Seasonal Variations of Mercury's Magnesium Dayside Exosphere from MESSENGER Observations

Merkel et al. (2017)

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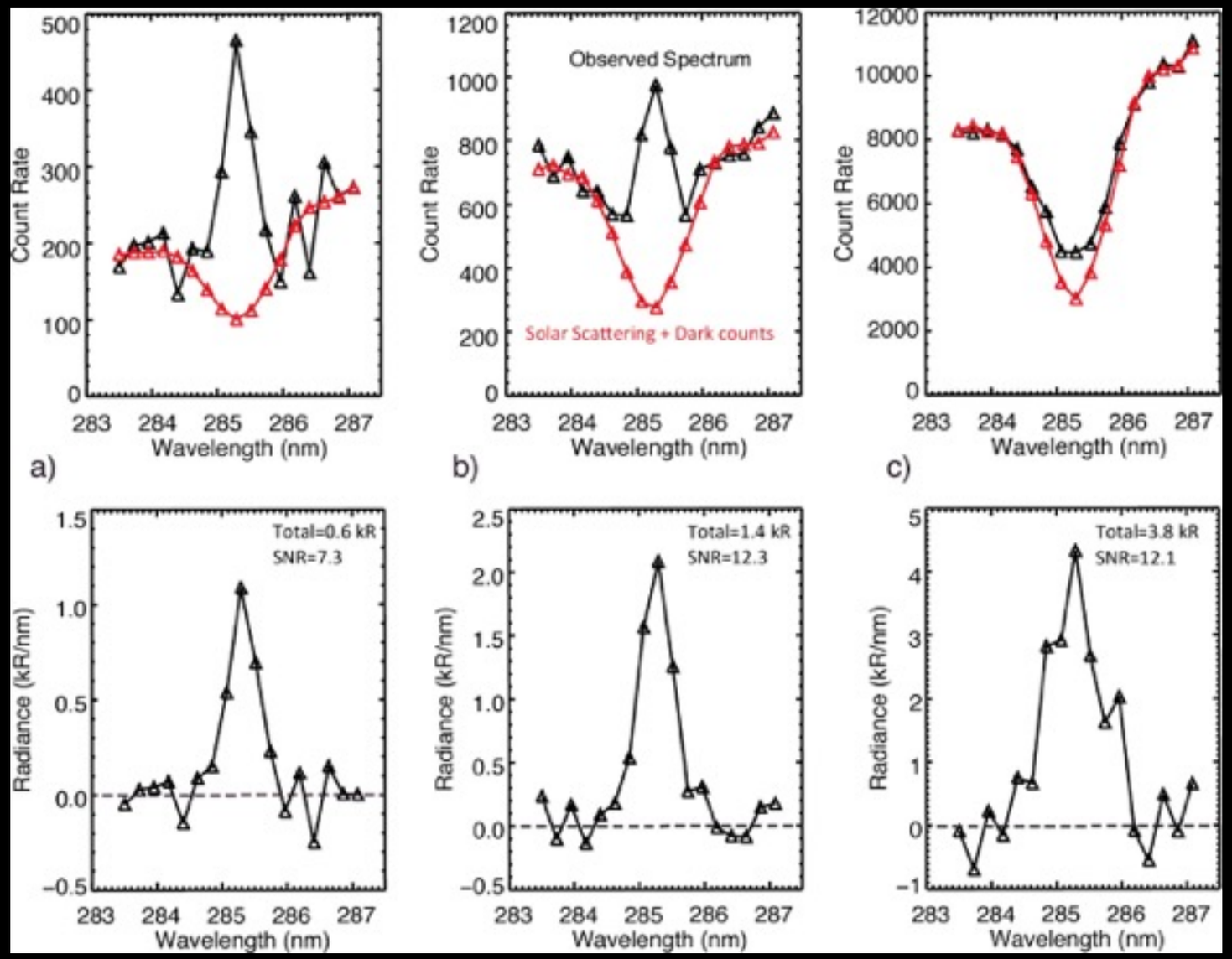
The data

