EXOPLANET GALACTIC-ADDRESS DEPENDENECE: The Small Planet Decline

Jon Zink

October 4th , 2023 DPS Press Panel

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Caltech

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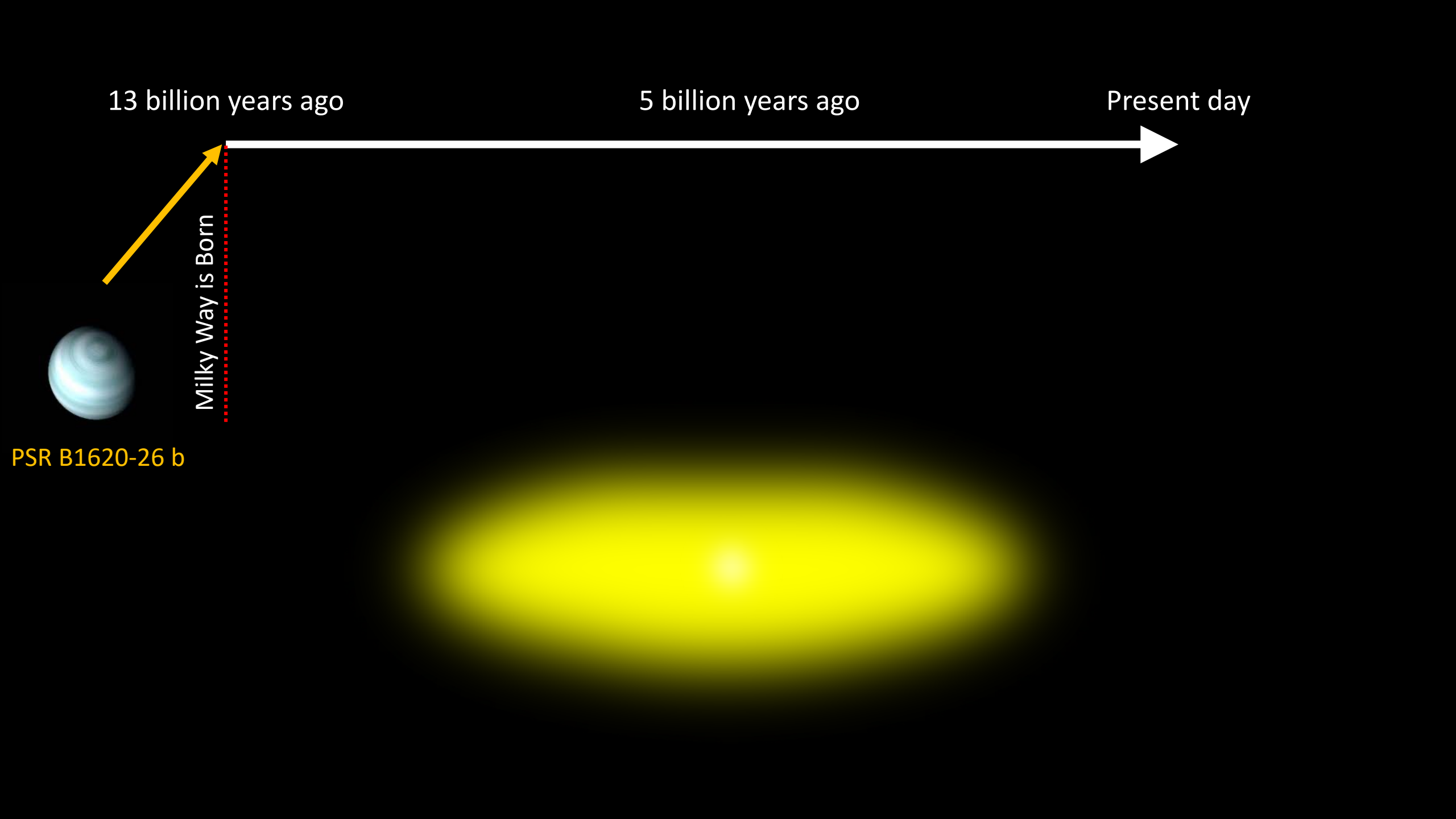
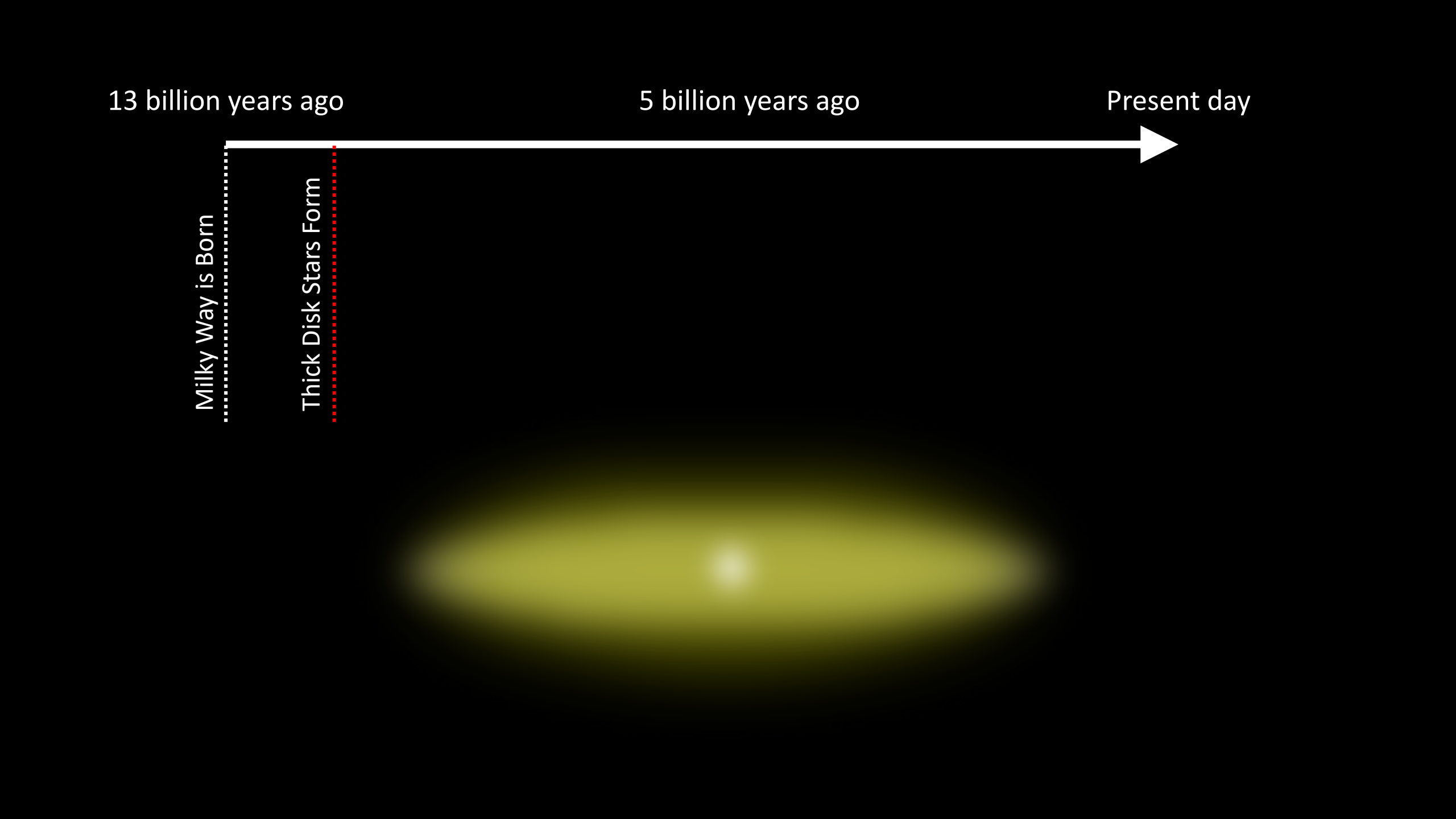
13 billion years ago

