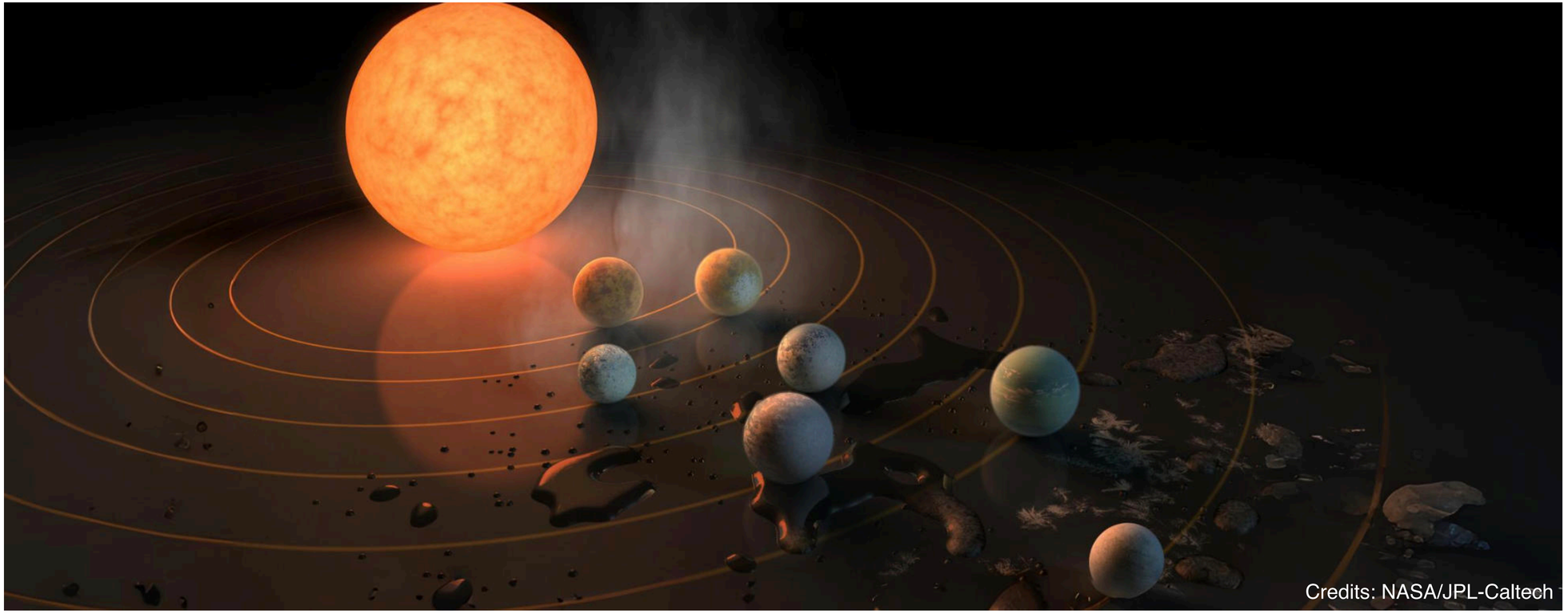
Swiss National Science Foundation

UNIVERSITÄT BERN

CSH CENTER FOR SPACE AND HABITABILITY

Create your own planetary systems



Yann Alibert & Sara Marques

18 September 2025

PlanetS National Centre of Competence in Research

The National Centres of Competence in Research (NCCR) are a research instrument of the Swiss National Science Foundation.