- center spectrometer on Mg I emission line
- contamination from scattered solar light and detector
- radiance: subtract contaminants, multiply by instrument calibration



Modeling

- model radiance as function of altitude to get density and temperature

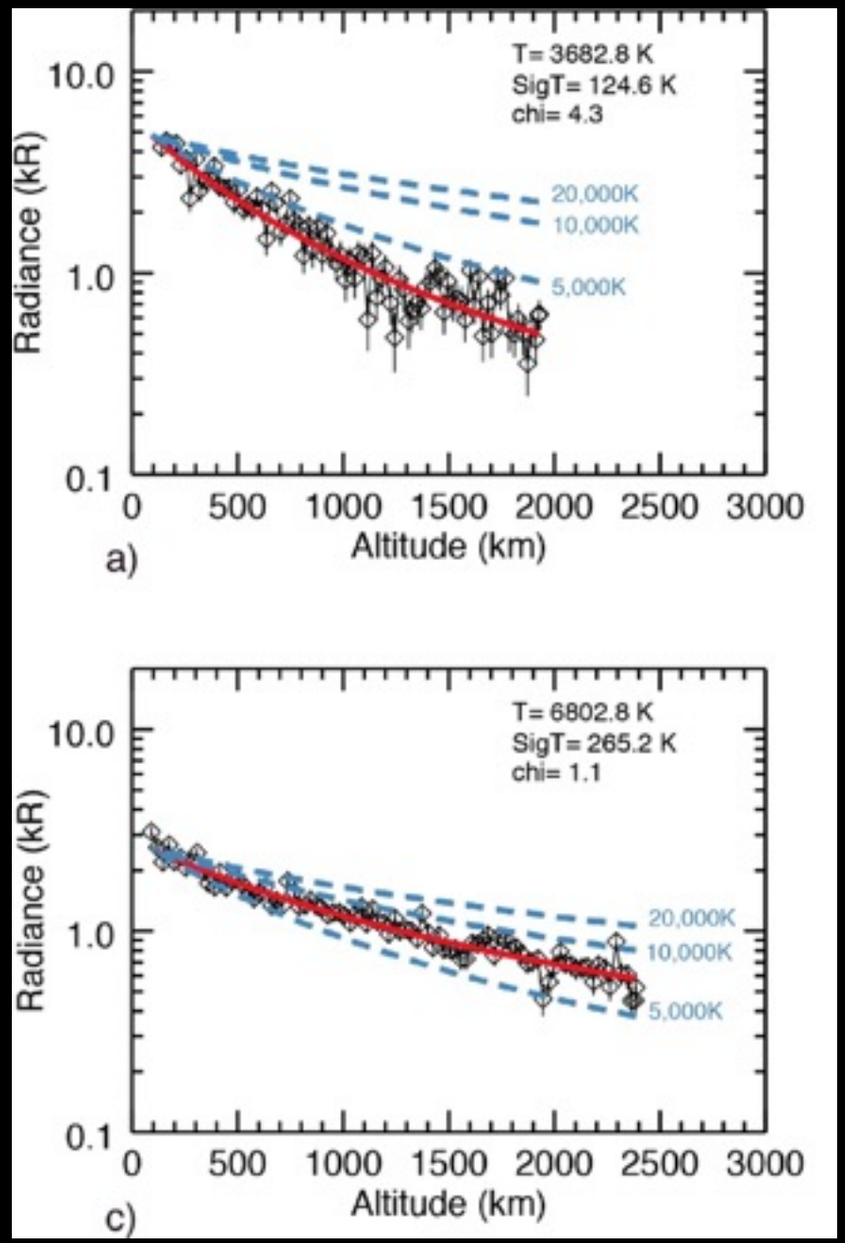
$$N(cm^{-2}) = \frac{4\pi I}{g} \times 10^9$$