5 billion years ago

Present day

Milky Way is Born


13 billion years ago
5 billion years ago
Present day
Milky Way is Born
PSR B1620-26 b


13 billion years ago
5 billion years ago
Present day
Milky Way is Born
Thick Disk Stars Form

13 billion years ago

5 billion years ago

Present day

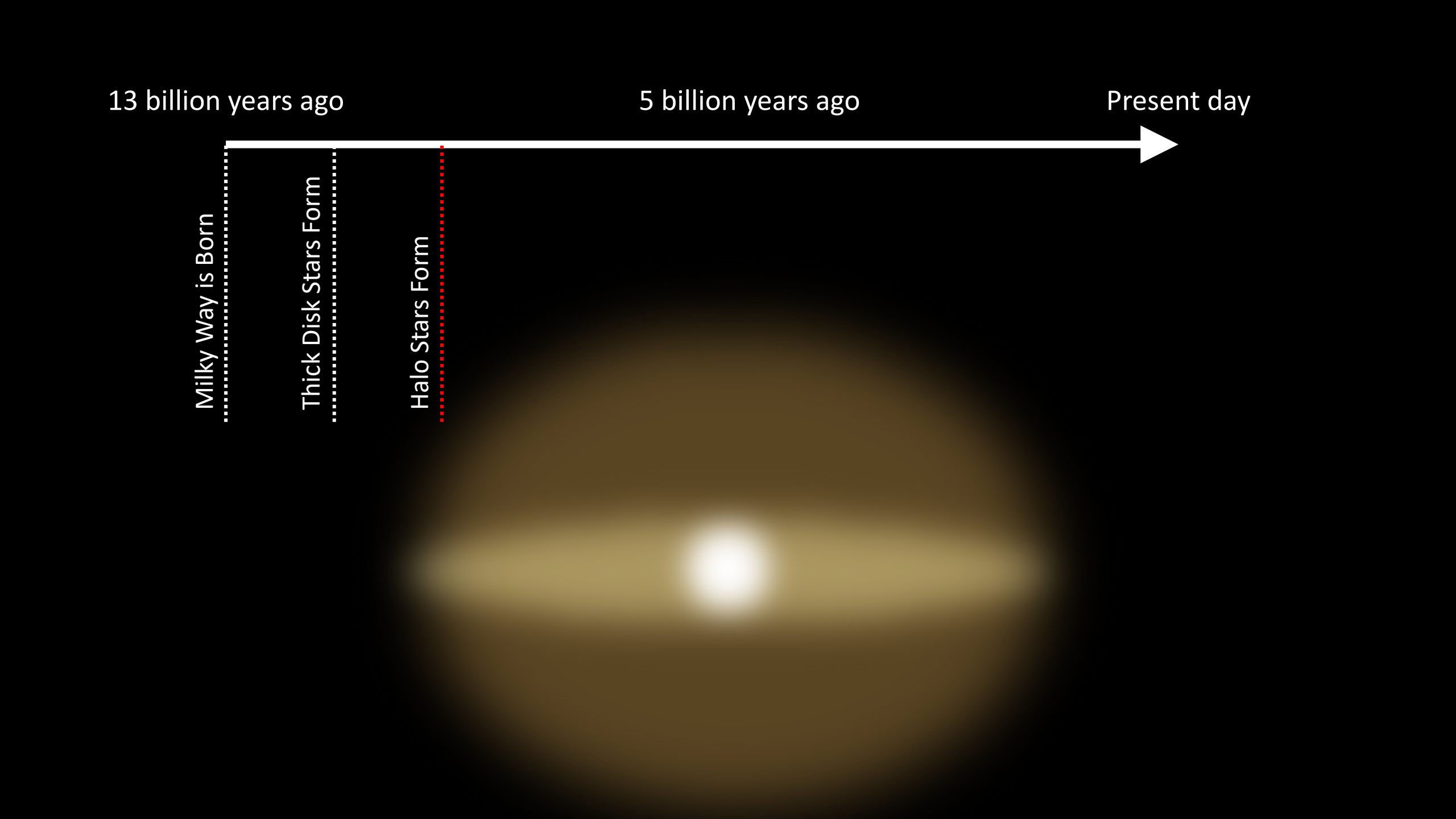
Milky Way is Born

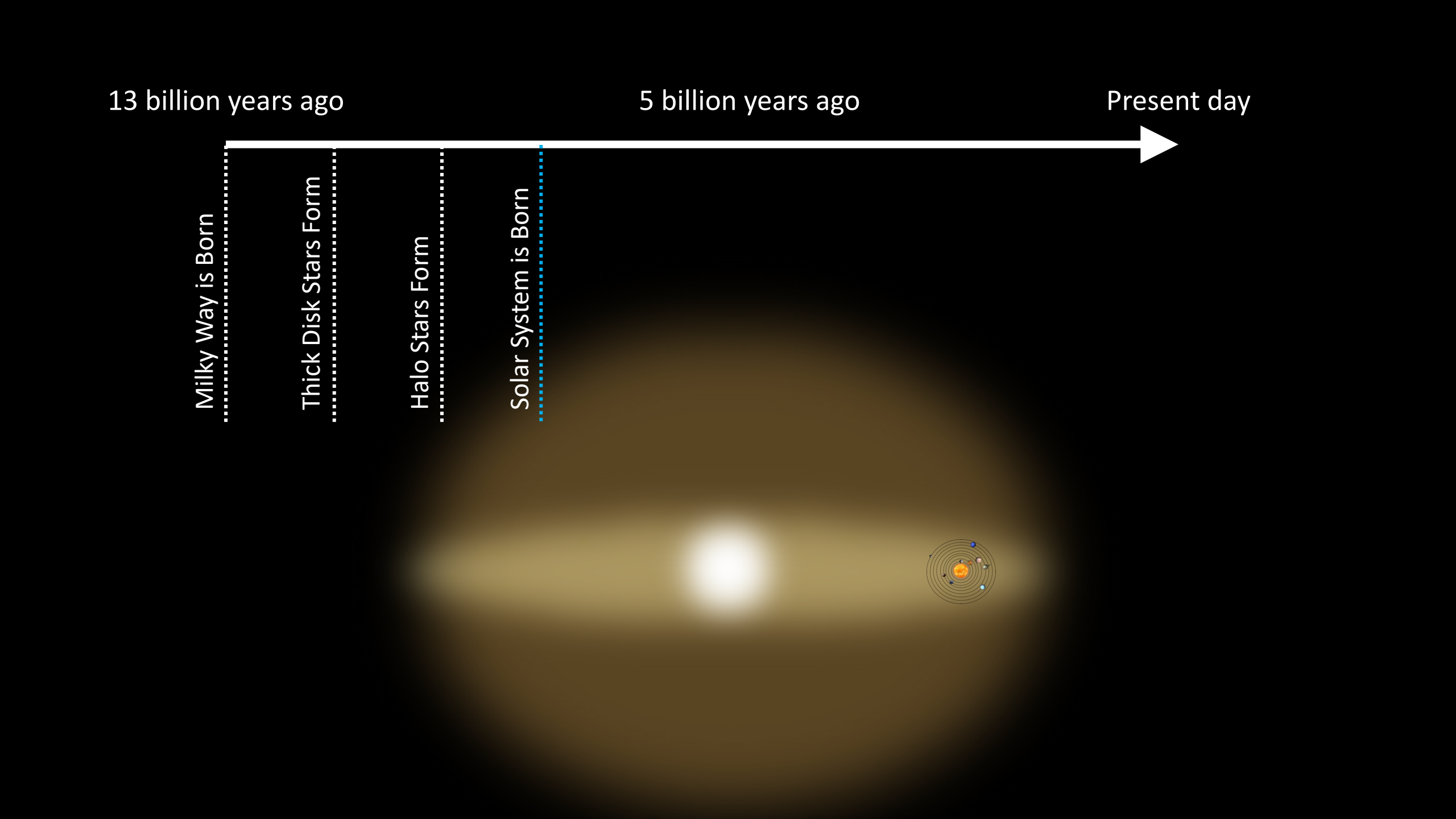
Thick Disk Stars Form

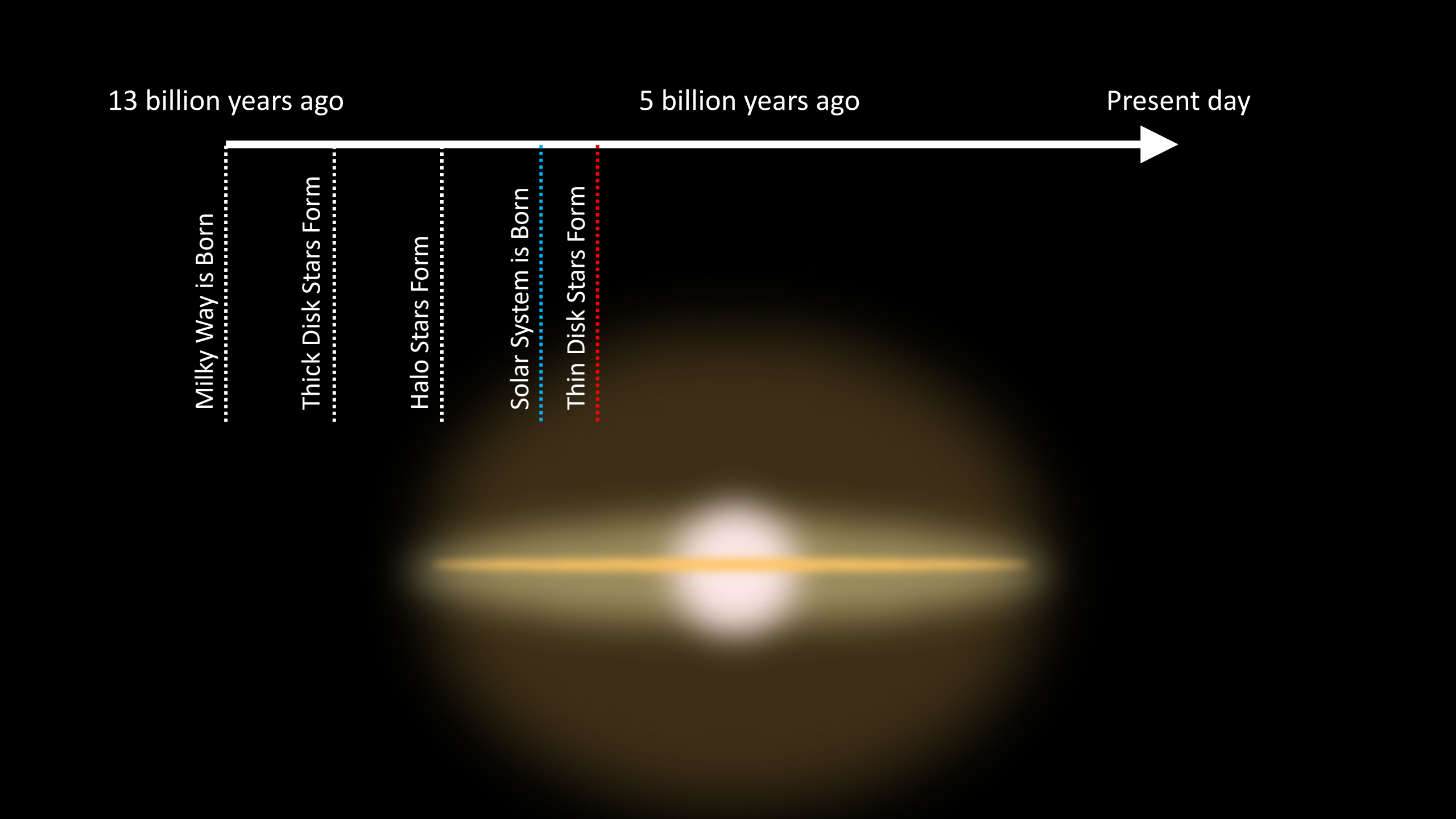
ERA OF HEIGHTENED α ELEMENT ABUNDANCES

- Type II SN Dominate

Roughly 75% of the Earth's crust is made up of α elements (silicon & oxygen)


13 billion years ago
5 billion years ago
Present day
Milky Way is Born
Thick Disk Stars Form
Halo Stars Form


13 billion years ago
5 billion years ago
Present day
Milky Way is Born
Thick Disk Stars Form
Halo Stars Form
Solar System is Born


13 billion years ago
5 billion years ago
Present day
Milky Way is Born
Thick Disk Stars Form
Halo Stars Form
Solar System is Born
Thin Disk Stars Form

