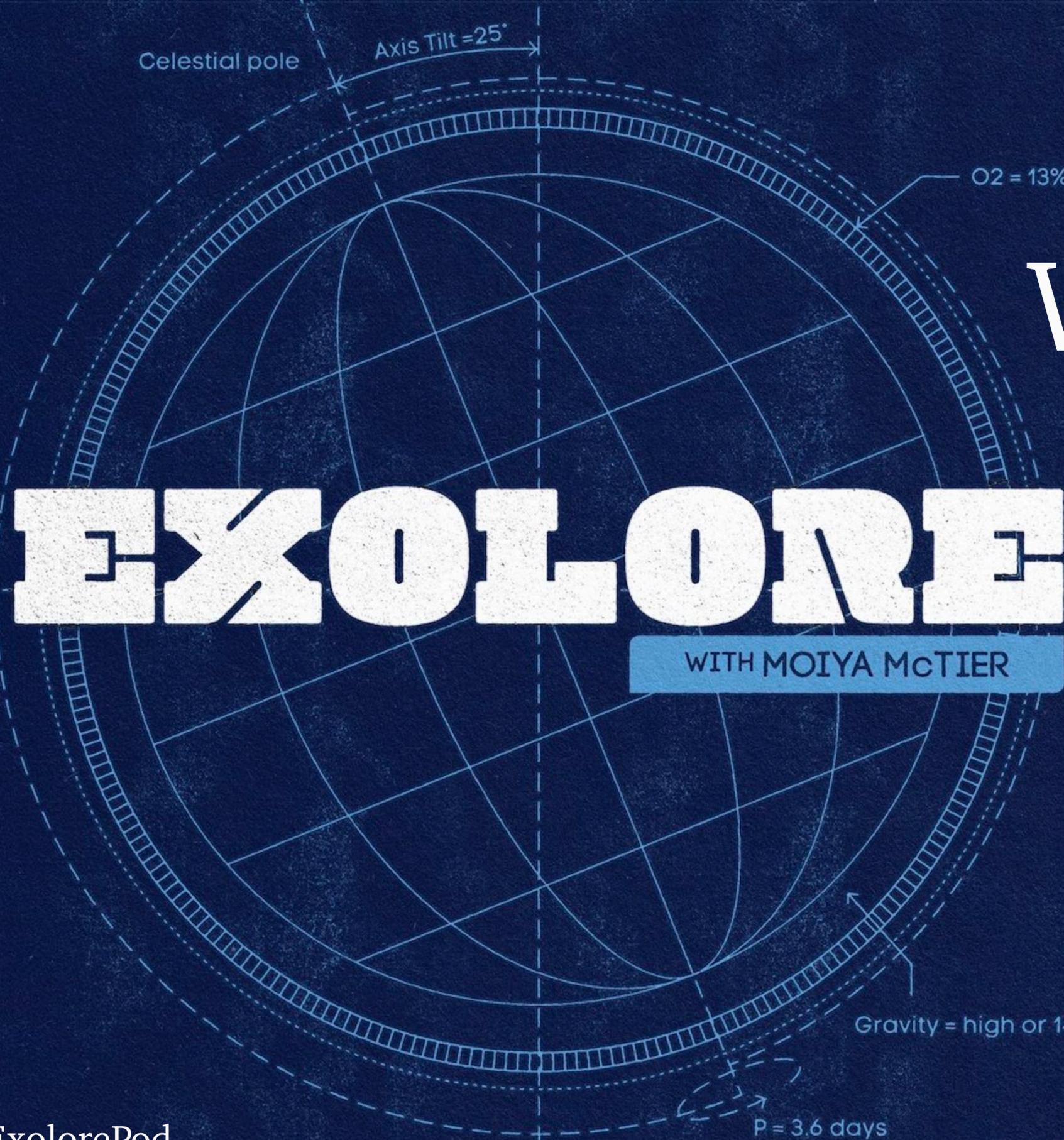


Season 2 Episode 1:

