

Properties of TPF Target Stars

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The Purpose of the TPF Mission

Goals: To directly detect and characterize Earth-like planets around nearby stars.

Habitable Zone: search the range of temperatures **within which life may be possible** on a terrestrial planet

$$0.7 \text{ to } 1.5 \text{ AU} \propto L_*^{1/2}$$

“Minimum” Mission:

Search 35 “core” stars to 90% completeness

“Full” Mission:

130 additional stars

90% completeness for ensemble

The Purpose of the TPF Mission

Spectral Characterization:

0.5 to 1.05 microns for TPF-C (O_2 , H_2O , O_3)

6.5 to 17 microns for TPF-I (CO_2 , H_2O , O_3)

Types of Planets:

at least 1/2 Earth surface area

Earth albedo

Habitable Zone, $e = 0$ to 0.35

Types of Stars:

Main Sequence

$\tau_{\text{MS}} > 2 \text{ Gyr}$

F, G and K stars

The Cost

\$1 billion

Choosing TPF Targets

**Approach #1: Instrumental Approach
(i.e. observe the “easy” targets)**

Choosing TPF Targets

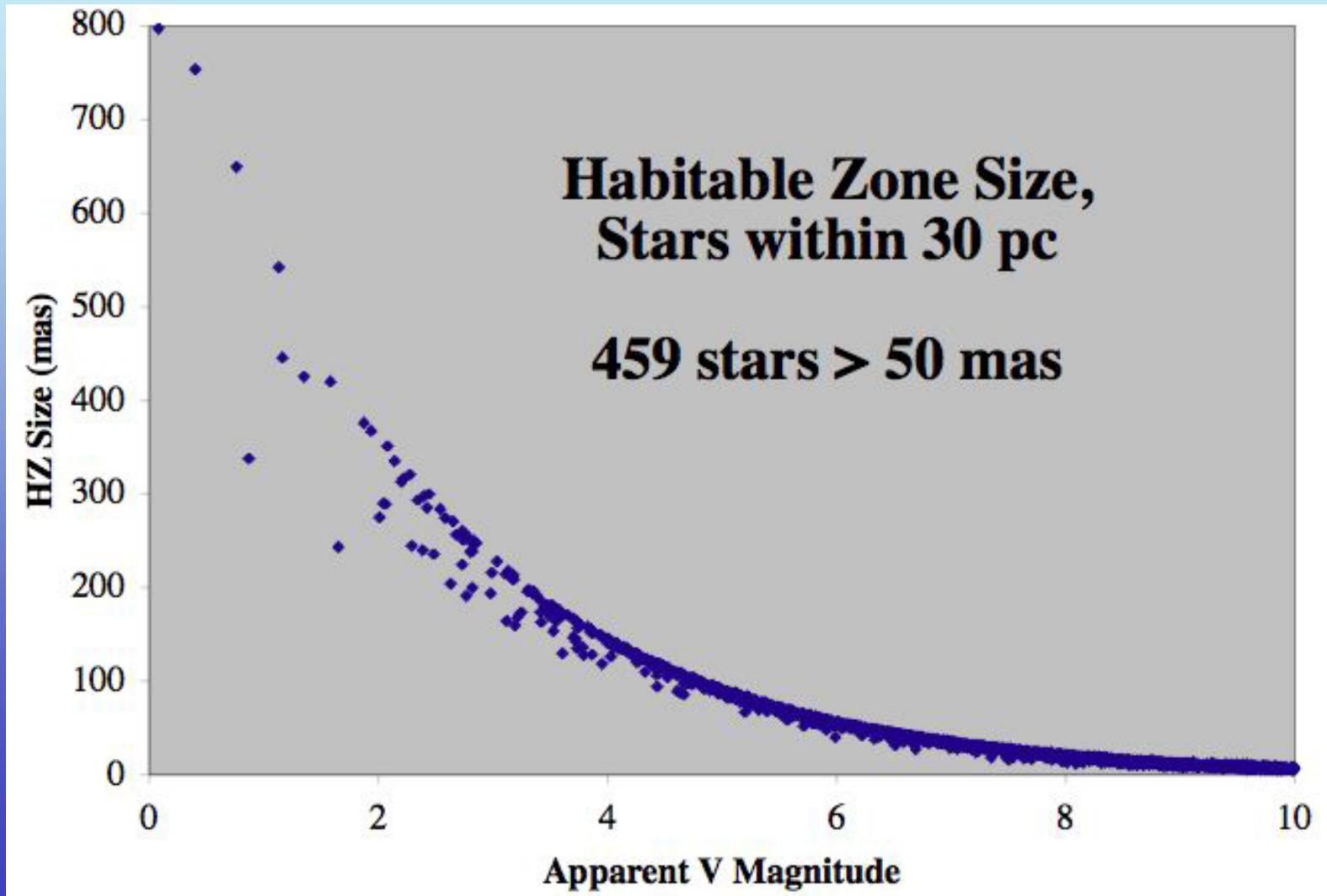
**Approach #1: Instrumental Approach
(i.e. observe the “easy” targets)**

NOTES:

- 1. angular HZ size depends on stellar apparent V magnitude**
 - 5th mag -> 100 mas**
 - 6th mag -> 50 mas**
 - 7th mag -> 30 mas**

Choosing TPF Targets

Approach #1: Instrumental Approach



Choosing TPF Targets

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Choosing TPF Targets

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NOTES:

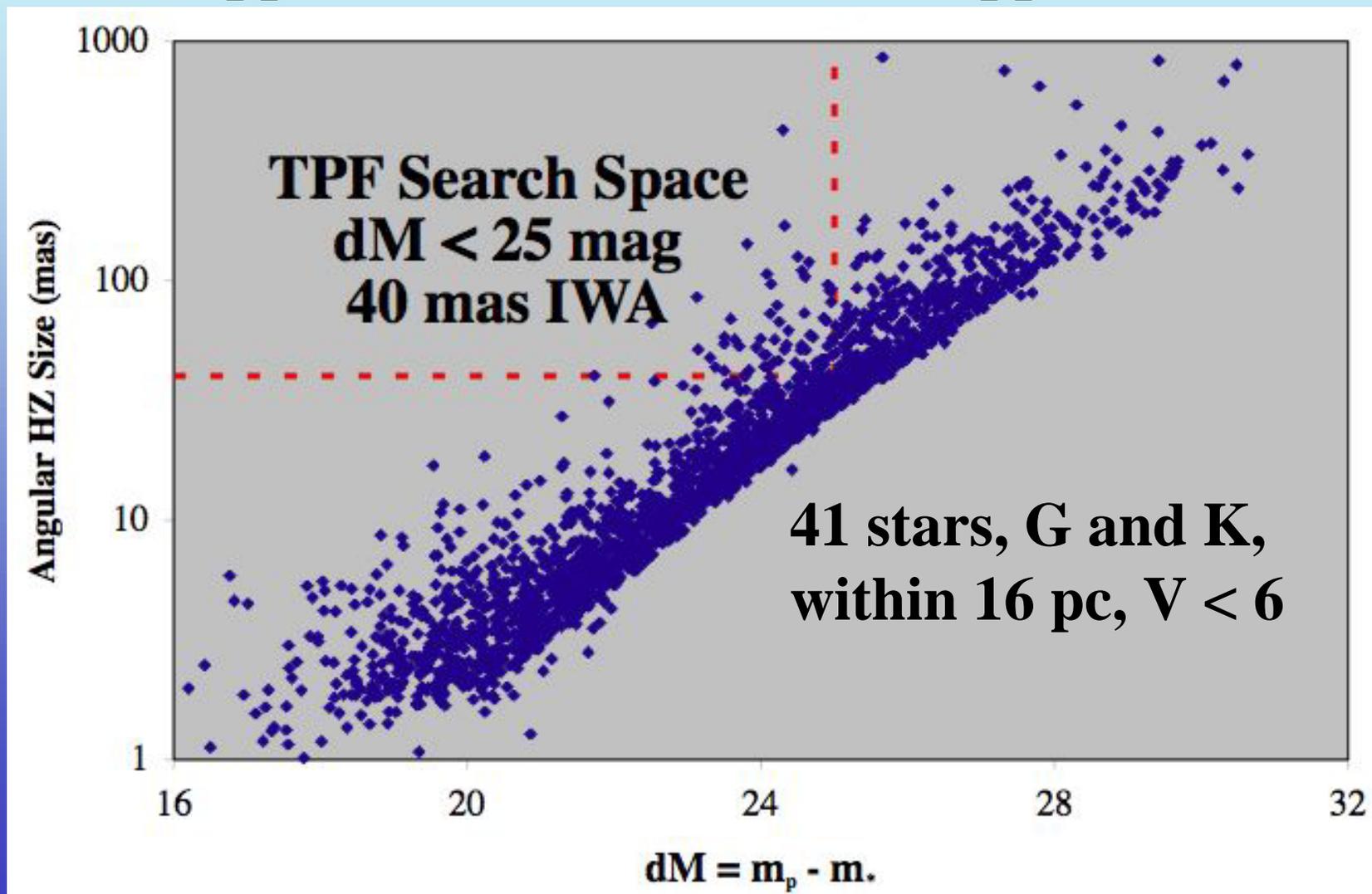
2. planet brightness depends upon $1/(\text{distance})^2$