13 billion years ago

5 billion years ago

Present day

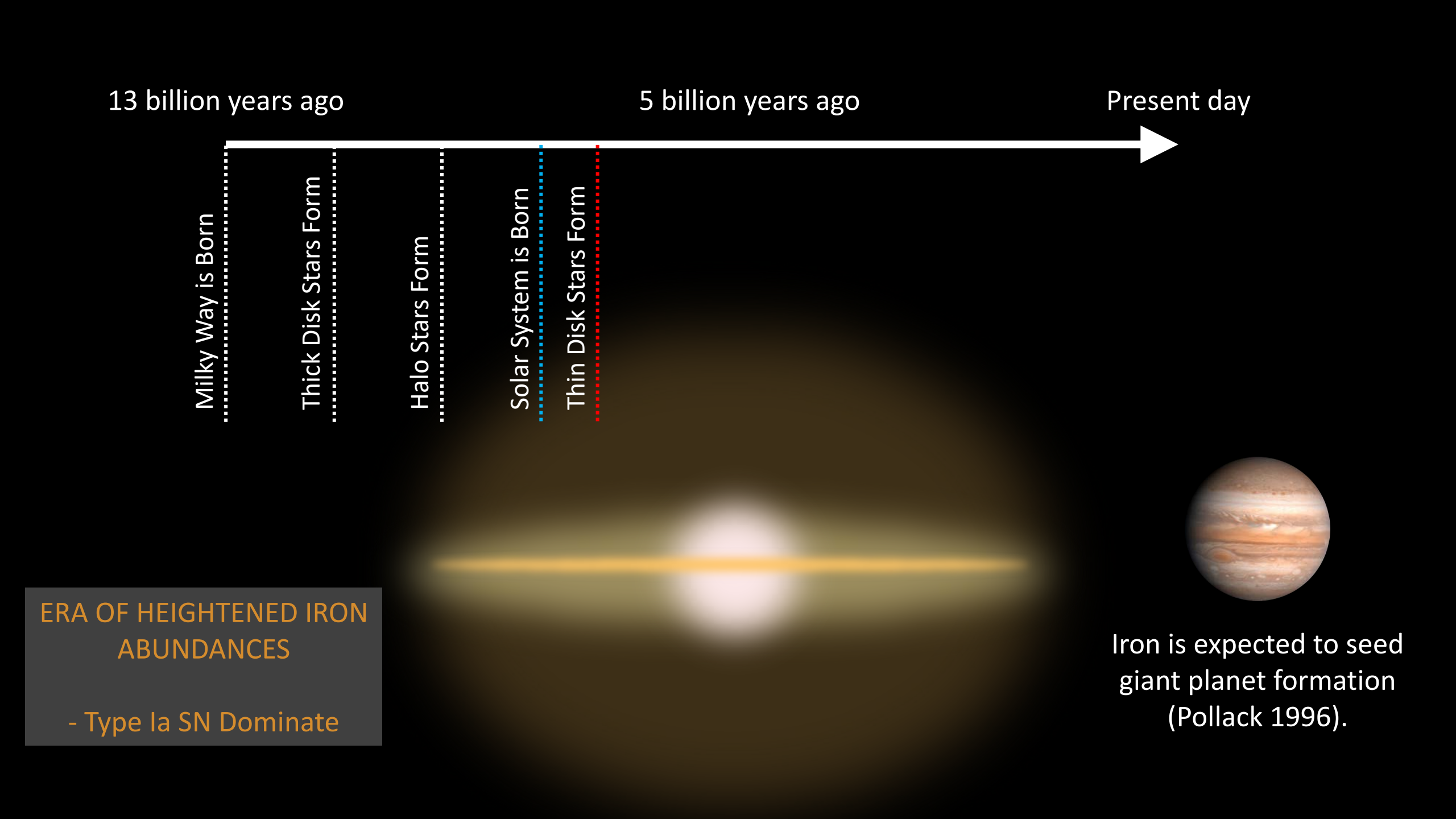
Milky Way is Born

Thick Disk Stars Form

Halo Stars Form

Solar System is Born

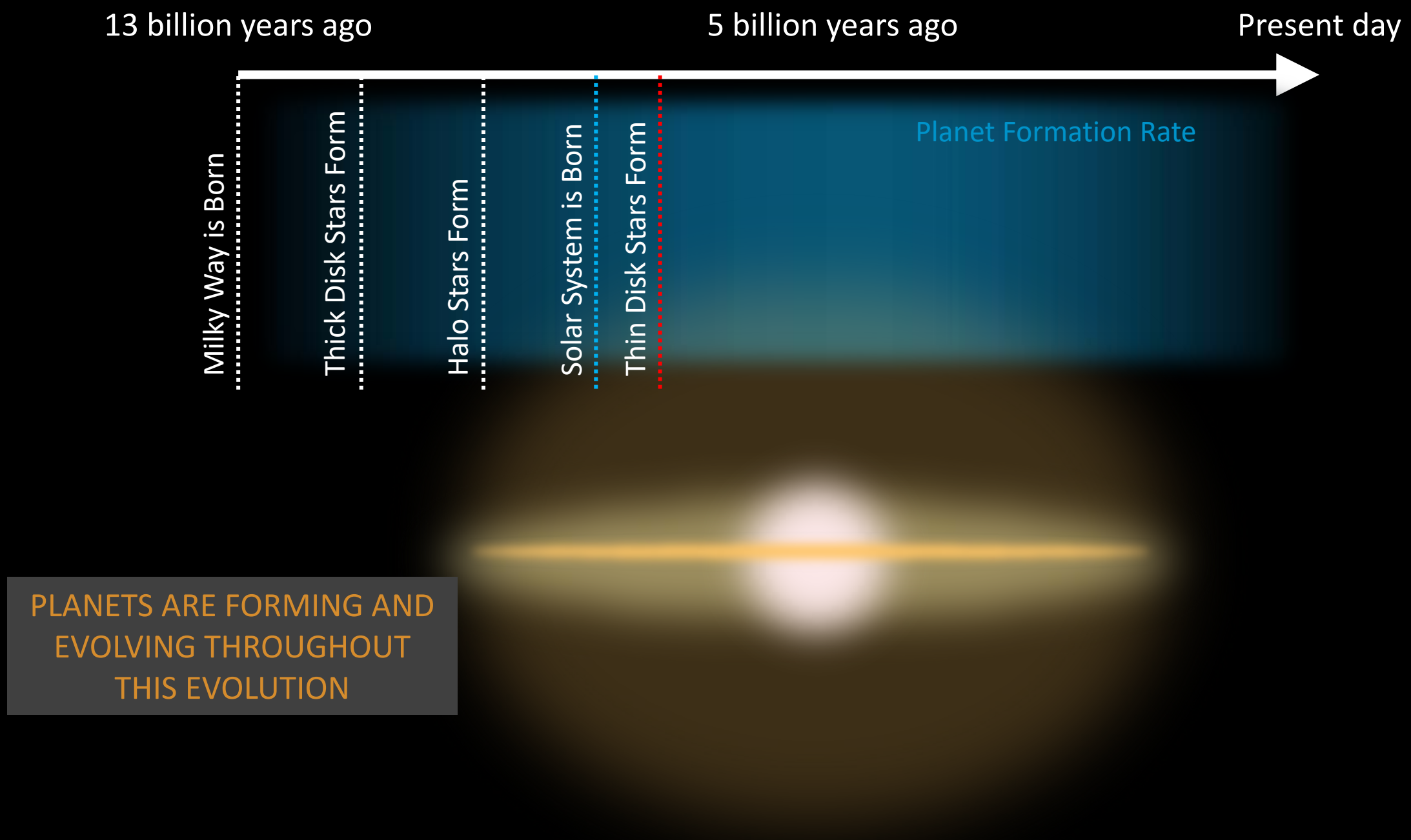
Thin Disk Stars Form



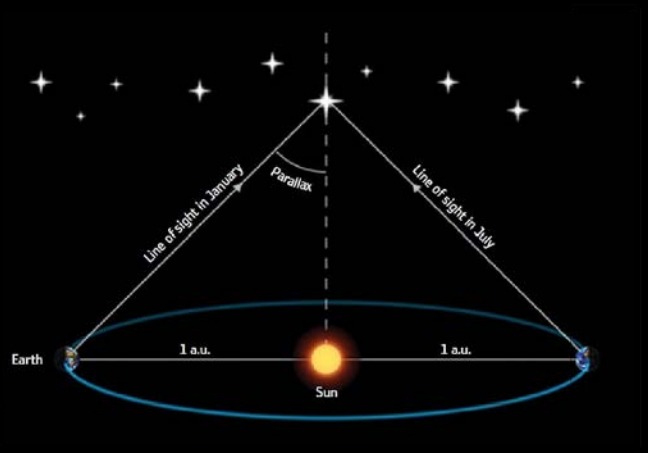
ERA OF HEIGHTENED IRON ABUNDANCES

- Type Ia SN Dominate

Iron is expected to seed giant planet formation (Pollack 1996).