Worldbuilding of My Research



EXOLORE

WITH MOIYA McTIER

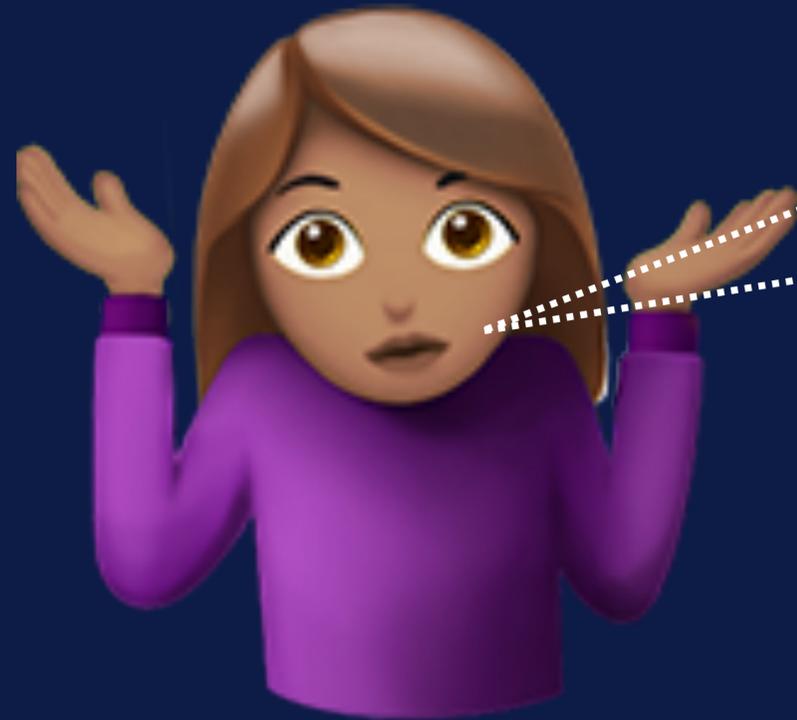
I'm a Doctor now!

* My [public thesis defense](#) is up on YouTube

* Next steps

* Finish Milky Way book

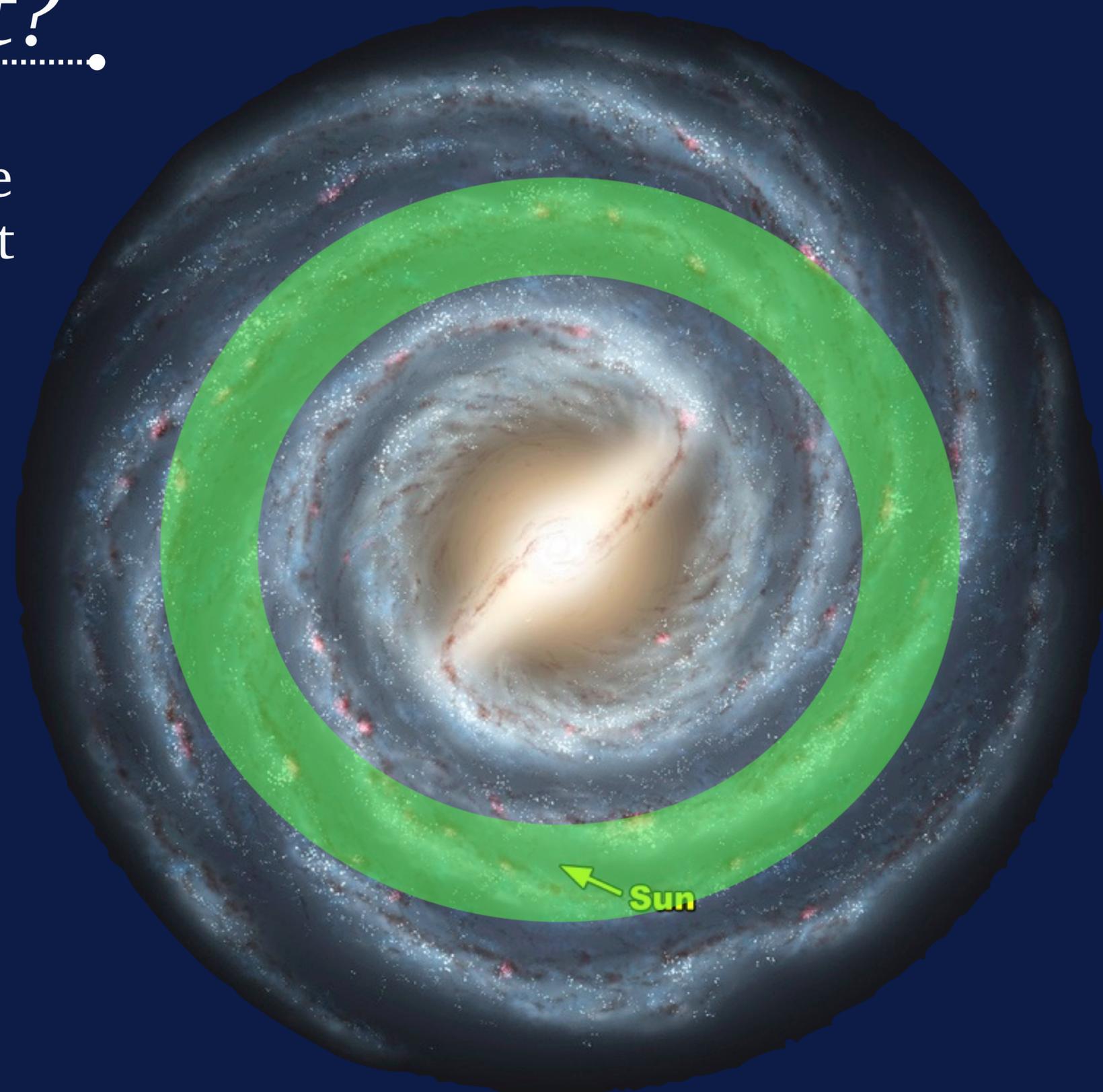
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Full-time science communication!! But how...

