

# TOI-469: A three-planet system spanning the radius valley

Tools for analysing the internal structure and formation history of an observed planetary system

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Evolved K0V star hosting two super-Earths and one sub-Neptune on close orbits (Damasso et al. 2023)

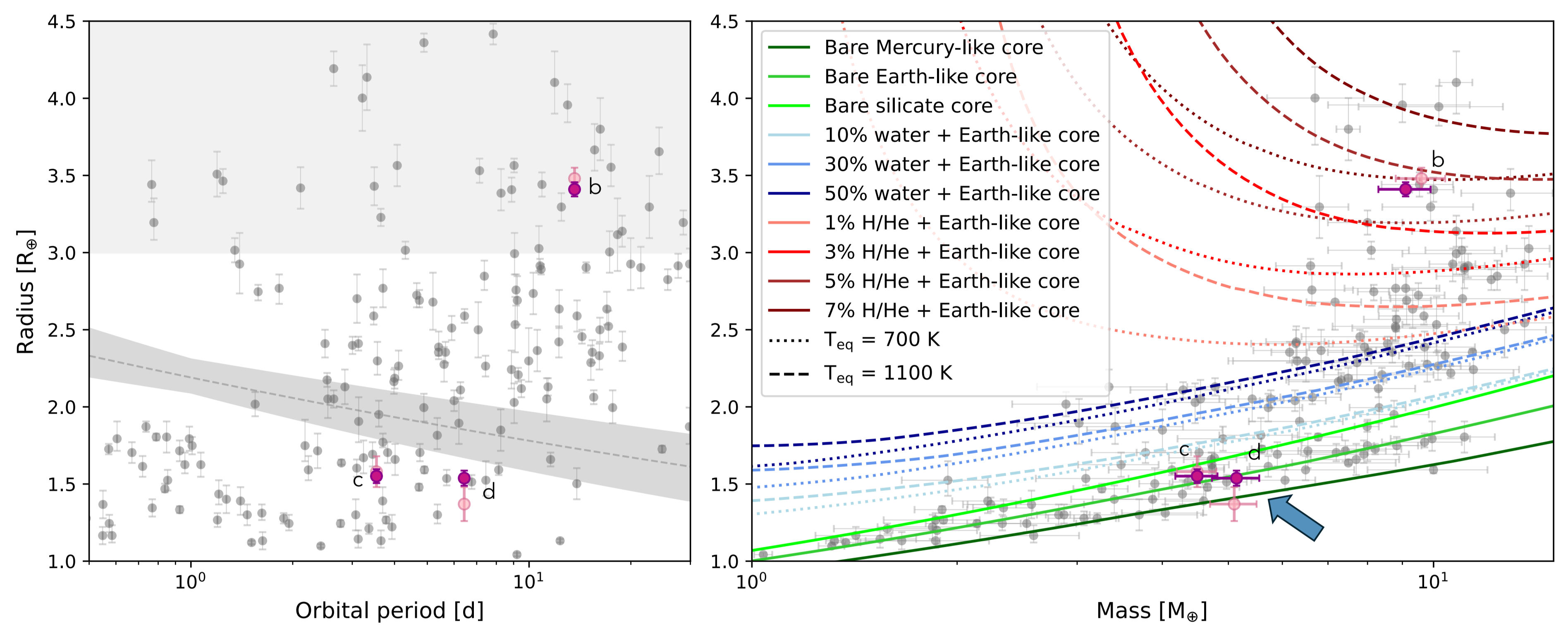
**Photometric follow-up:** (Egger et al. in review)  
9.6 days of CHEOPS observations total, analysed together with two sectors of TESS data

## Conclusions

Radius of planet d deviates by  $>3\sigma$  from the median value reported in discovery paper

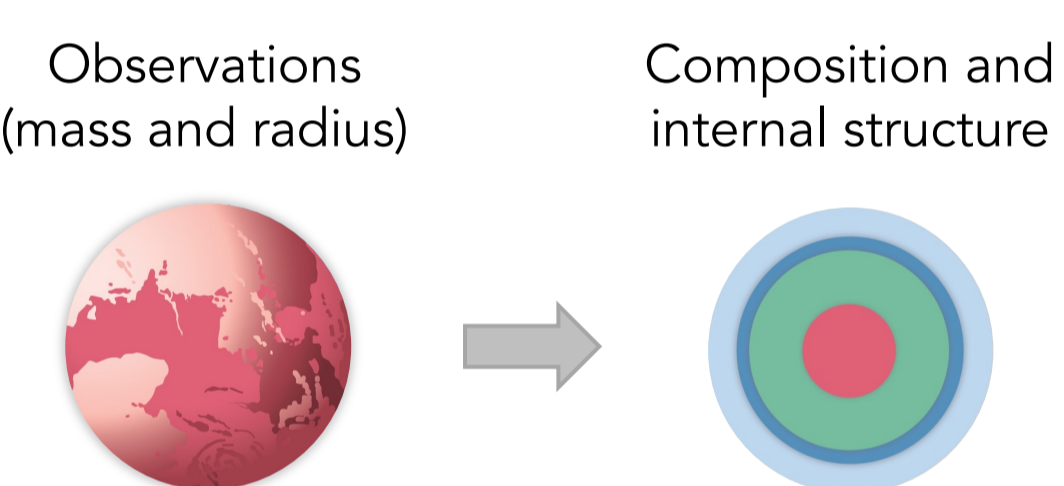
New tools for analysing the internal structures and possible formation pathways of an observed planetary system