10 pc -> 30th mag

33 pc -> 32.5th mag

Choosing TPF Targets

Approach #1: Instrumental Approach



Choosing TPF Targets

**Approach #2: Scientific Approach
(i.e. observe the “best” targets)**

NOTES:

- 1. TPF targets will likely be a subset of or strongly intersecting set with SIM and RV search targets.**
- 2. What is the conclusion in the case of a null result?**

Habstars as TPF Targets

habstar, 'hab stār, *noun*, -s

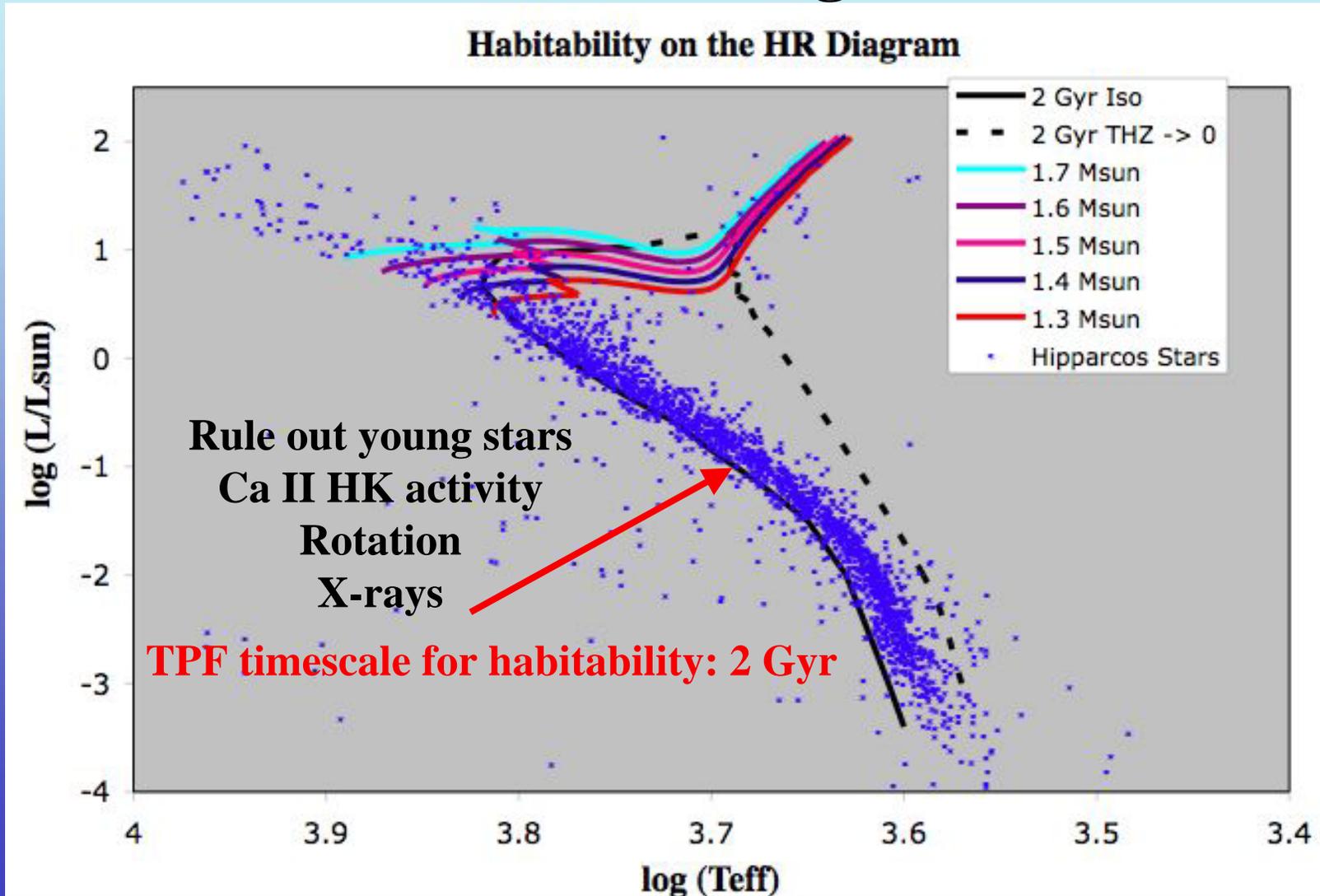
A star which has:

- (1) A *habitable zone* that is *dynamically stable** on a *timescale* that is comparable to the timescale of *global biosignature* production,
- (2) A habitable zone that is *spatially static* on that same timescale, and
- (3) A *metallicity* that is consistent with the existence of *terrestrial planets*.