a galactic habitable *what?*

- * **Galactic Habitable Zone** = place in the galaxy where habitable planets are most likely to form
- * GHZ depends on
 - * metallicity, radiation, age of star, stellar number density, path of star's orbit, etc.
- * Between 7 and 9 kiloparsecs from galactic center (according to most studies)
- * **NOTE:** life *can* form elsewhere, especially non Earth-like life



a journey through my thesis•

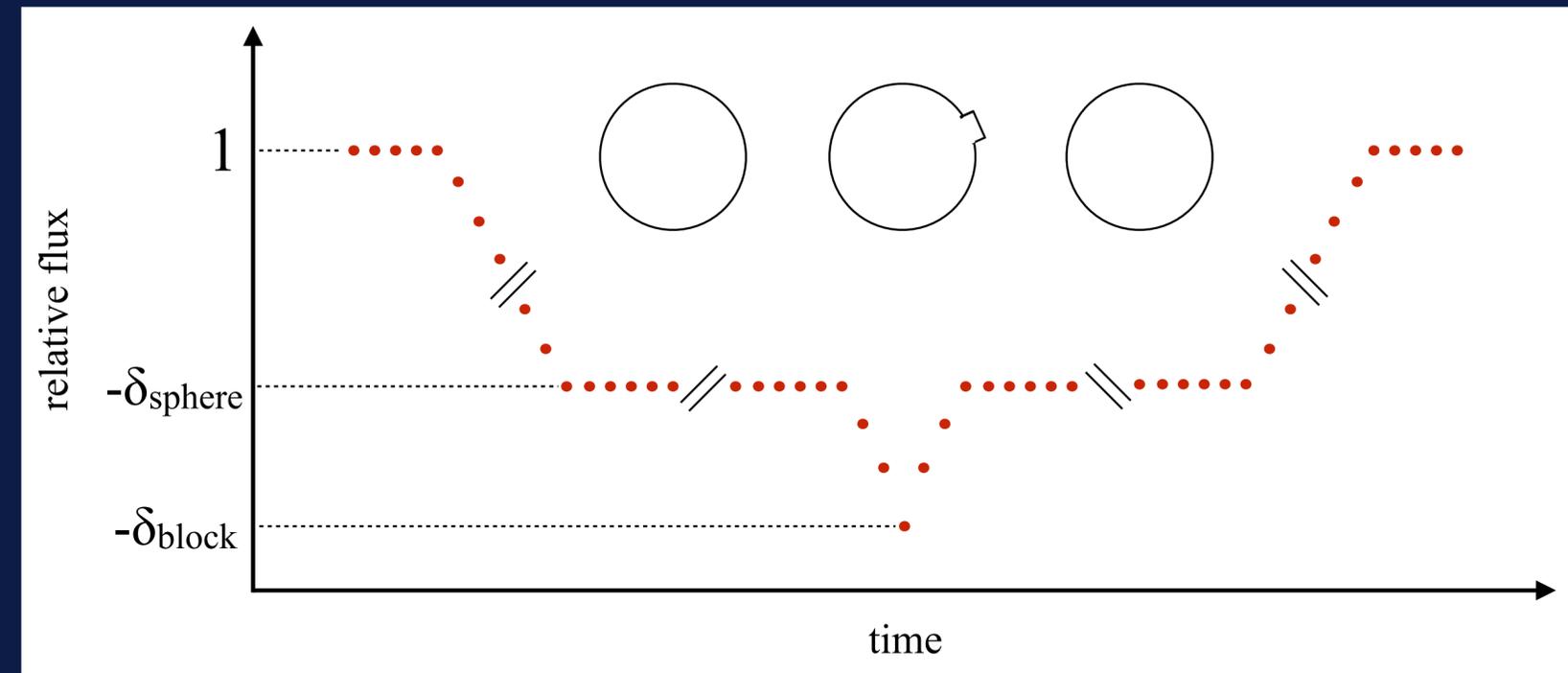
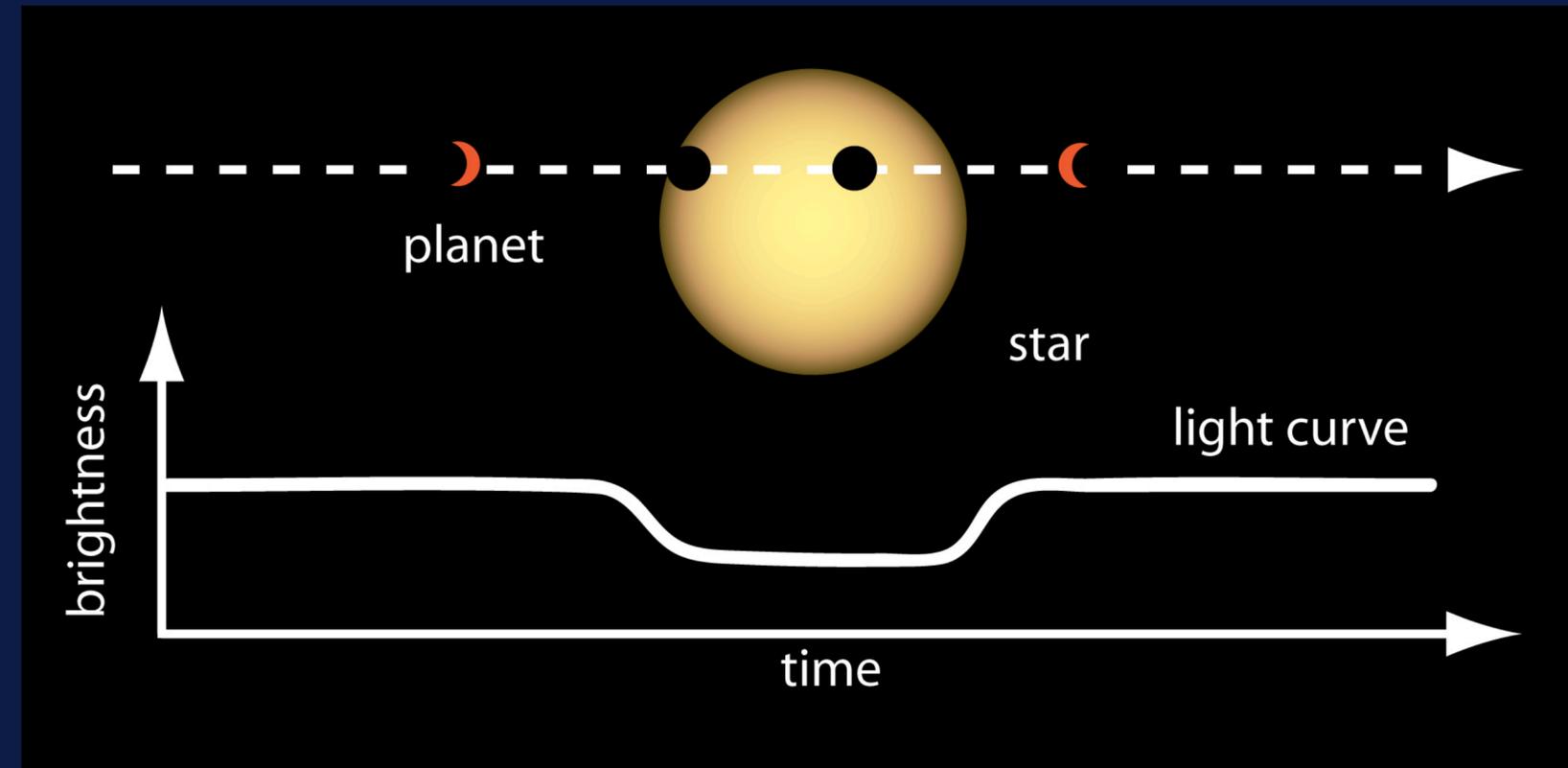
1. [Exotopography](#): what makes planets habitable from the inside?
2. Chemistry of moving groups: how do stars and elements get mixed throughout the galaxy?
3. [Planet occurrence](#): can fast stars (near the Sun) hold onto their planets?
4. [Stellar encounters](#): how common are close stellar fly-bys in the Milky Way bulge?

exotopography.