A Rosetta stone system for understanding the radius valley: Testing the compatibility with both the evaporation hypothesis and the migrated, water-rich sub-Neptune scenario



## plANETic: A neural network based internal structure modelling framework

### 1 - The goal



### 3 - The solution

- Go through **all possible** internal structures
- Calculate radii using a **planetary structure model**
- Find the ones compatible with **observations**

### However...

Computation time of the planetary structure model

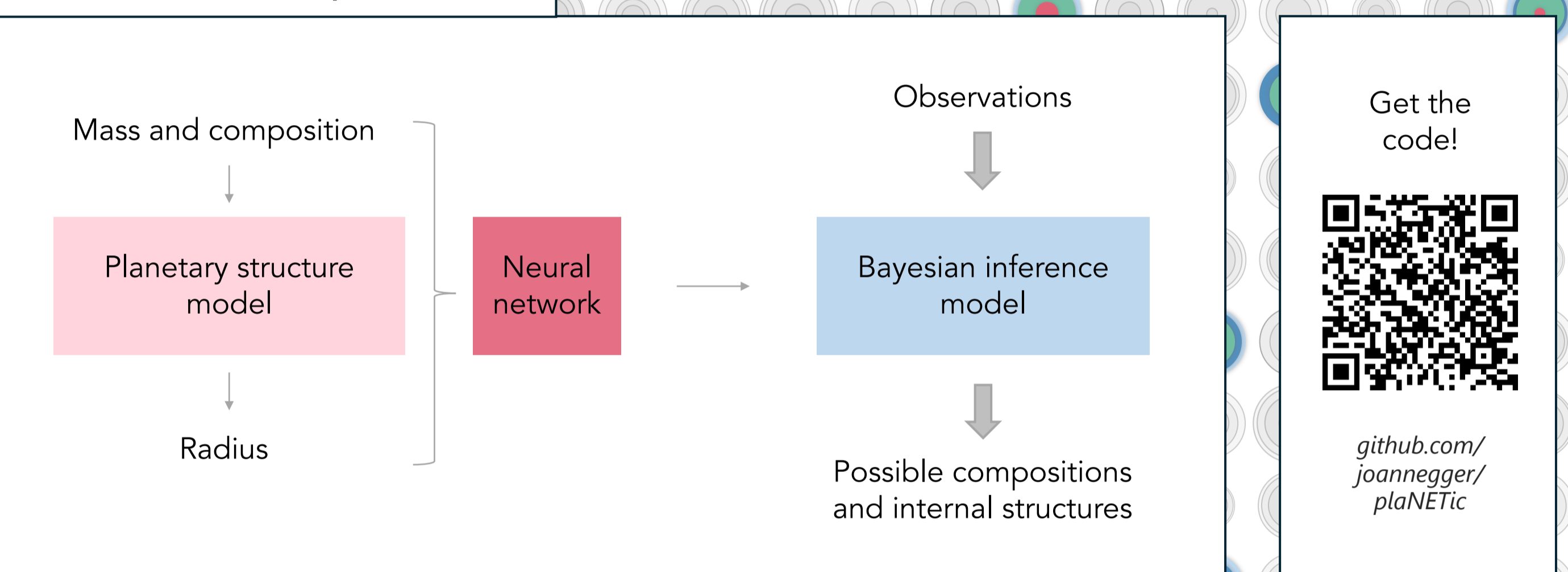
### 2 - The problem

Inherent degeneracy: Multiple structures can lead to the same observed mass and radius values