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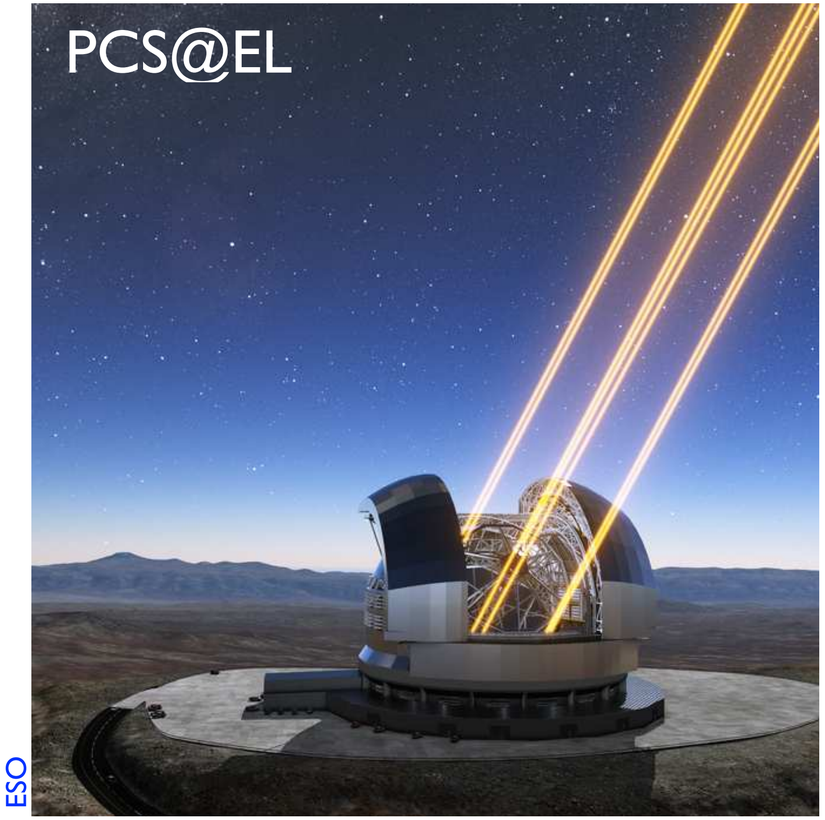
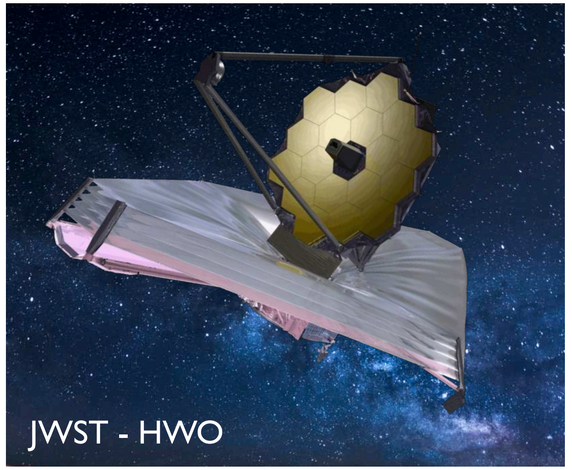
AI FOR EXOPLANETS

Finding another Earth

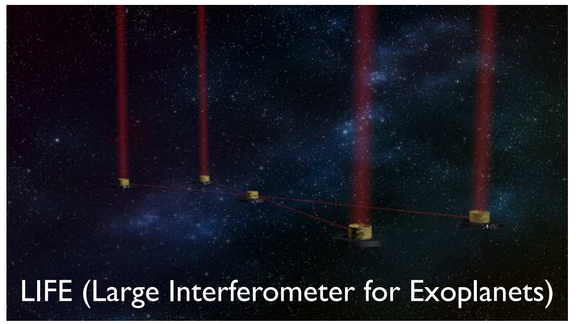
Is the Earth, and the Solar System in general, unique?



ESO



NASA



ETH Zürich

Finding another Earth will soon be possible, **if we know where to search** !

Blind *versus* optimized search

Blind search

We probe the entire sky in the search for an Earth-like planet.