* and does not overlap any major resonances w/companions

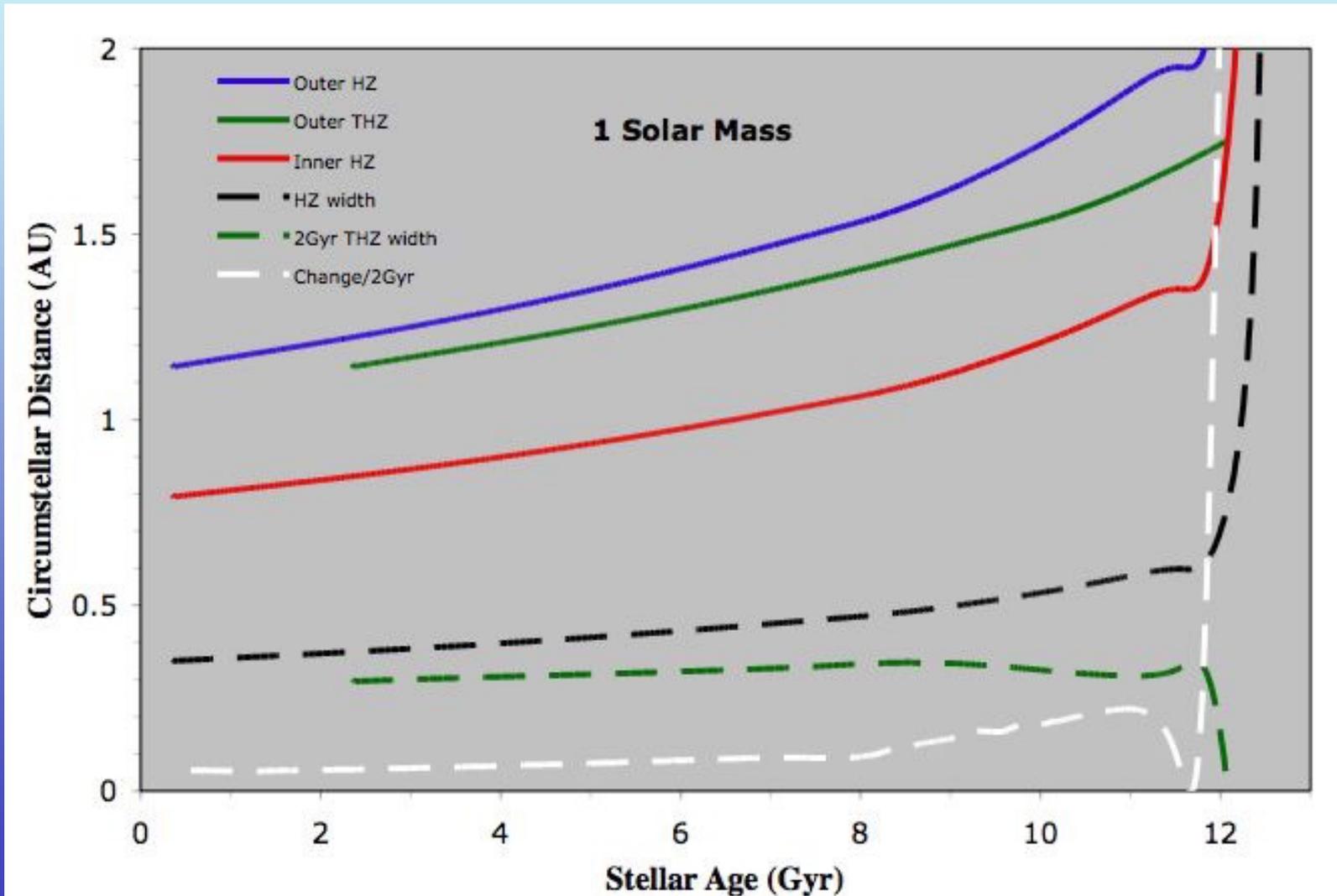
Habstars as TPF Targets

1. Timescale for Global Biosignature Production



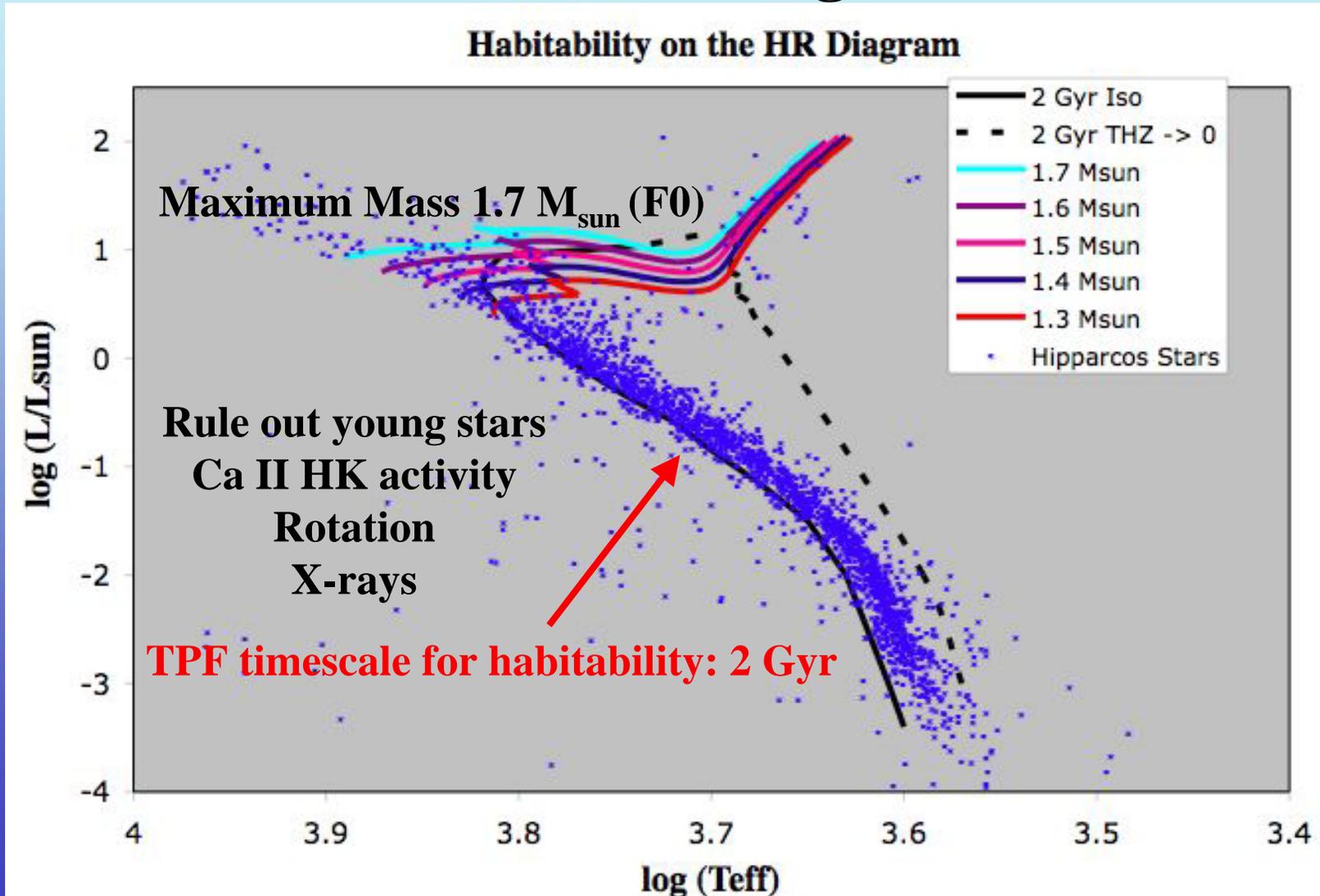
Habstars as TPF Targets

1. Timescale for Global Biosignature Production