$$N(cm^{-2}) = 2KH \int_{z_o}^{z_1} n(z)dz$$

$$n(z) = \zeta n_0 e^{-(\lambda - \lambda_0)}$$

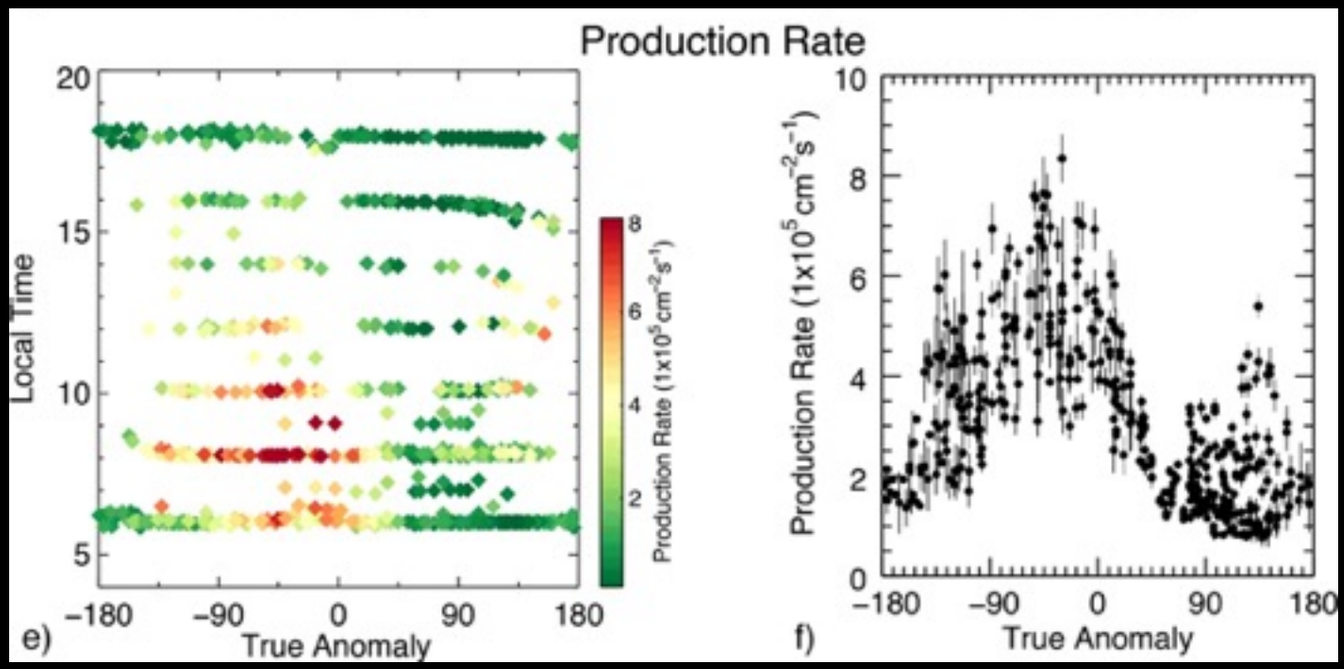
- λ and λ_0 depend on temperature and z

- determine production rate from density and temperature



Results

- production rate function of true anomaly
- peaks at ~140° and -45°
- stronger in the morning



- idea: micrometeoroid impact vaporization

Extension Summary

variations in Ca also observed by MESSENGER

modeled by Killen and Hahn (2015)