Optimized search

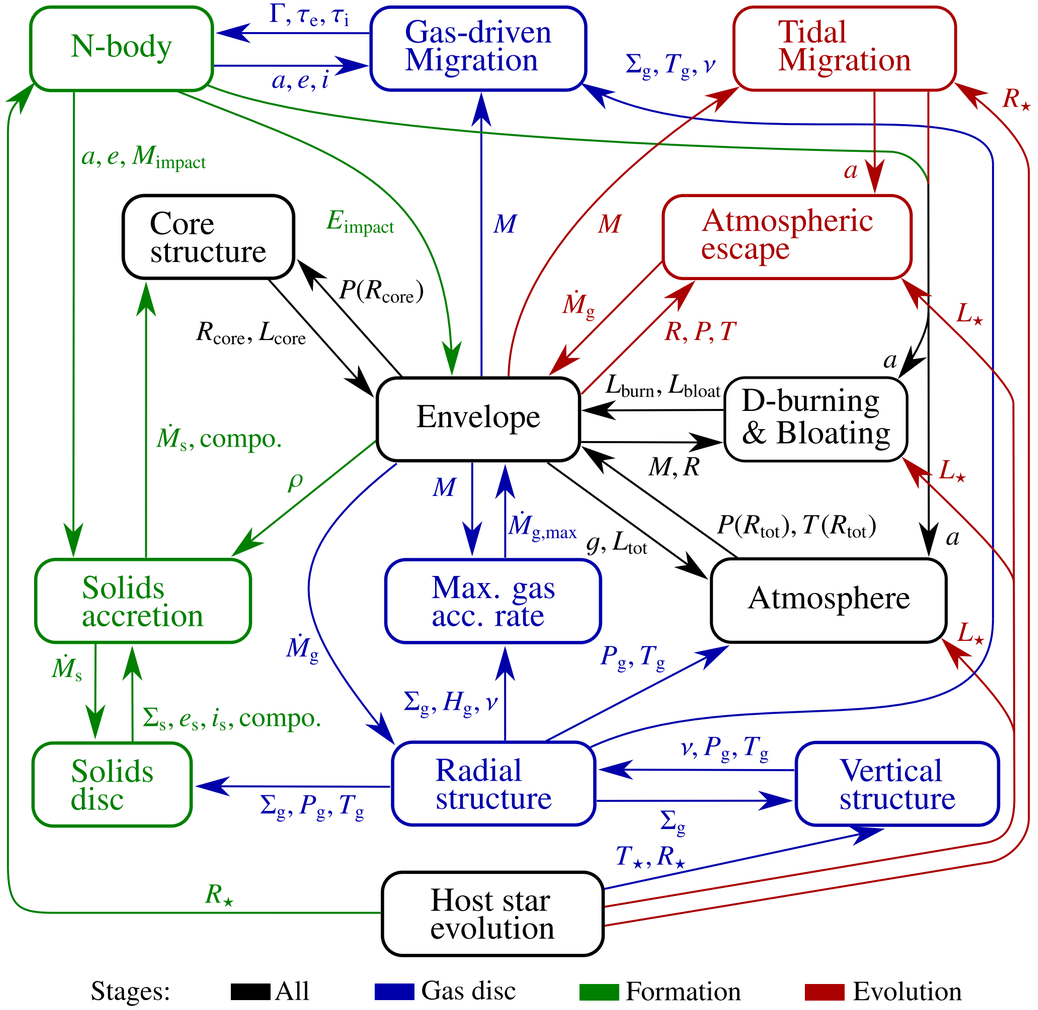
We find a way to guide the search by providing some context.

Architecture of planetary systems = **correlation** between **properties** of bodies in the **same system**

Understand the formation of planetary *systems* via end-to-end models

Numerical model

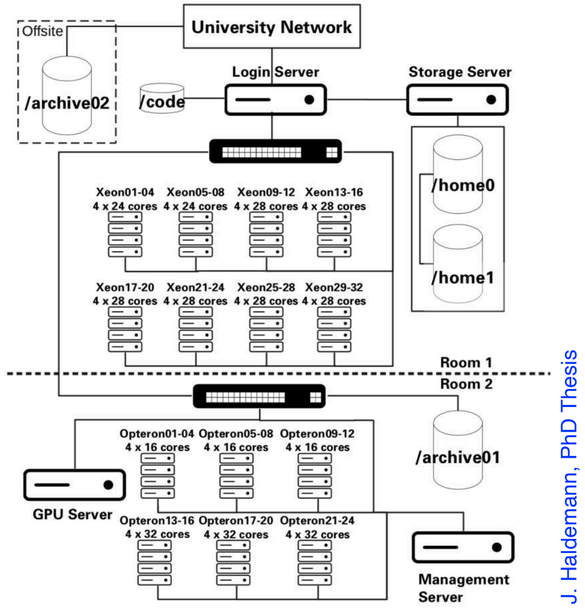
In Bern, we have developed a convoluted model that is capable of generating synthetic populations.



