

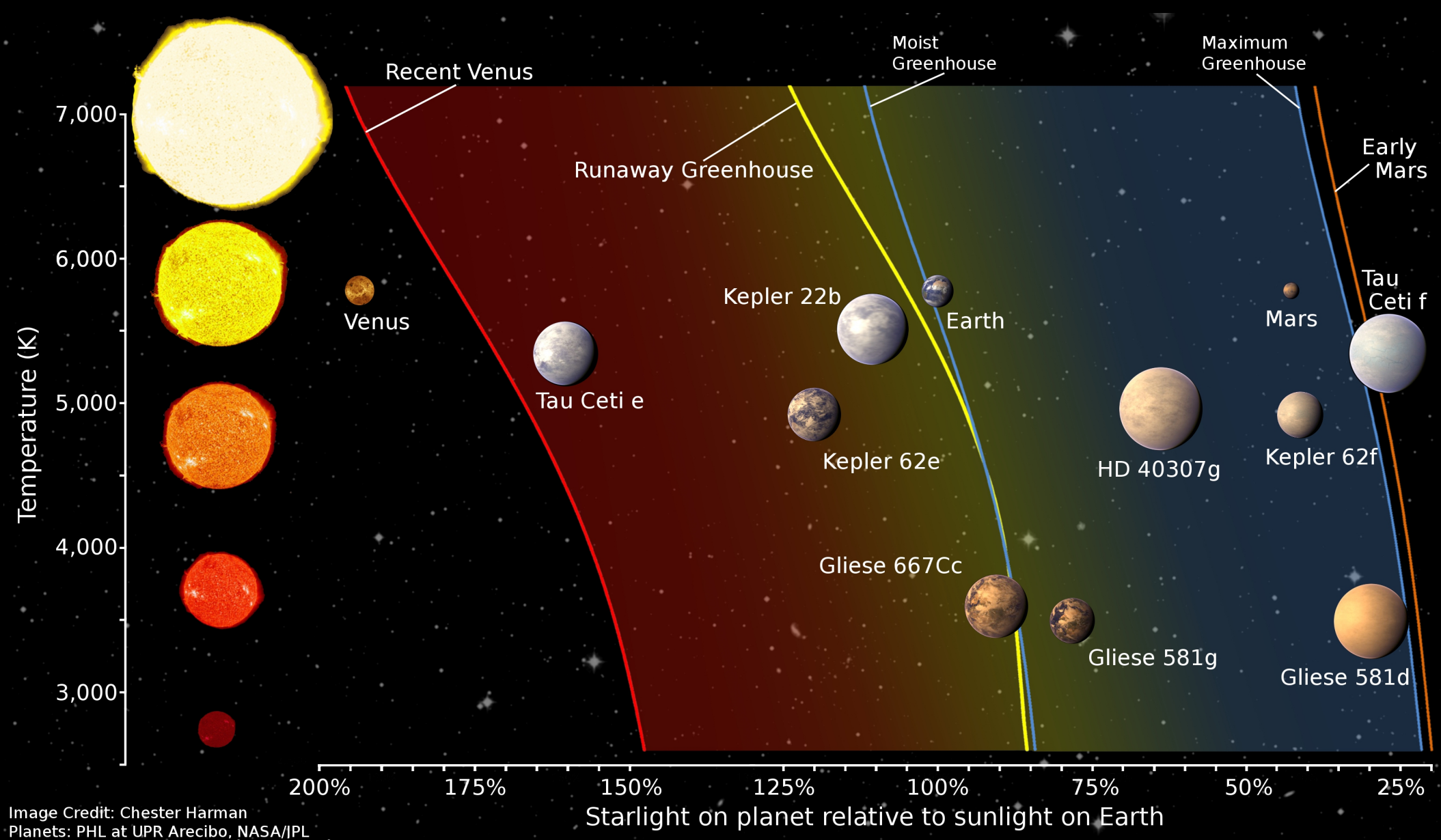
An Inconvenient Truth: Do We Really Know Where the Habitable Zone is?