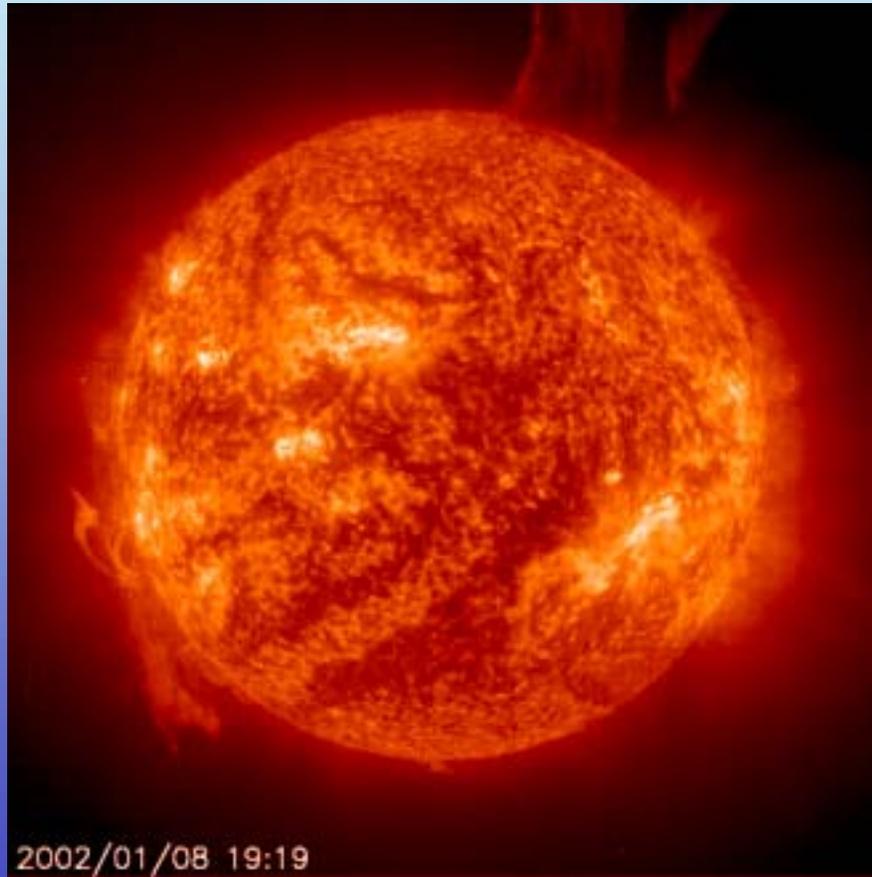
Habstars as TPF Targets

1. Timescale for Global Biosignature Production

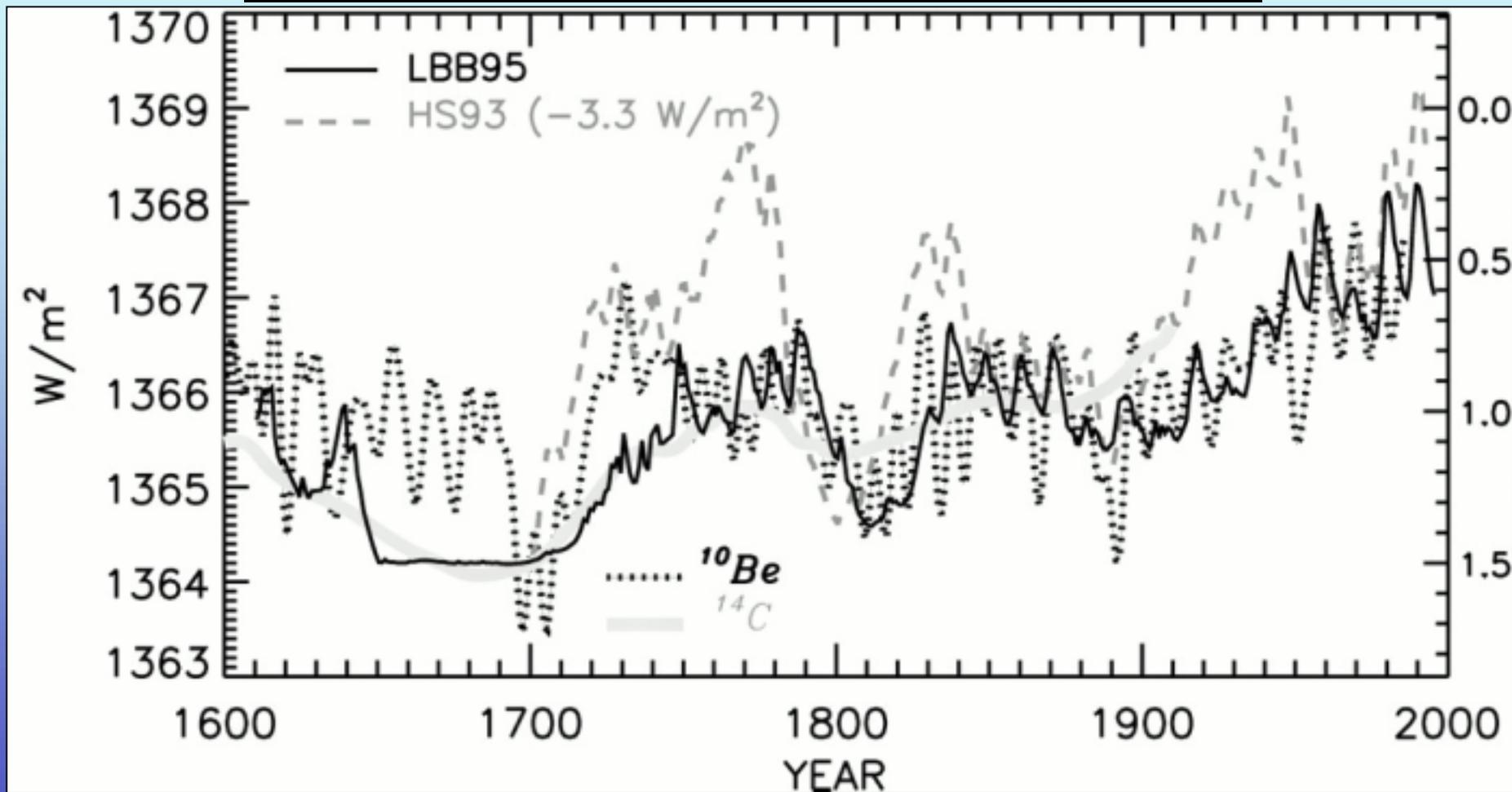


Habstars as TPF Targets

1. Timescale for Global Biosignature Production



Habstars as TPF Targets



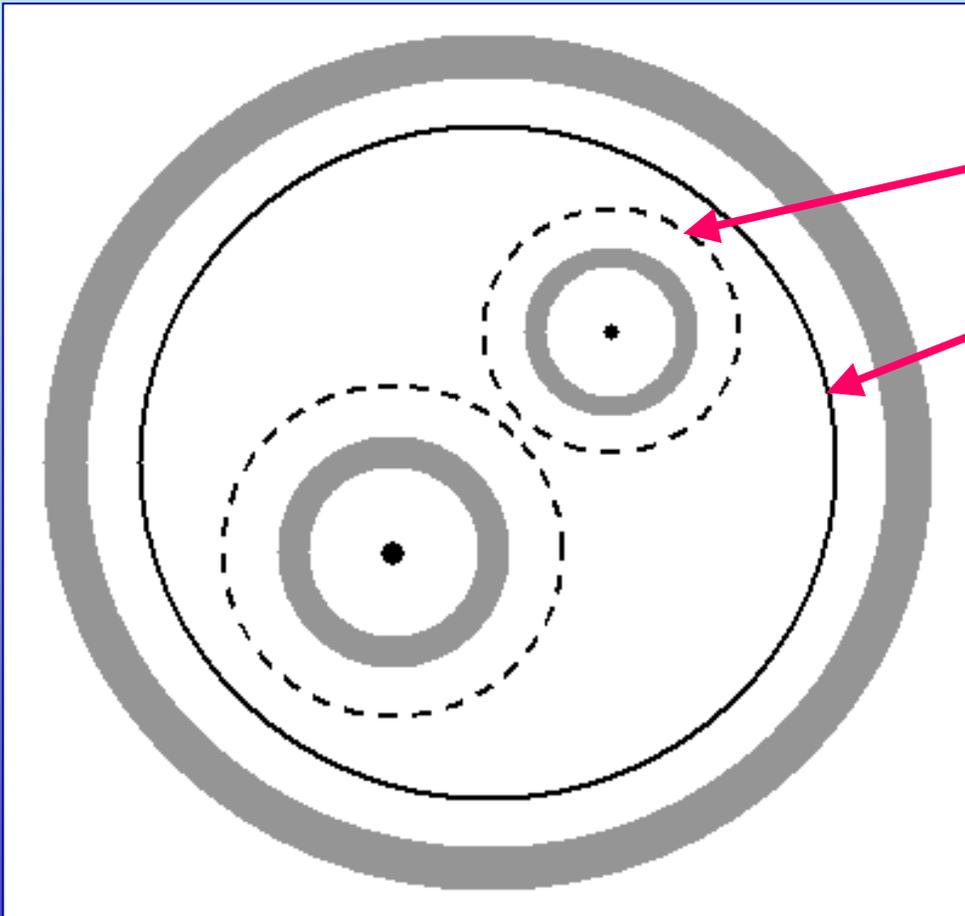