13 billion years ago
5 billion years ago
Present day
Milky Way is Born
Thick Disk Stars Form
Halo Stars Form
Solar System is Born
Thin Disk Stars Form
Planet Formation Rate
PLANETS ARE FORMING AND EVOLVING THROUGHOUT THIS EVOLUTION

GAIA Astrometry Enables Measurement of the Star's Amplitude



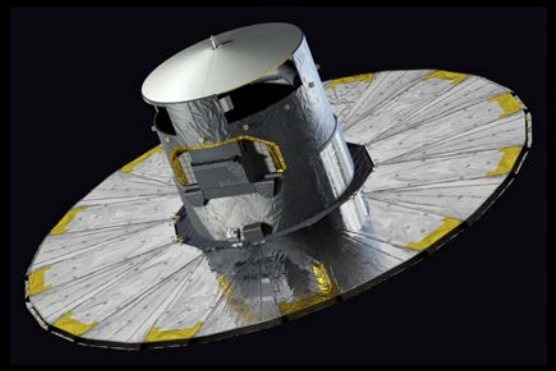
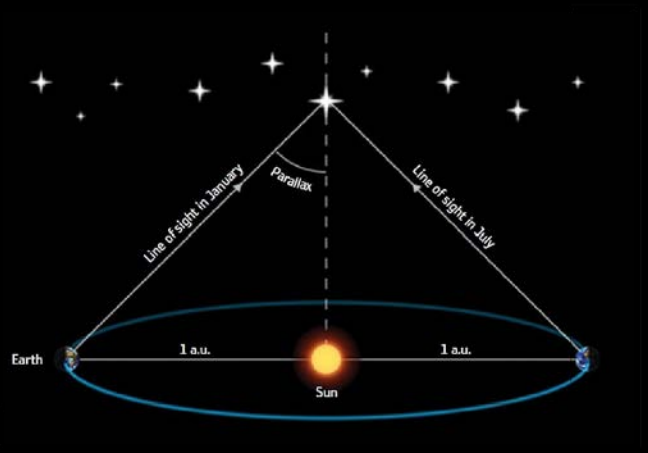
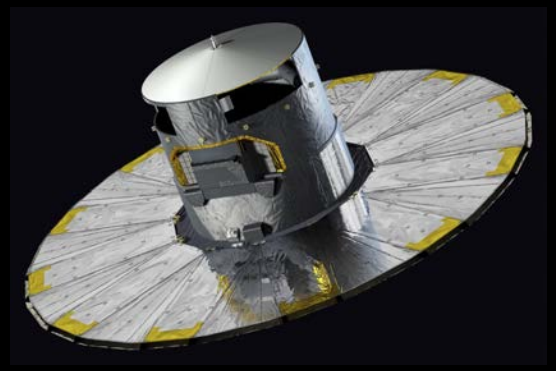