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- **Conservative Habitable Zone: Runaway Greenhouse to Maximum Greenhouse**
- **Optimistic Habitable Zone: Recent Venus to Early Mars**

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TARGET SELECTION

Stellar Parameters



Kopparapu et al. 2013, 2014



Habitable Zone Boundaries

Stellar Parameters +/- X



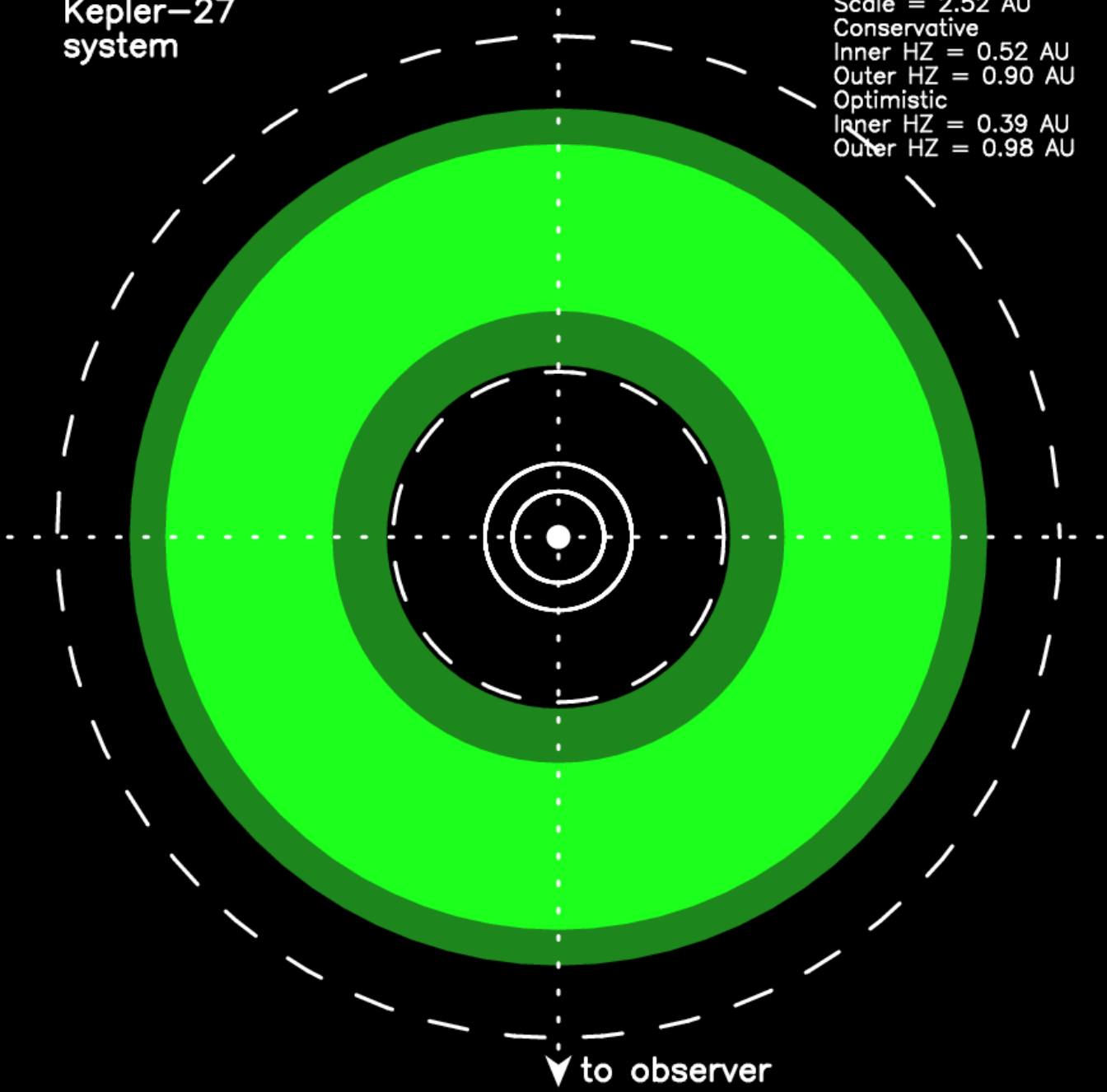
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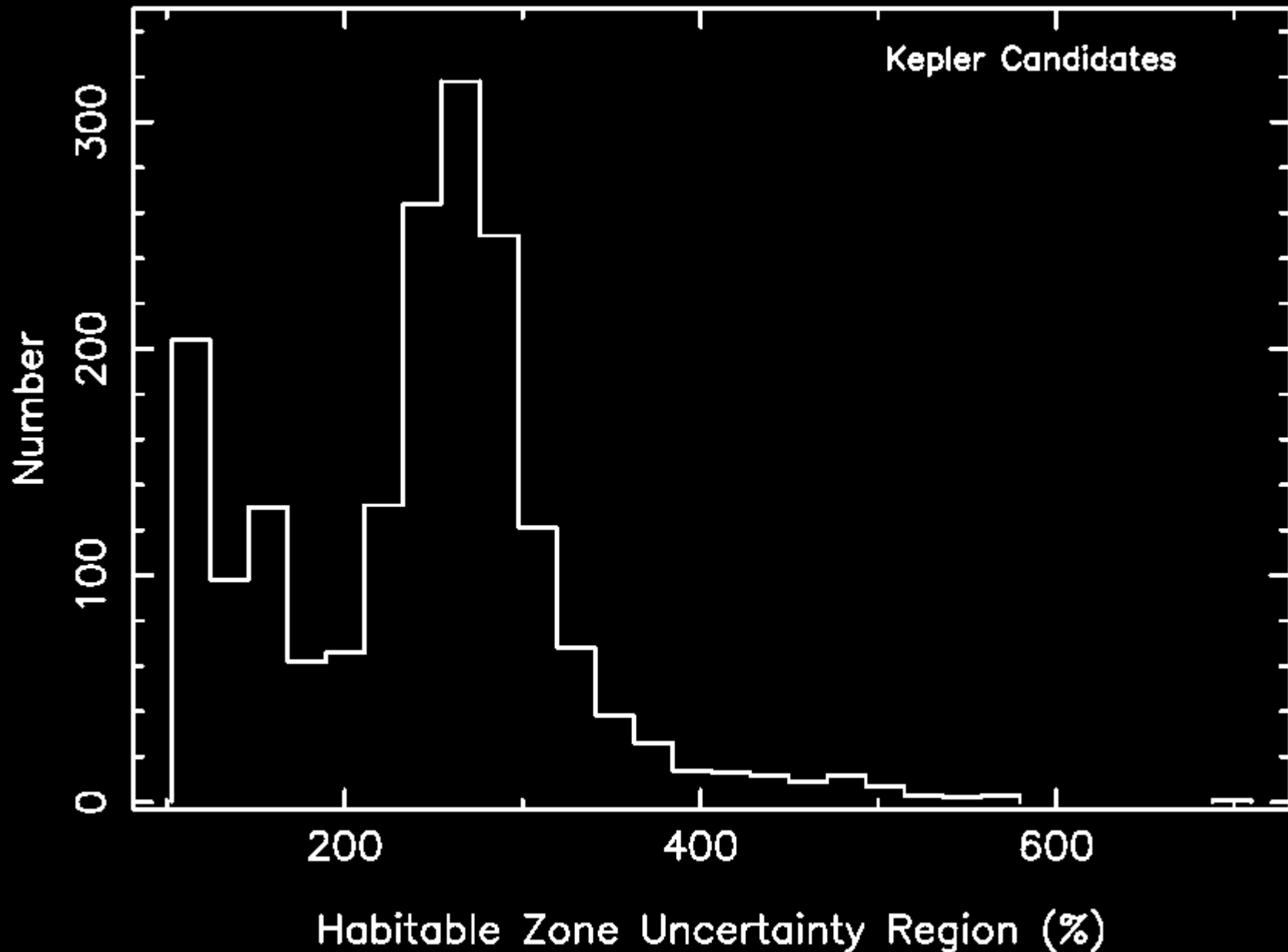
Habitable Zone Boundaries +/- Y