Lean 1997, ARA&A, 35, 33

Wilson & Hudson 1991, Nature, 351, 42

Tkachuck 1983, Origins, 10, 51

Habstars as TPF Targets

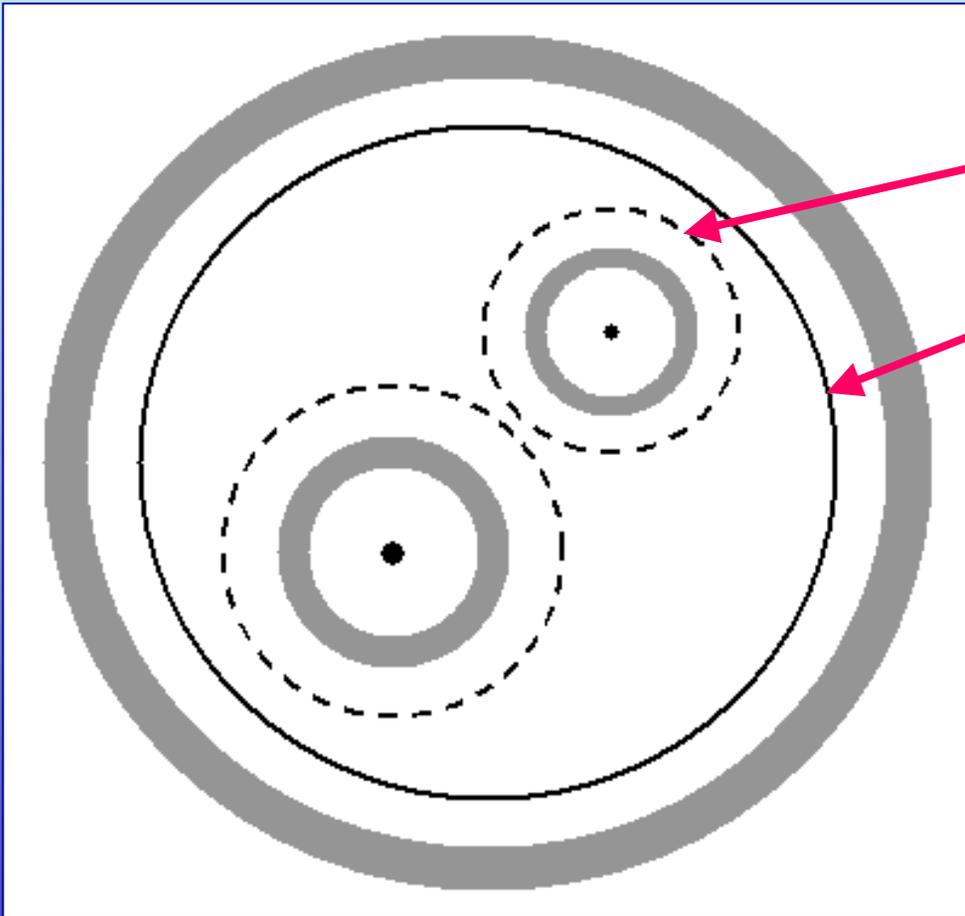
1. Dynamical Stability



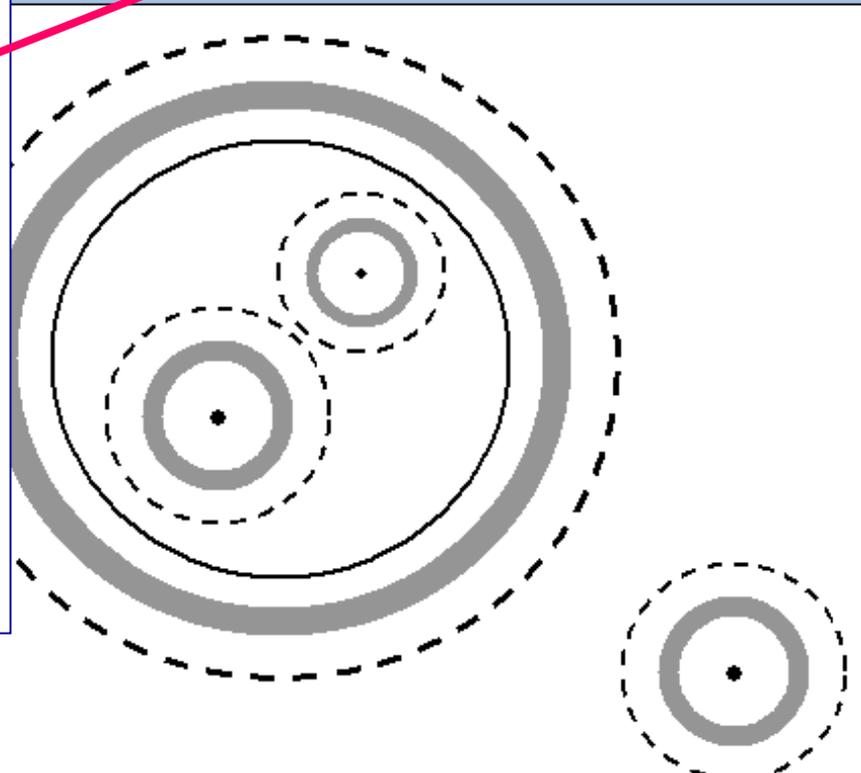
Safe *interior* to here
Safe *exterior* to here