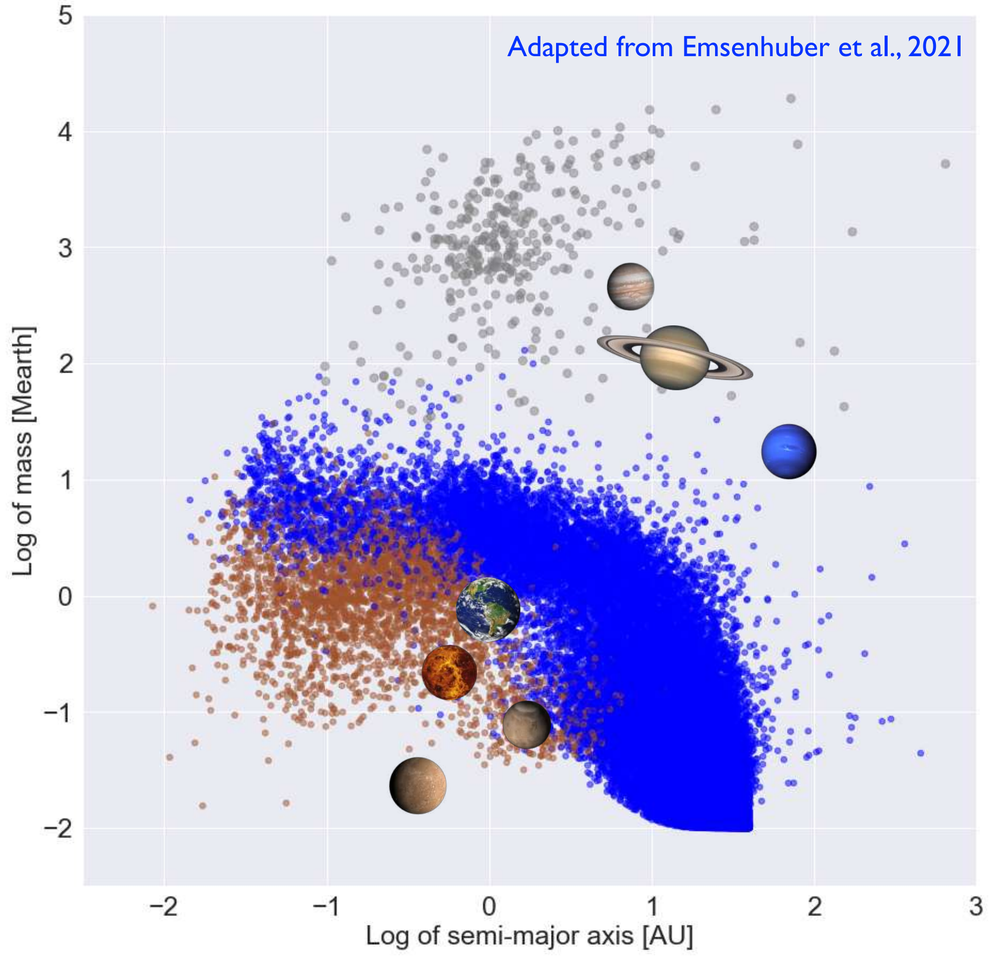
The Bern model

The Bern model is capable of producing populations of planetary systems but it is quite computationally expensive.

Eg. 1 simulation of 1000 planetary systems with 100 planetary embryos takes ~1 Million CPU hours (months of computations in a cluster).