implement simplified version of model

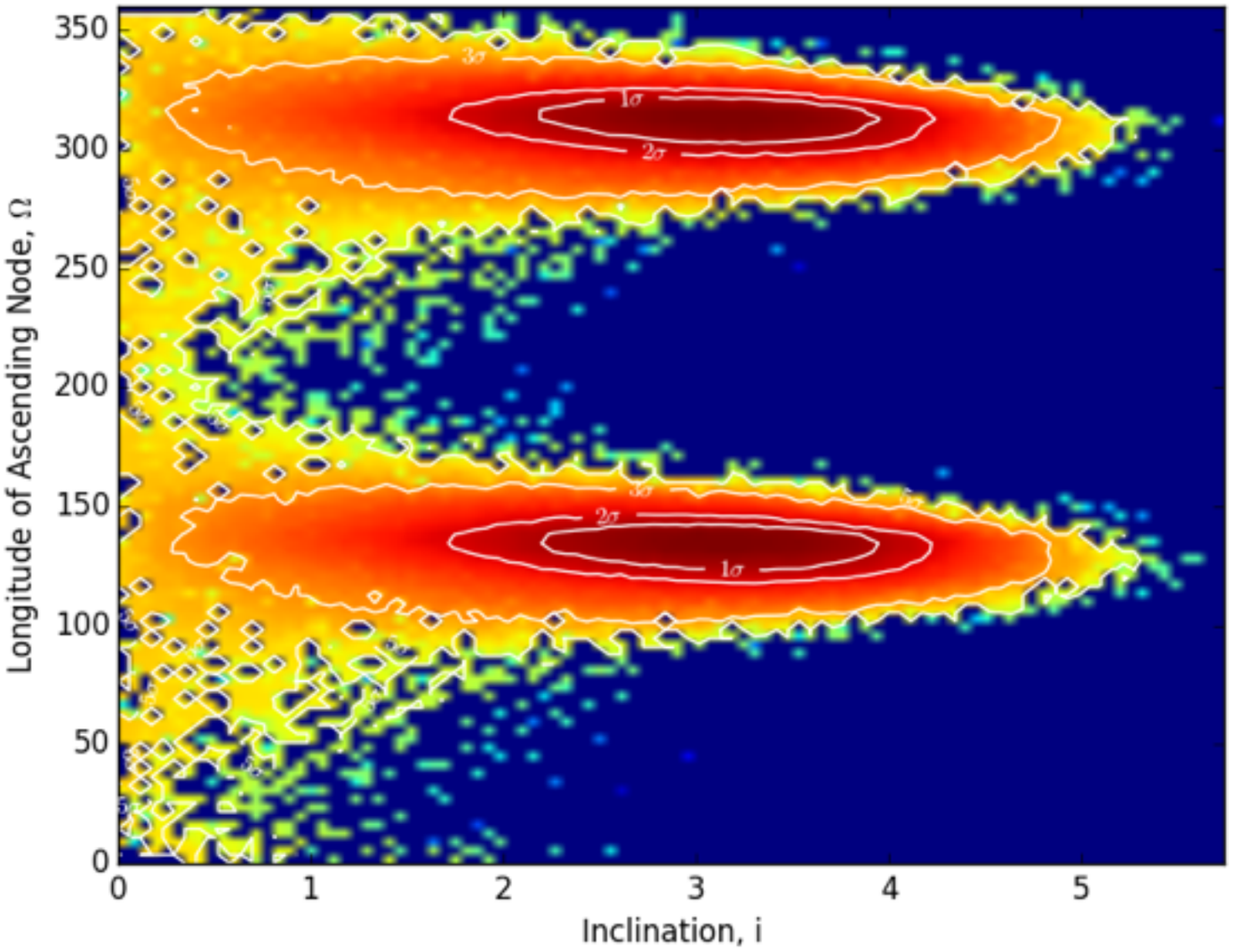
test on Mg data from Merkel et al. (2017)

Dust-Disk Model

- Mercury sweeping through circular dust-disk
- assume disk composed of low and high inclination population
- Bayesian modeling of inclination and longitude of ascending node of dust-disk (MultiNest, Feroz et al. 2013)

