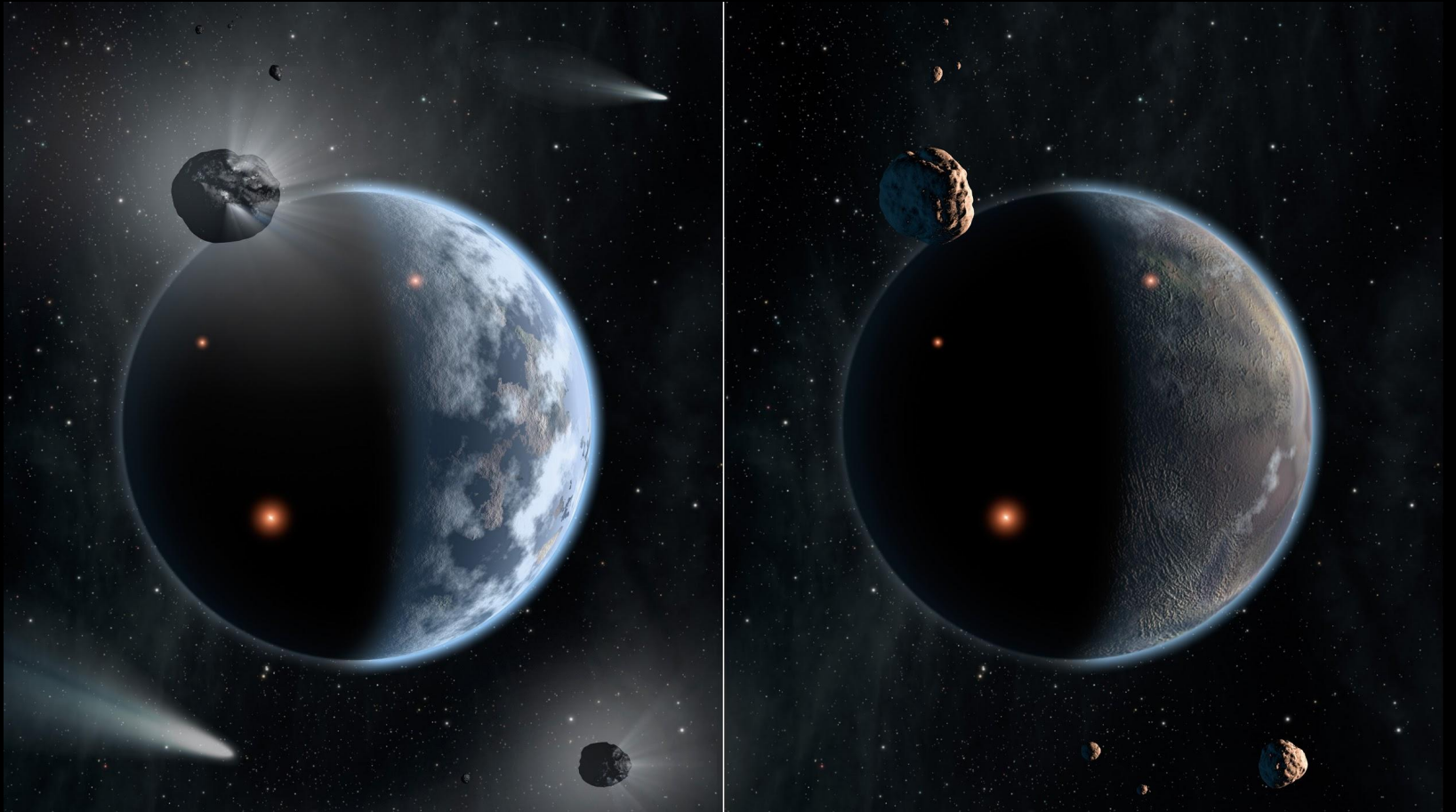
Fe/Ni follows Solar system values



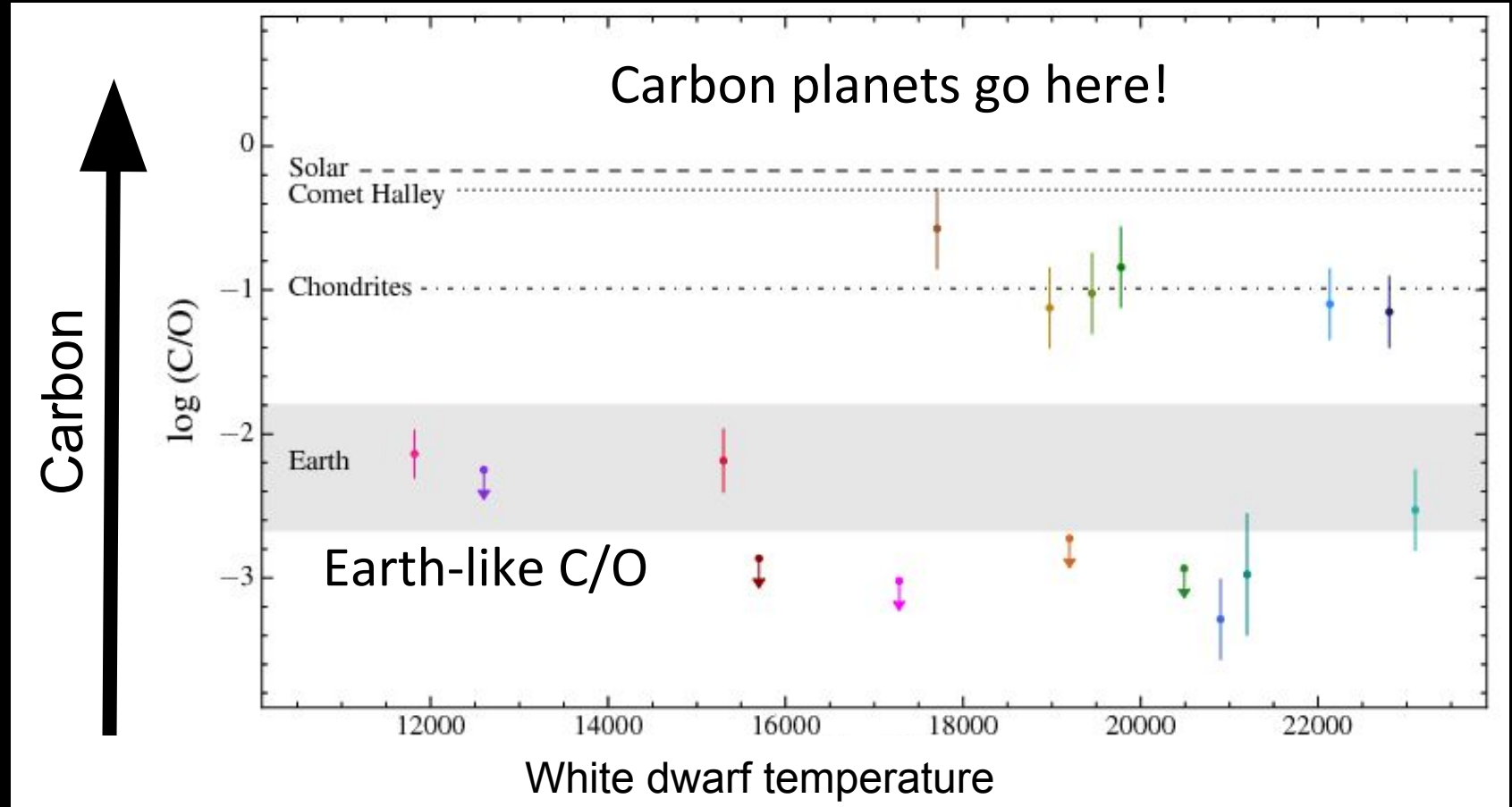
Fe/Ni follows Solar system values



Carbon-rich planetesimals?



Carbon-rich planetesimals are rare- if they exist at all.