J. Haldemann, PhD Thesis

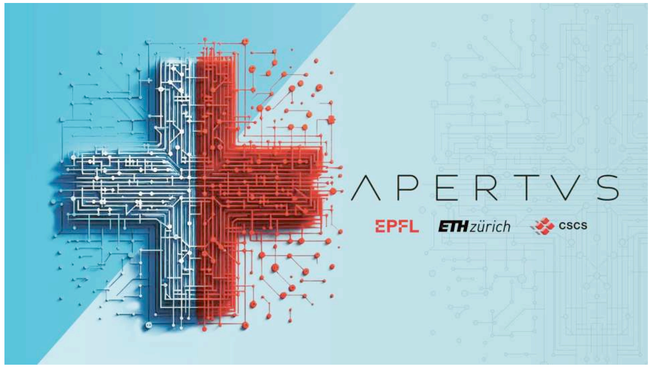


Your goals for this Hackathon

At the end of this hackathon, you should be able to:

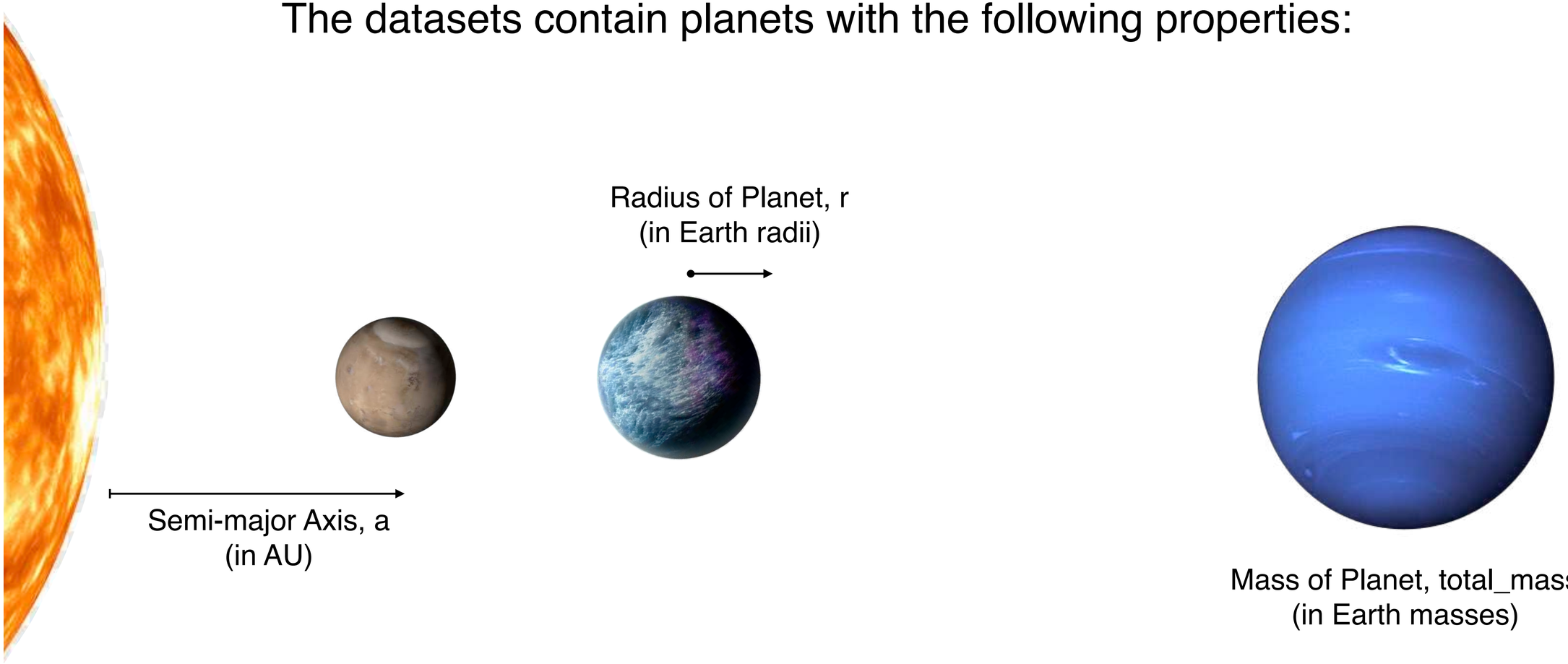
1. Find correlations between the planets inside a planetary system;
2. Generate more planetary systems based on the statistics of the provided dataset(s).

You can use whatever algorithm you want, and help from your favorite AI assistant.



The Data

The datasets contain planets with the following properties:



Each planetary system is identified by the system_number