Habstars as TPF Targets

2. Dynamical Stability

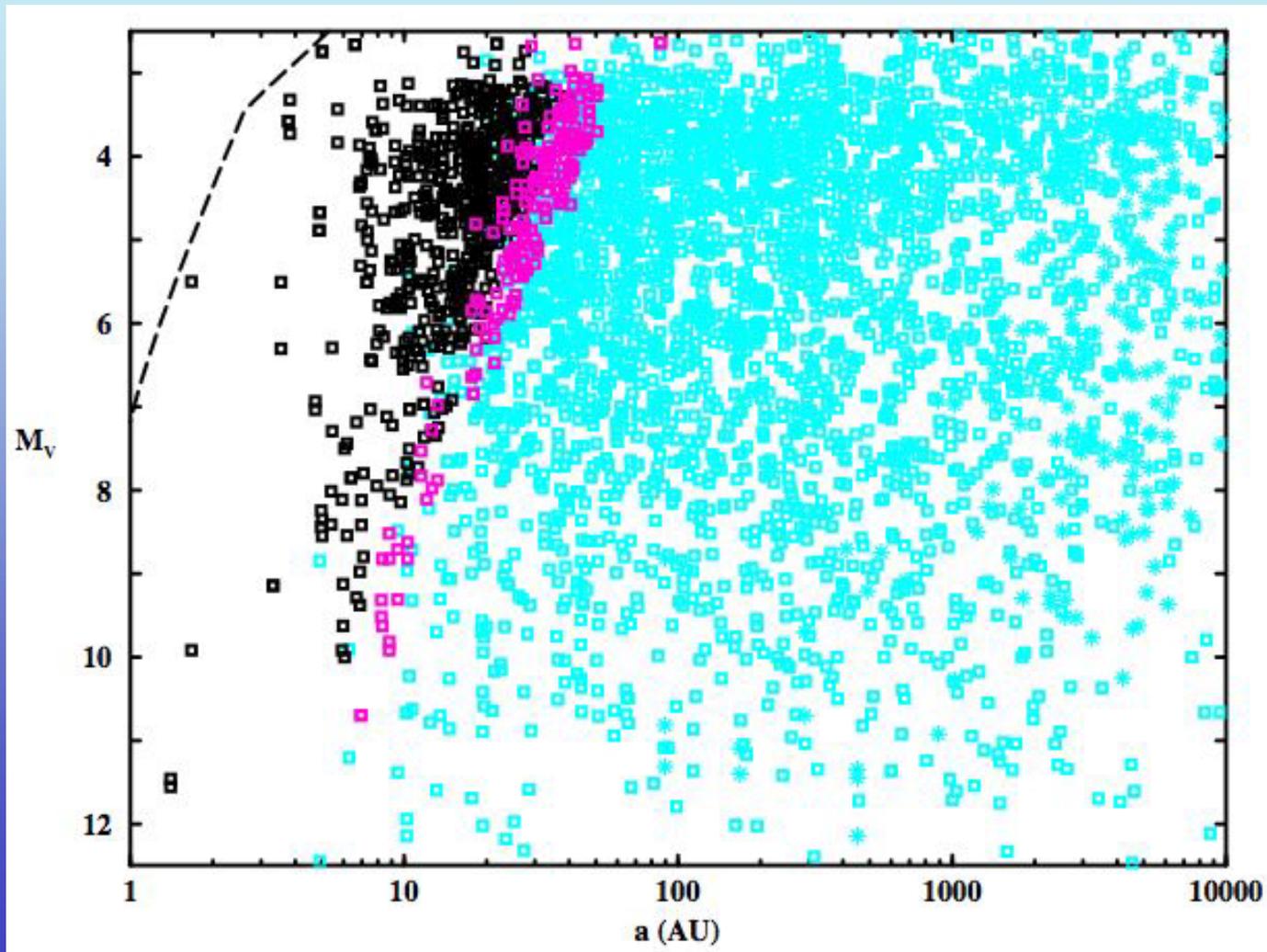


Safe interior to here
Safe exterior to here



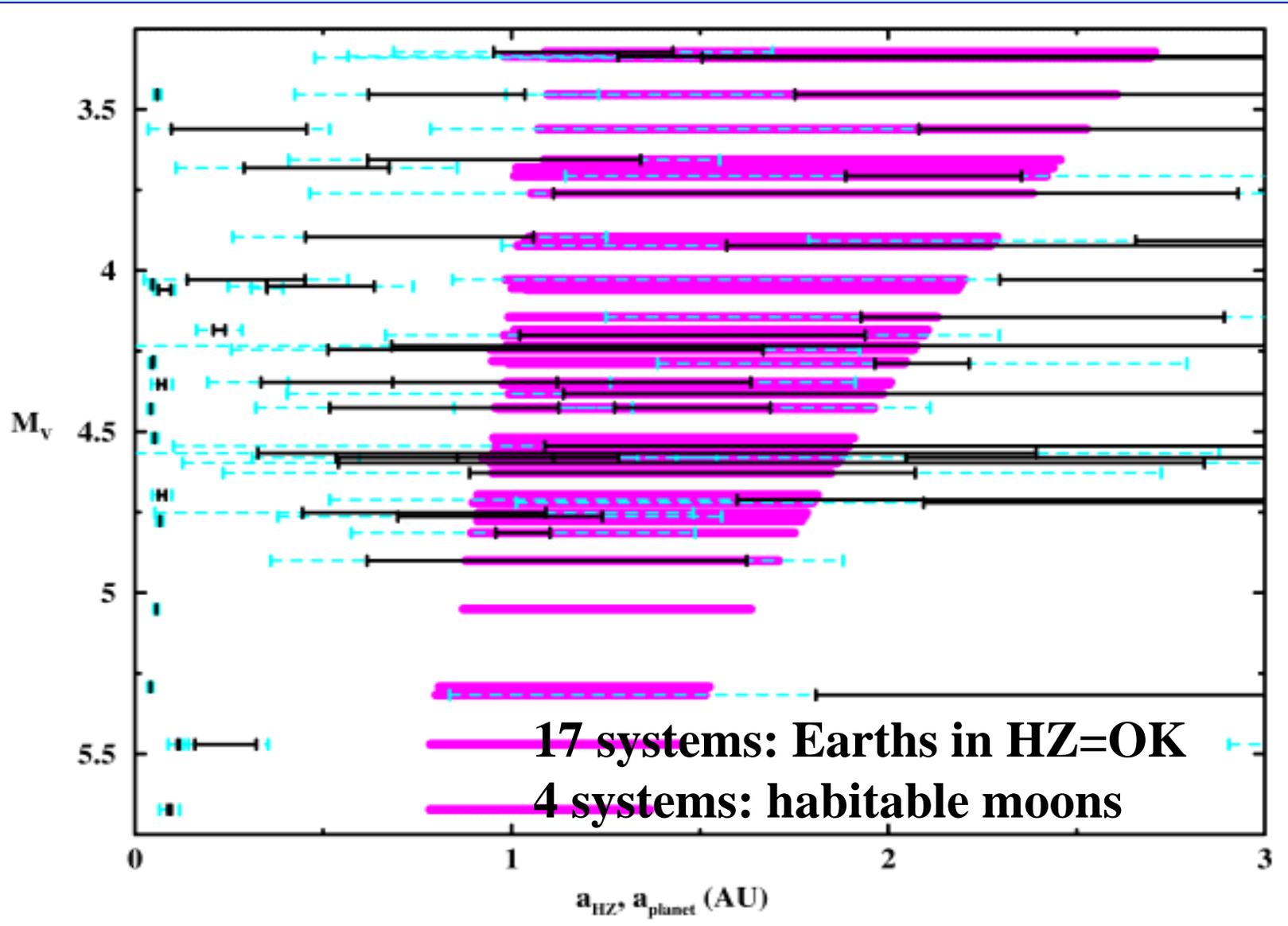
Habstars as TPF Targets