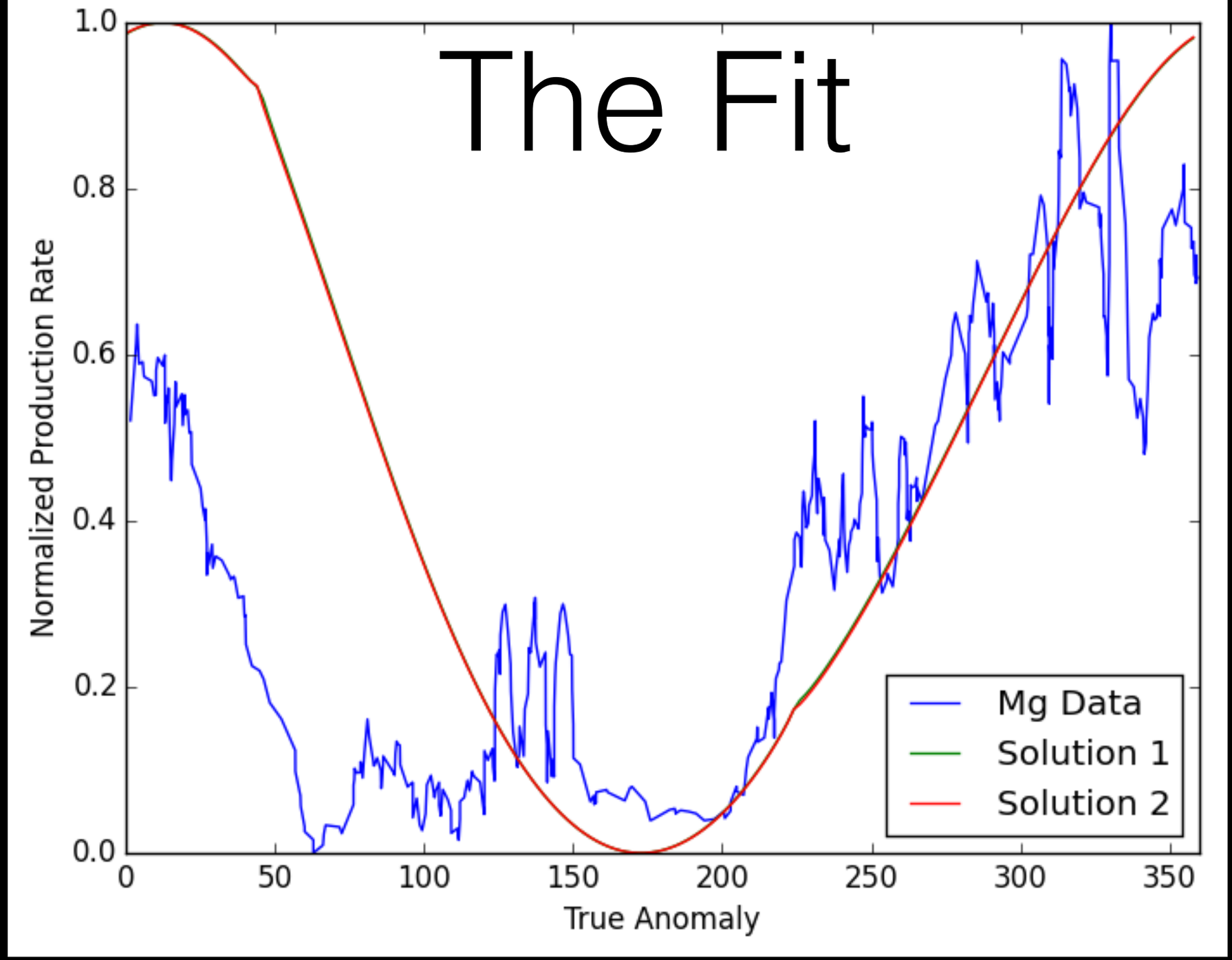
$$n(R, \beta) \propto R^{-\chi_j} h_j(\beta),$$

Result of Fitting



- Solution 1: i = 3.16° and Ω = 135°
- Solution 2: i = 3.09° and Ω = 316°

The Fit



- unable to fit data with single dust-disk model

Conclusion

- implemented model from Killen and Hahn (2015)
- applied to Mg results from Merkel et al. (2017)
- unable to fit with single dust-disk model
- more complex model/include chemistry?