Image Credit: ESA

GAIA Astrometry Enables Measurement of the Star's Amplitude





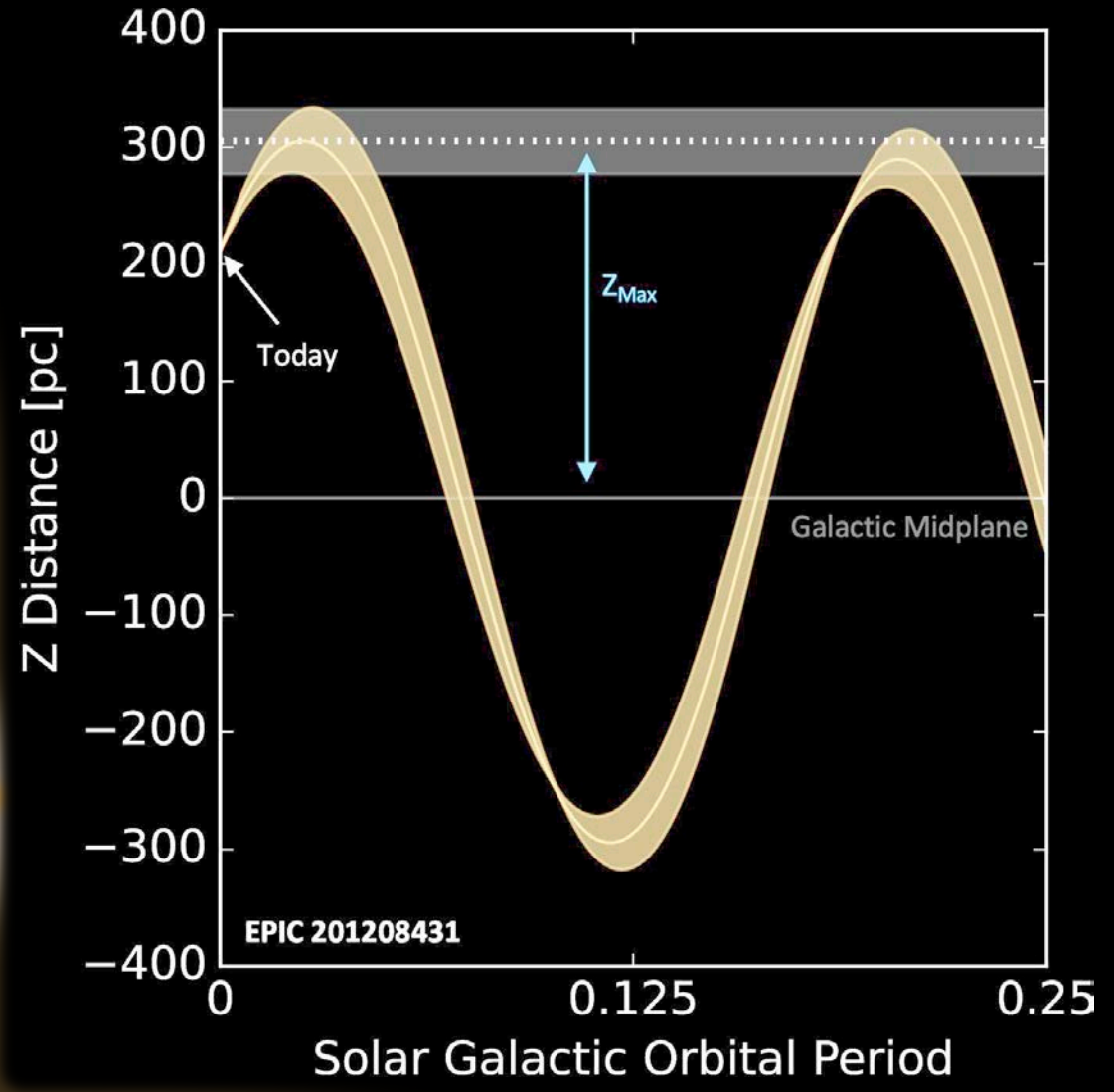


Image Credit: ESA

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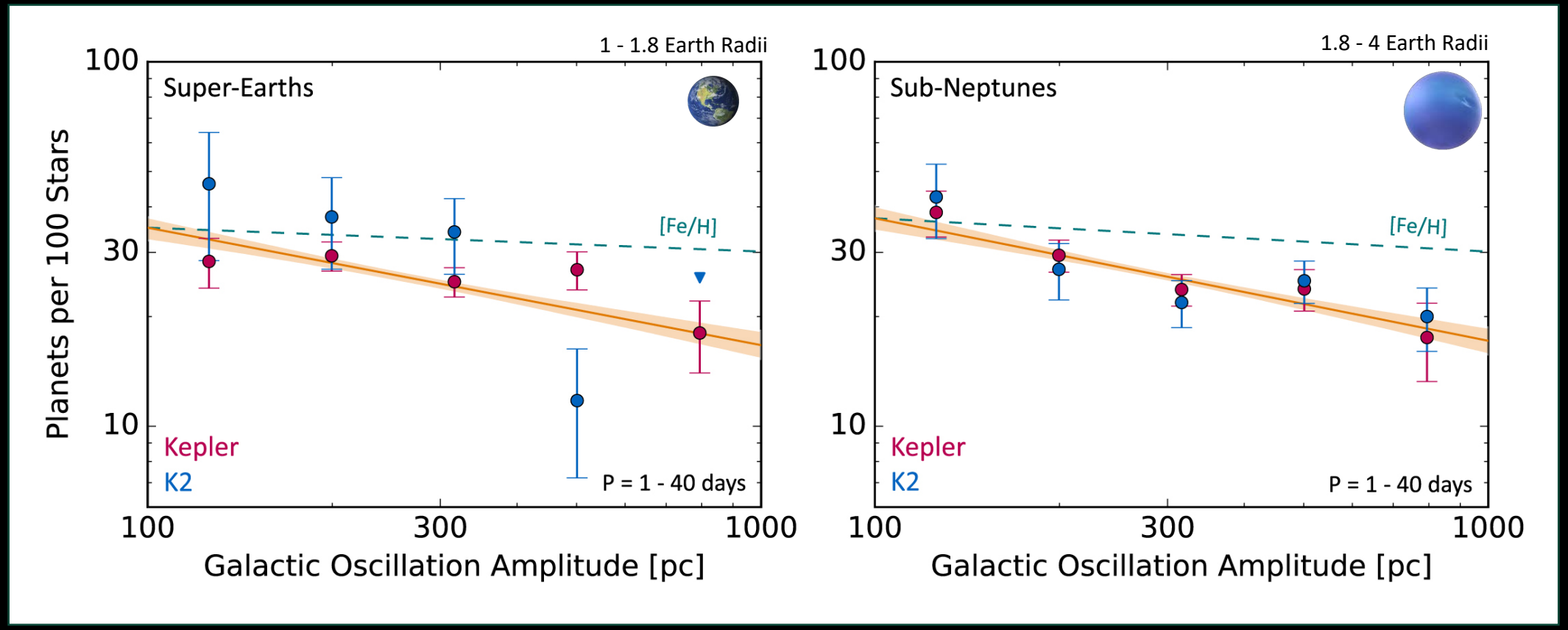
Small Planets Are Less Common At High Galactic Oscillation Amplitudes



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SUPER-EARTHS

50±8% Reduction within the first kpc.

14% Reduction expected from [Fe/H]

SUB-NEPTUNES

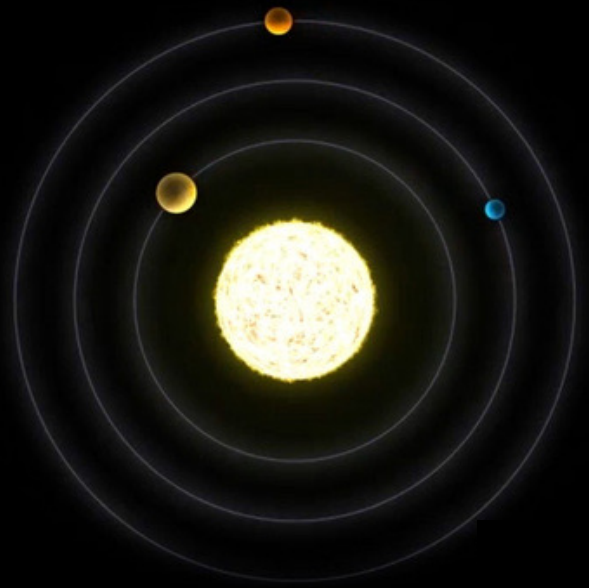
56±7% Reduction within the first kpc.