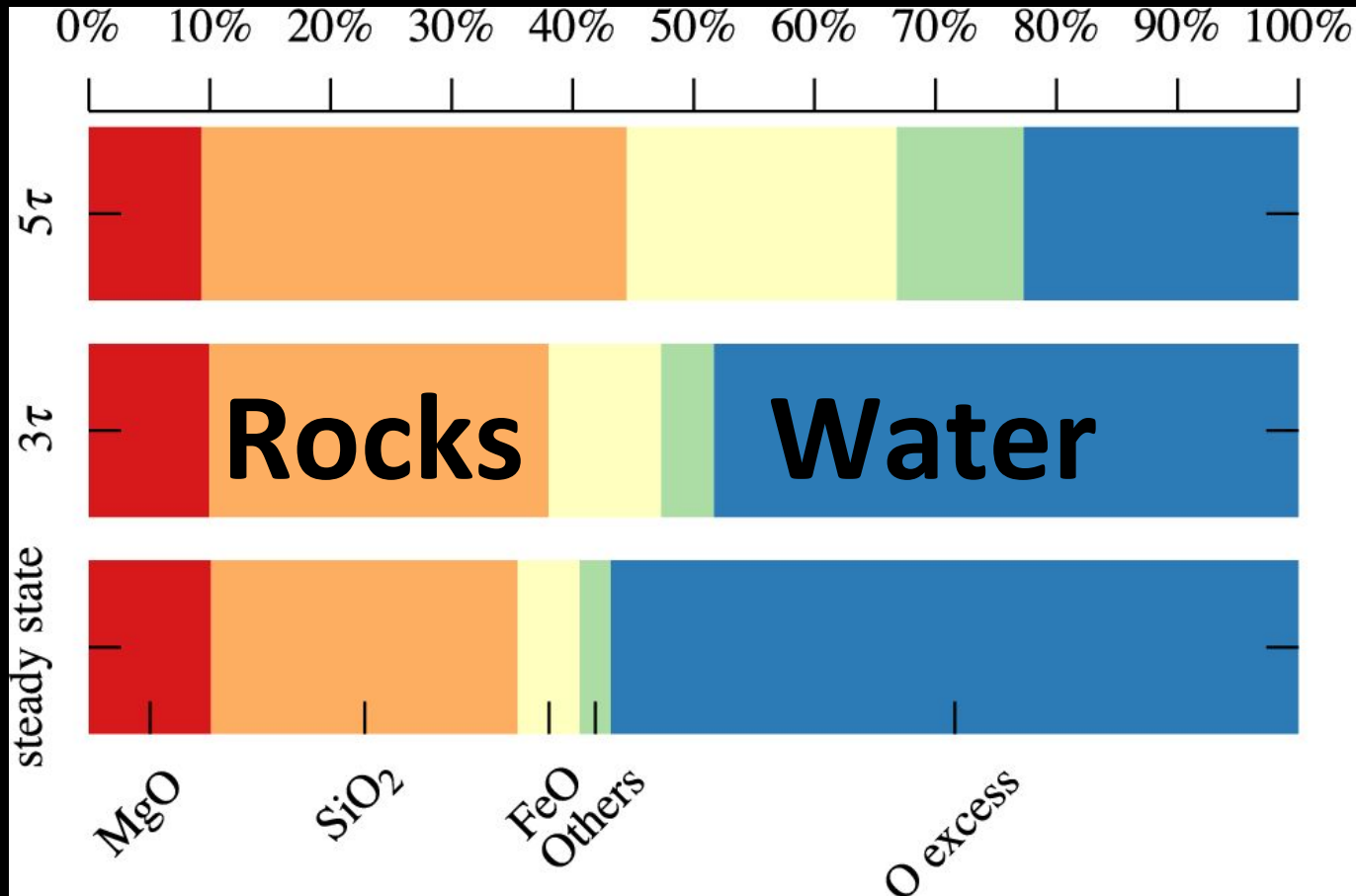


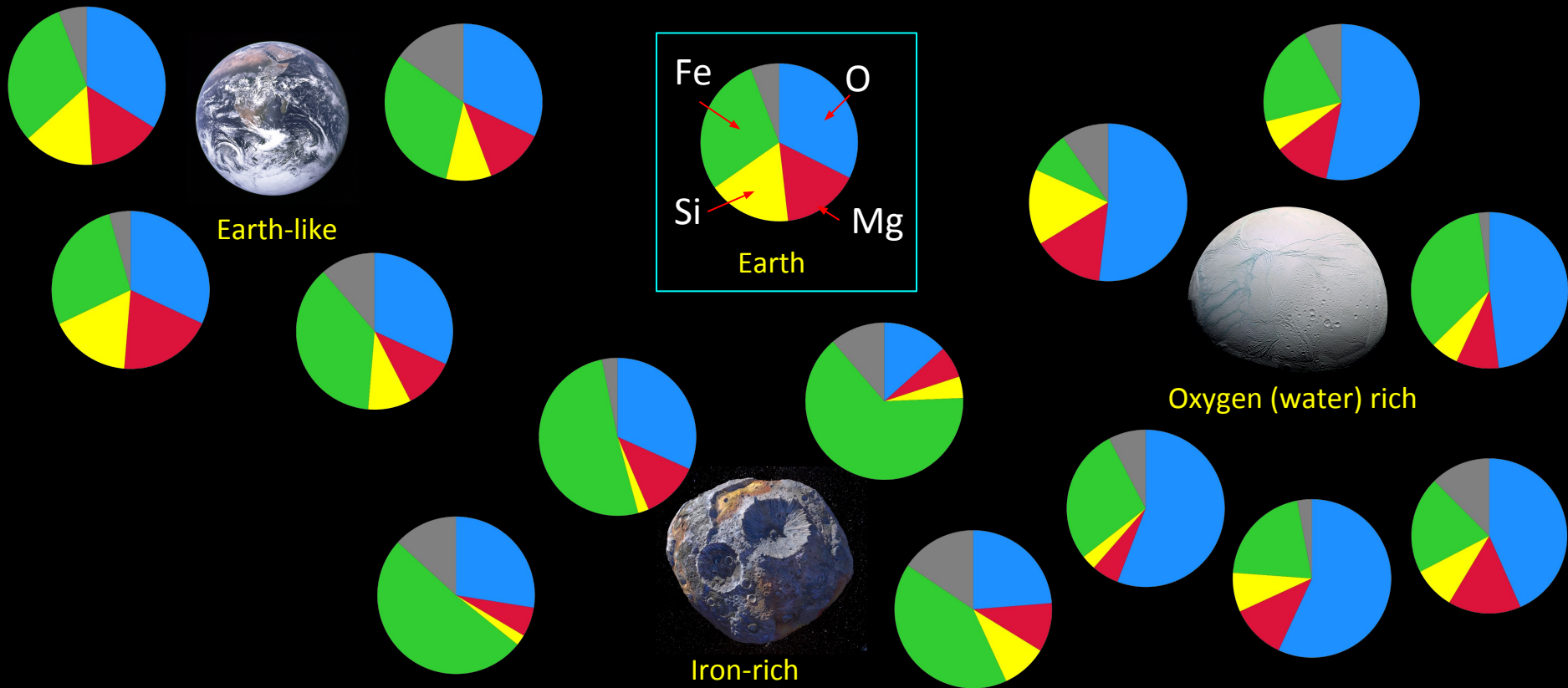
Water in extrasolar systems



Image: Mark Garlick

A water-rich exoplanetesimal





Klein et al (2011), Gaensicke et al. (2012), Dufour et al. (2012), Jura et al. (2012), Farihi et al. (2013, 2016), Xu et al. (2014, 2015), Raddi et al. (2015), Wilson et al. (2015, in prep)

Conclusions

- Measurements of planetary chemistry available from white dwarfs.
- So far: Similar to Solar system, no carbon planets, iron cores, water.
- Future: Move from individual objects to large (100+) samples.