Kepler-27
system

Scale = 2.52 AU
Conservative
Inner HZ = 0.52 AU
Outer HZ = 0.90 AU
Optimistic
Inner HZ = 0.39 AU
Outer HZ = 0.98 AU



Where are the Habitable Zone Boundaries?



Admitting We Have a Problem



Doctor, my Habitable Zone boundaries are uncertain. What should I do?

Admitting We Have a Problem



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eta-Earth

Future mission planning

Admitting We Have a Problem



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Future mission planning

The Solution

- Propagate uncertainties through to Habitable Zone boundaries (Chandler et al. 2016, AJ, 151, 59).

Admitting We Have a Problem



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The Solution

- Propagate uncertainties through to Habitable Zone boundaries (Chandler et al. 2016, AJ, 151, 59).
- Determining accurate stellar parameters (Huber et al. 2017, ApJ, 844, 102).

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Future mission planning

The Solution

- Propagate uncertainties through to Habitable Zone boundaries (Chandler et al. 2016, AJ, 151, 59).
- Determining accurate stellar parameters (Huber et al. 2017, ApJ, 844, 102).
- Careful assessment of specific high priority mission targets.

Detection

- Transits
- Radial velocities
- Microlensing
- Imaging
- Observing strategies

Characterization

- Eccentricity
- Atmospheres
- Orbital stability
- Multiplicity
- Statistics

Habitability

- Habitable Zones
- Venus analogs
- Obliquity & eccentricity
- Atmospheric signatures
- Volcanic activity
- Target selection

**Graduate student
positions open!**

**Postdoctoral
positions open!**