19% Reduction expected from [Fe/H]

Small Planets Are Less Common At High Galactic Oscillation Amplitudes

...but why?

System Evolution
(Planets Ejected Internally)



Galactic Dynamics
(Planets Ejected Externally)

Changes in Disk Composition
(Fewer Planets Formed)

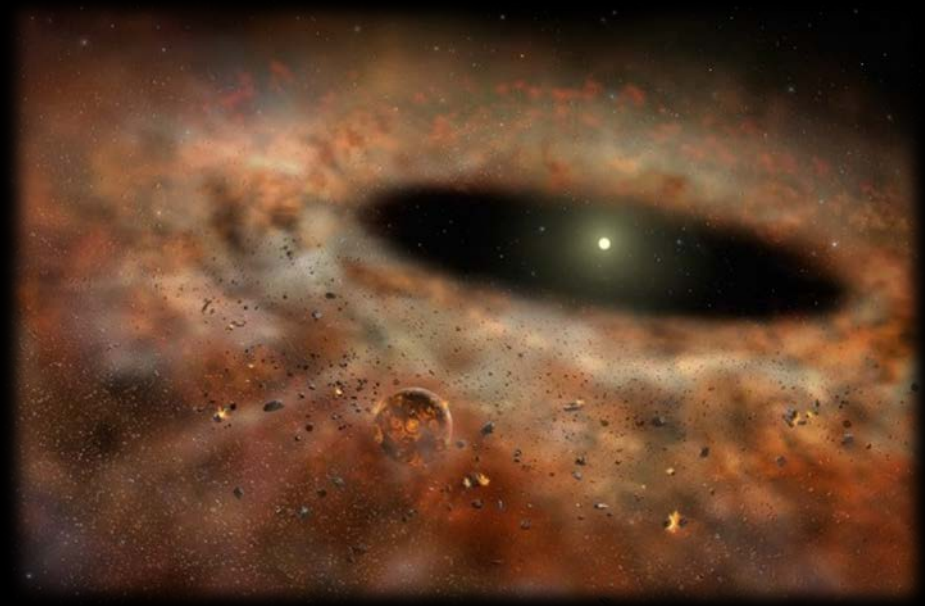
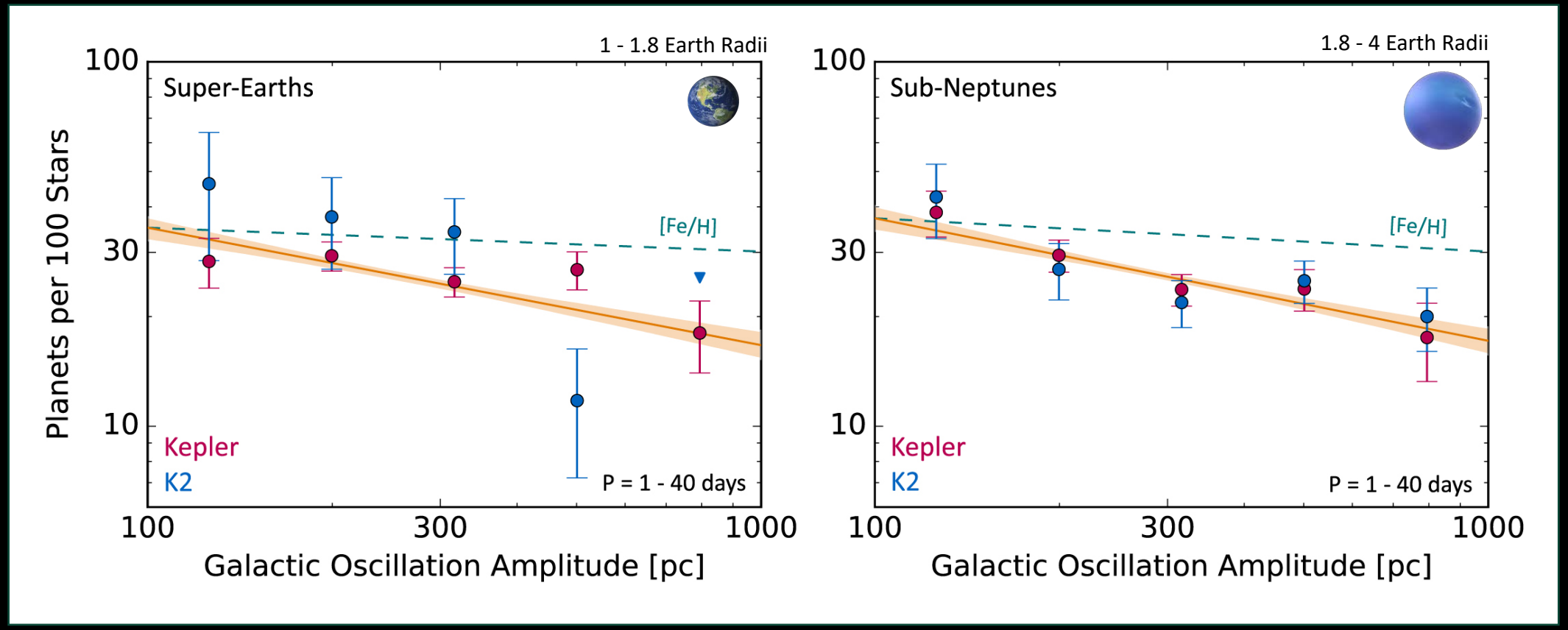


Image Credit: Nature Astro

Planet Occurrence is Address Dependent

Small Planets Are Less Common At High Galactic Oscillation Amplitudes



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