Two-Layer Model of Earth

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Motivation/Intro

- Create a two-layer model of the Earth using Central Pressure Method
- Analyze our model with Earth's data points in mind
- End goal is to analyze how adding a layer to a planet impacts mass and radius

Methods

- Copy example class code
- Python plotting
- Use EOS
- Normalize and compare values
- Notice equations —>

Pressure: $$dP = P_0 - \rho g dr$$

Mass: $$dM = \frac{4}{3}\pi\rho dr$$

Core Radius: $$R_c = \left(\frac{\frac{3M_\oplus}{4\pi} - R_\oplus^3 * \rho_m}{\rho_c - \rho_m}\right)^{(1/3)}$$

Gravity: $$g = \frac{GM}{r^2}$$

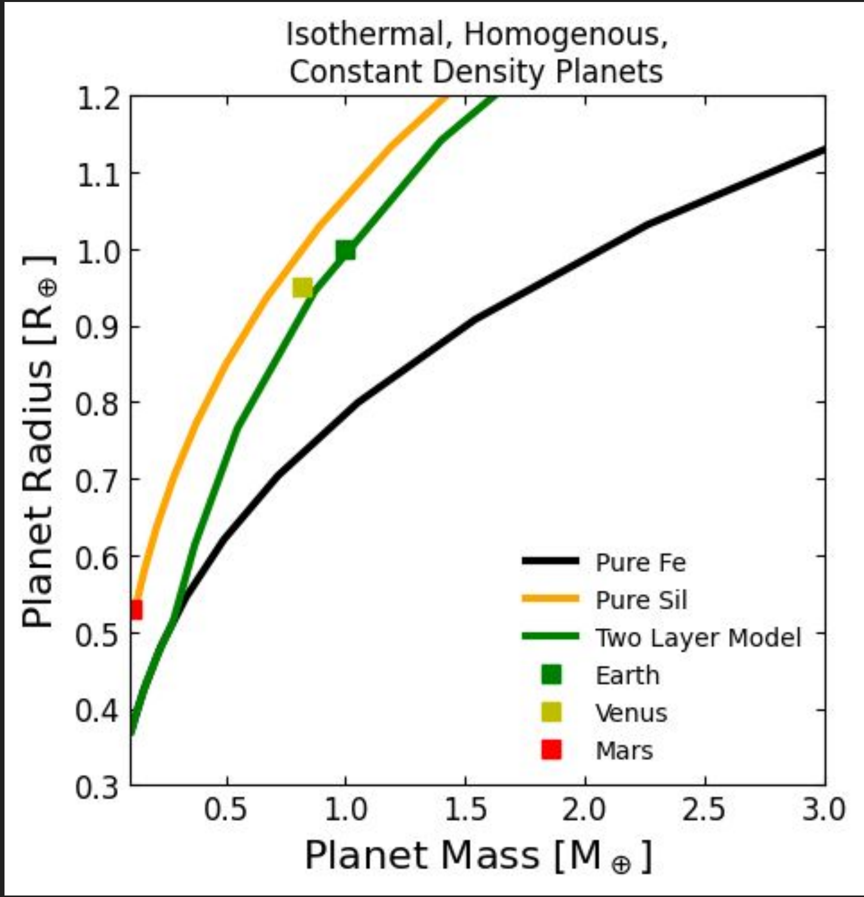
Code

- Calculate Core-Mantle Boundary (CMB)
- Rewrite example code to differentiate layers
- Store a pressure array
- Plotting two-layer model
- Plot pressure profiles

```
def get_rho(r, core_radius=core_radius):
    if r < core_radius:  # Inside the core
        return constant_density_Fe
    else:  # In the mantle
        return constant_density_sil
```

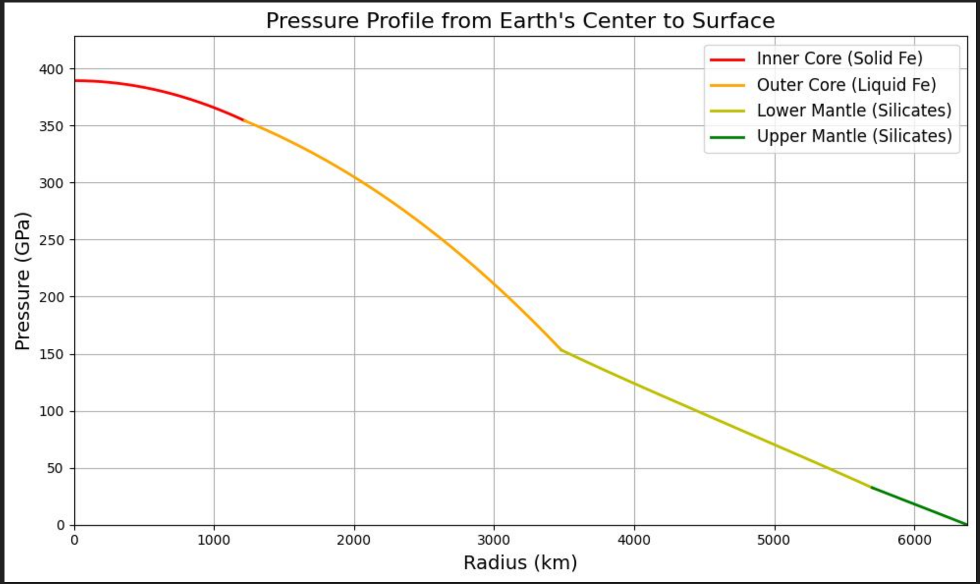
Plot 1

- Planet Radius and Planet Mass
- Pure Iron line, radius constantly decreases (black)
- Silicon line does the same but decreases less than iron (yellow)
- We can conclude as planetary density increases the mass-radius relation decreases
- Notice two layer model (Green)



Plot 2

- Pressure and Radius
- As core transitions to mantle, pressure goes from decreasing quadratic to negative linear slope
- Many assumptions to account for…



Conclusion

- Motivation successful!!
- Successfully created two layer model
- A Mass-Radius curve is not as simple as a log curve…
- Compared to other projects…