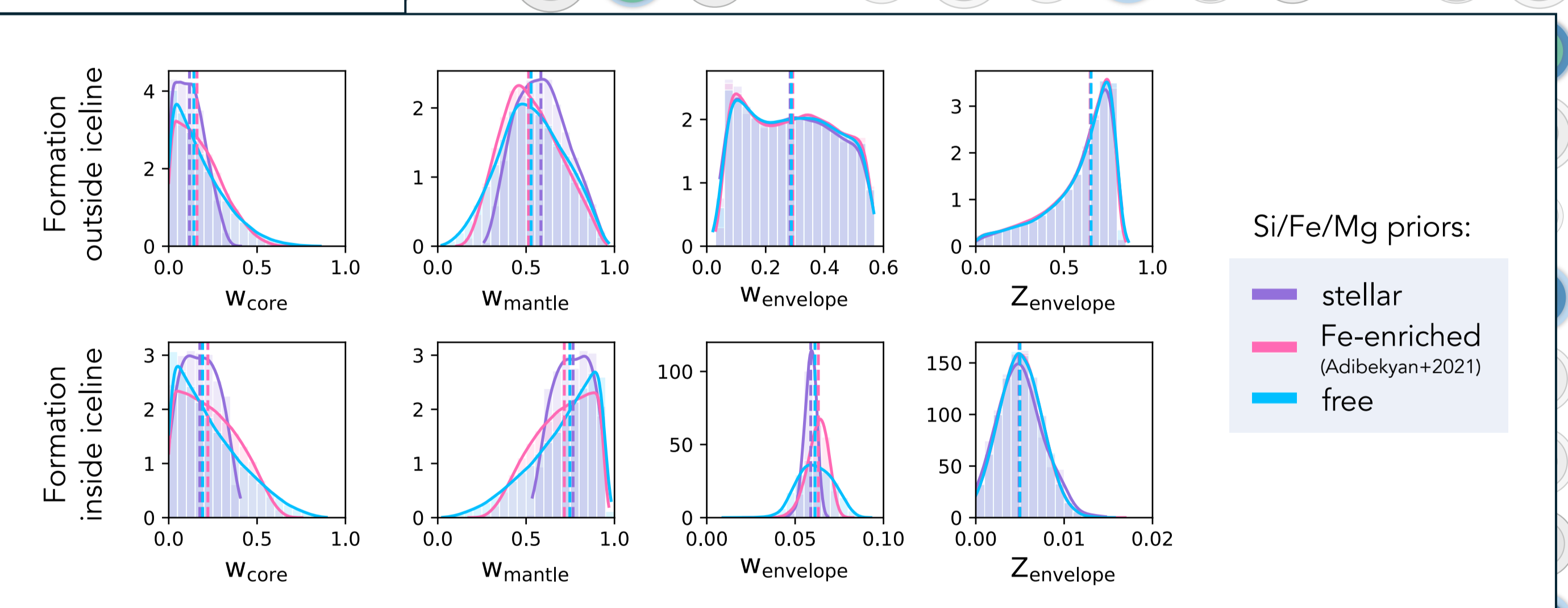
### 4 - The solution, part II

Train a **neural network** on data generated with the planetary structure model

### Model overview: plANETic



### Example: TOI-469 b



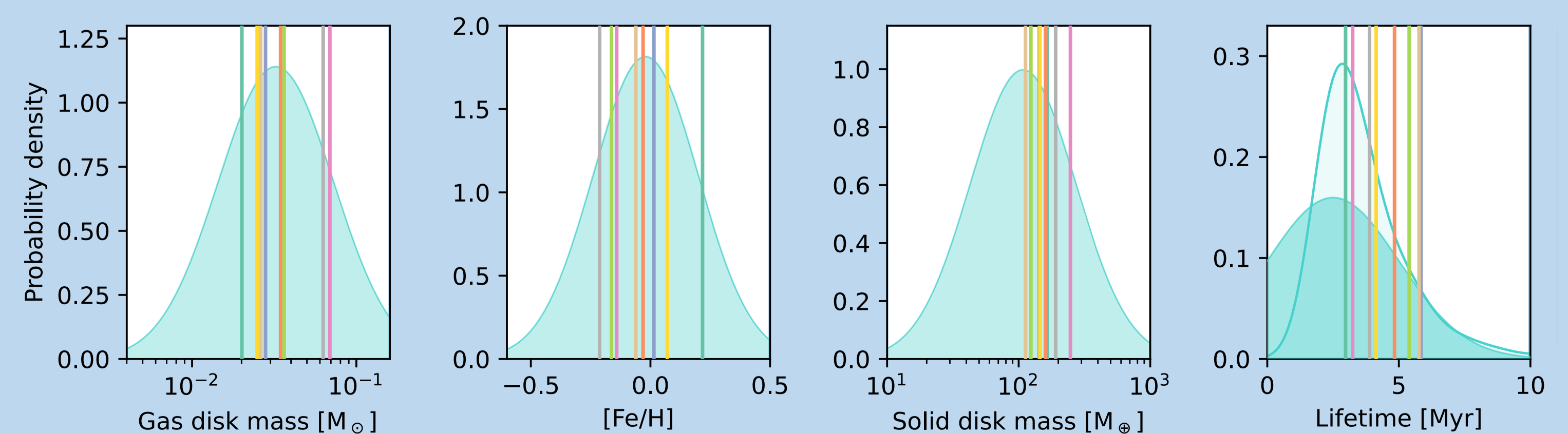
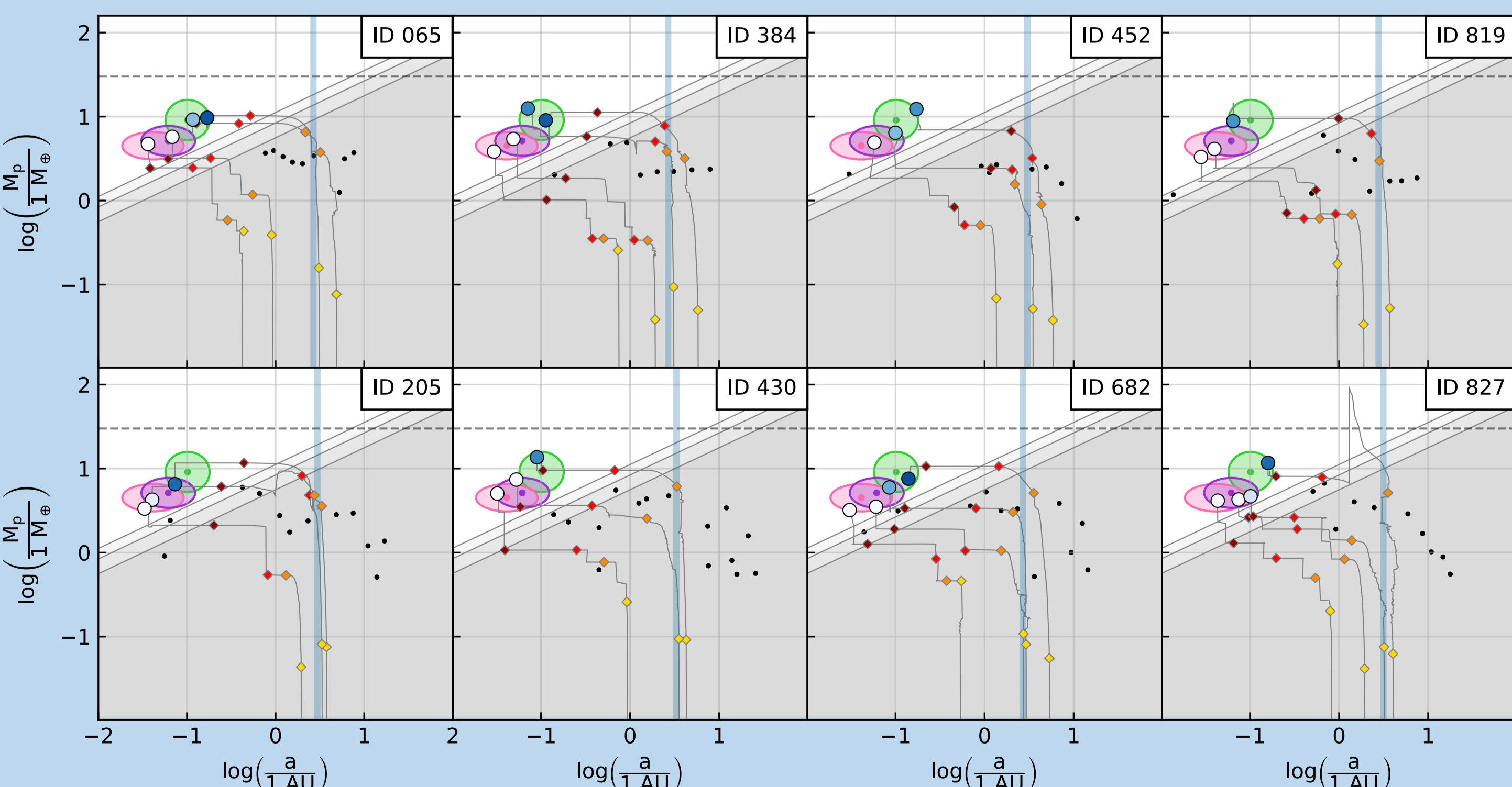
## Unlocking possible formation and evolution tracks of an observed planetary system

## Searching for analogue planetary systems in a synthetic population

The NGPPS population: 1000 synthetic planetary systems generated using the Bern model for formation and evolution (Emsenhuber+2021)

We identified **8 synthetic systems** in this population that qualify as **analogues** for the observed TOI-469 system based on the planetary masses and orbital distances.

Based on these analogues, we identify **possible formation and evolution tracks** of the observed system. In addition, we can also study the **properties of the protoplanetary disk** leading to the formation of such a system.



Interested? Send me an email!  
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I'm on the job market starting Spring 2025!

PlanetS

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