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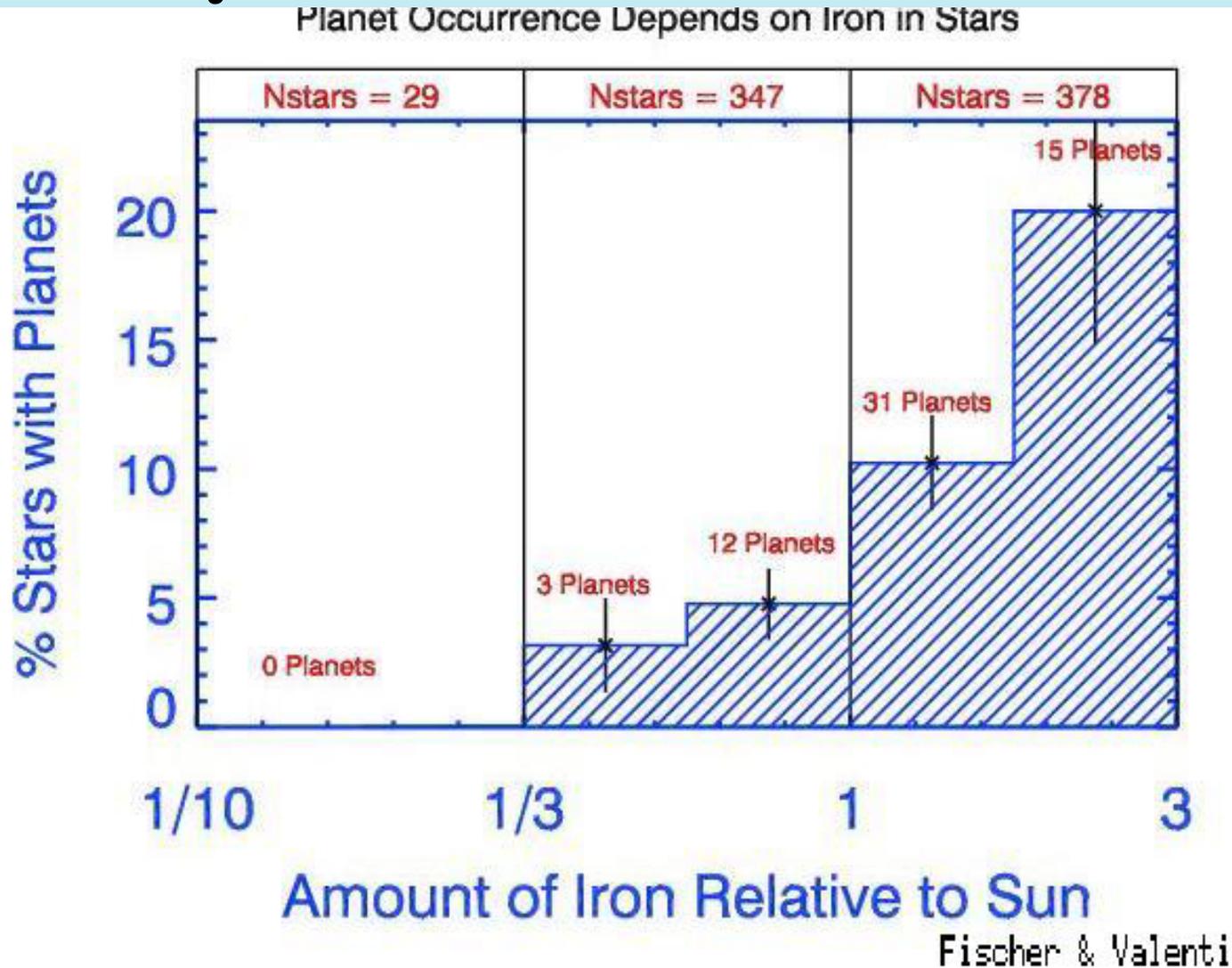
Habstars as TPF Targets

2.



Habstars as TPF Targets

3. Metallicity



Habstars as TPF Targets

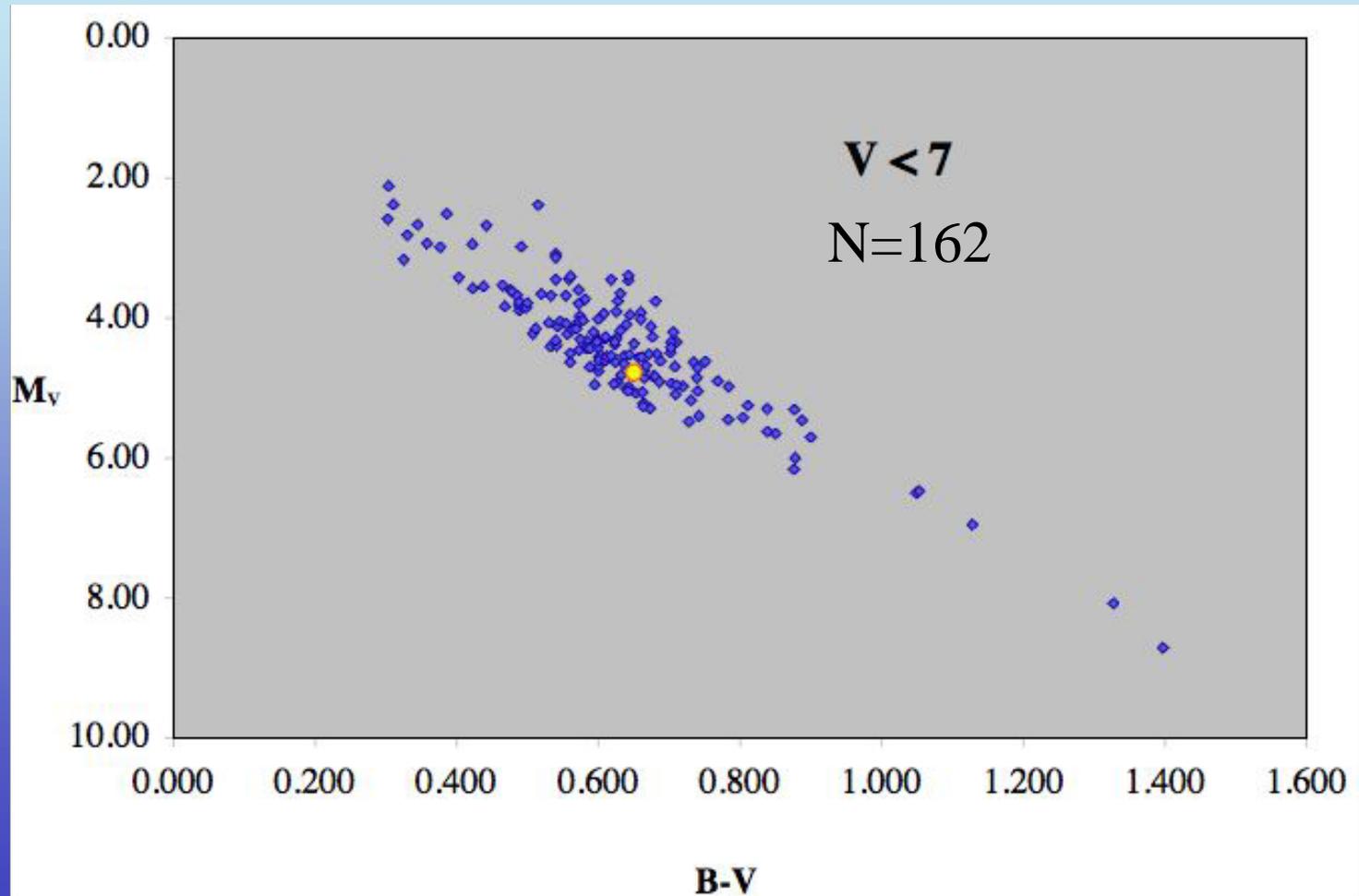
3.5 Kinematics



X-ing
?

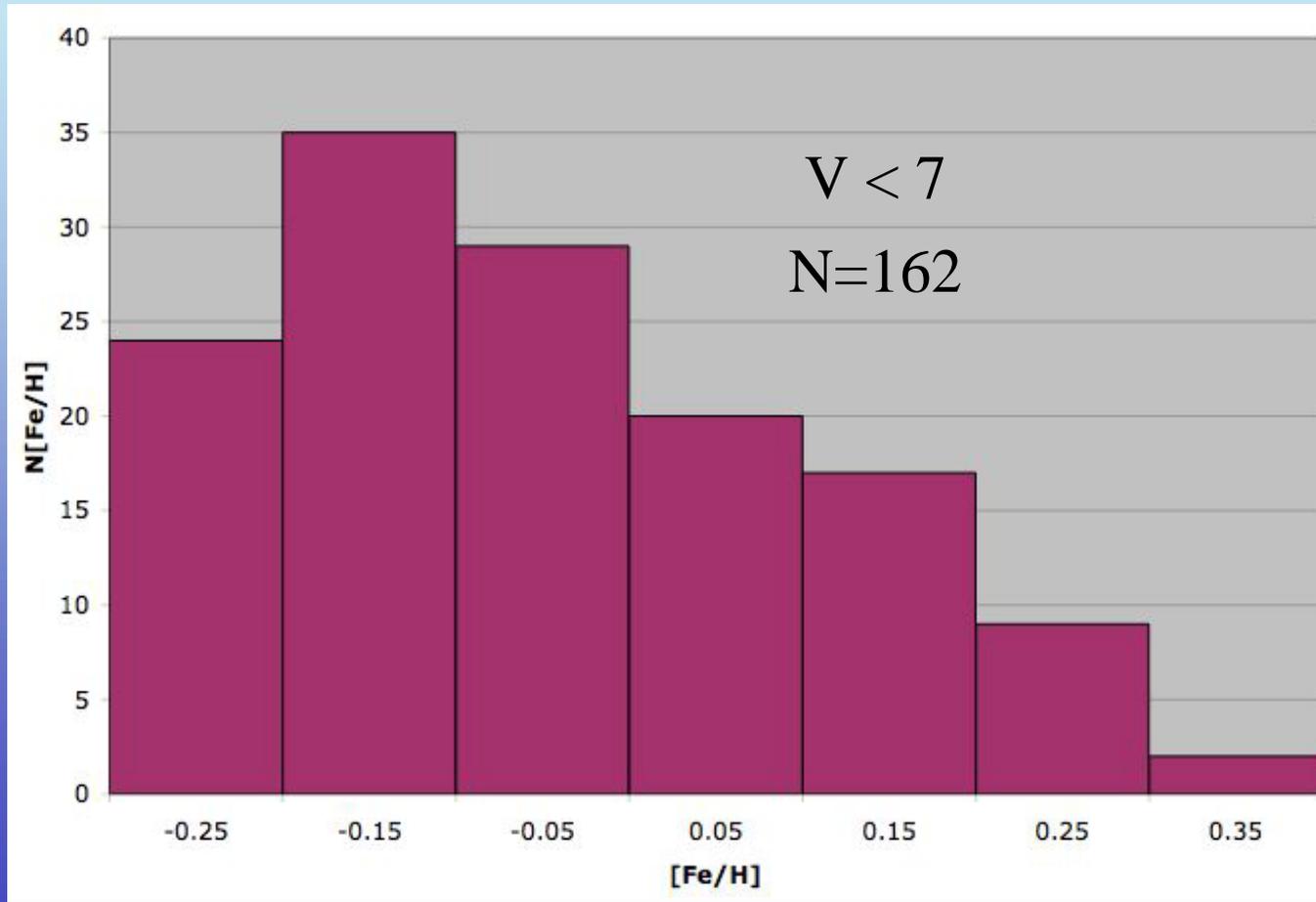
Habstars as TPF Targets

Results: 479 Scientifically Interesting Targets



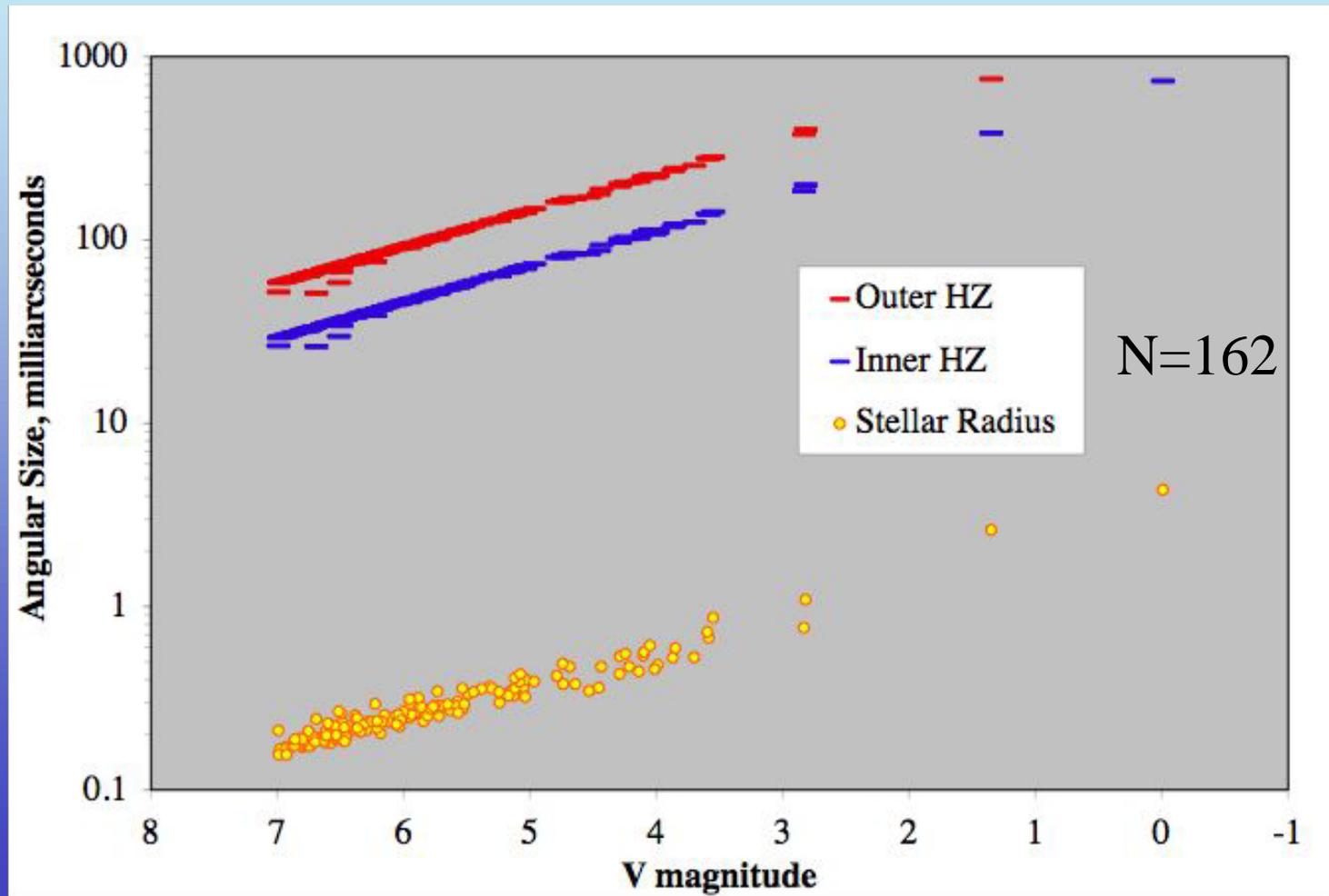
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