* Traditional [transit photometry](#) assumes spherical planets

* But real planets have bumps that should affect the light curve

* Astronomers *might* be able to see these signals with the [ELT](#) or larger telescopes

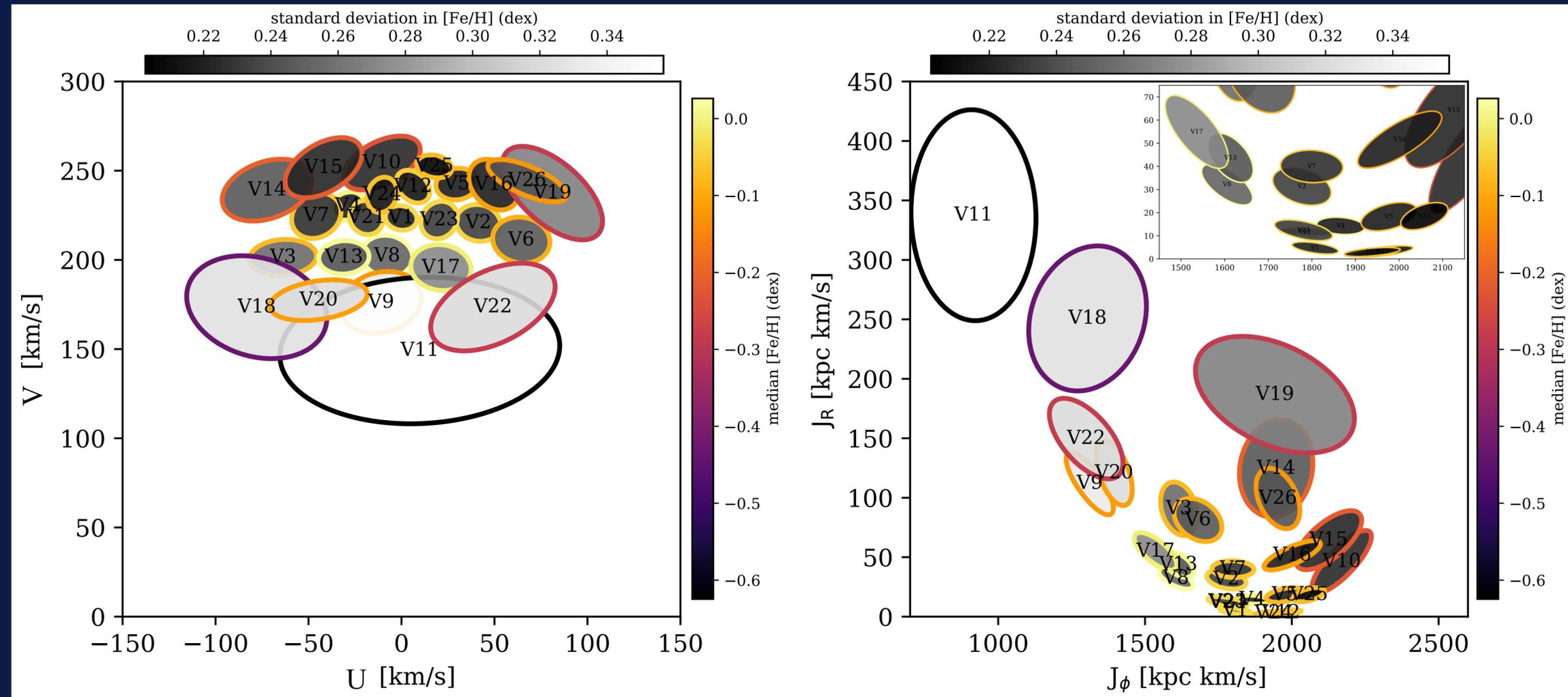


exotopography & worldbuilding...

- * Mountains imply volcanism and tectonic plate movement
 - * helpful for habitability, influence weather/climate
- * Biology
 - * help promote biodiversity (eg. human adaptations to high altitude)
- * Culture
 - * influence settlement patterns, could become sacred
- * In fiction
 - * Broken Earth trilogy by NK Jemisin, others?

chemistry of moving groups.

- * **Moving Groups** = stars moving at similar speeds in similar directions (i.e. clustered in velocity space)
- * Compared the chemistry and orbits of groups to try and figure out how and where they formed

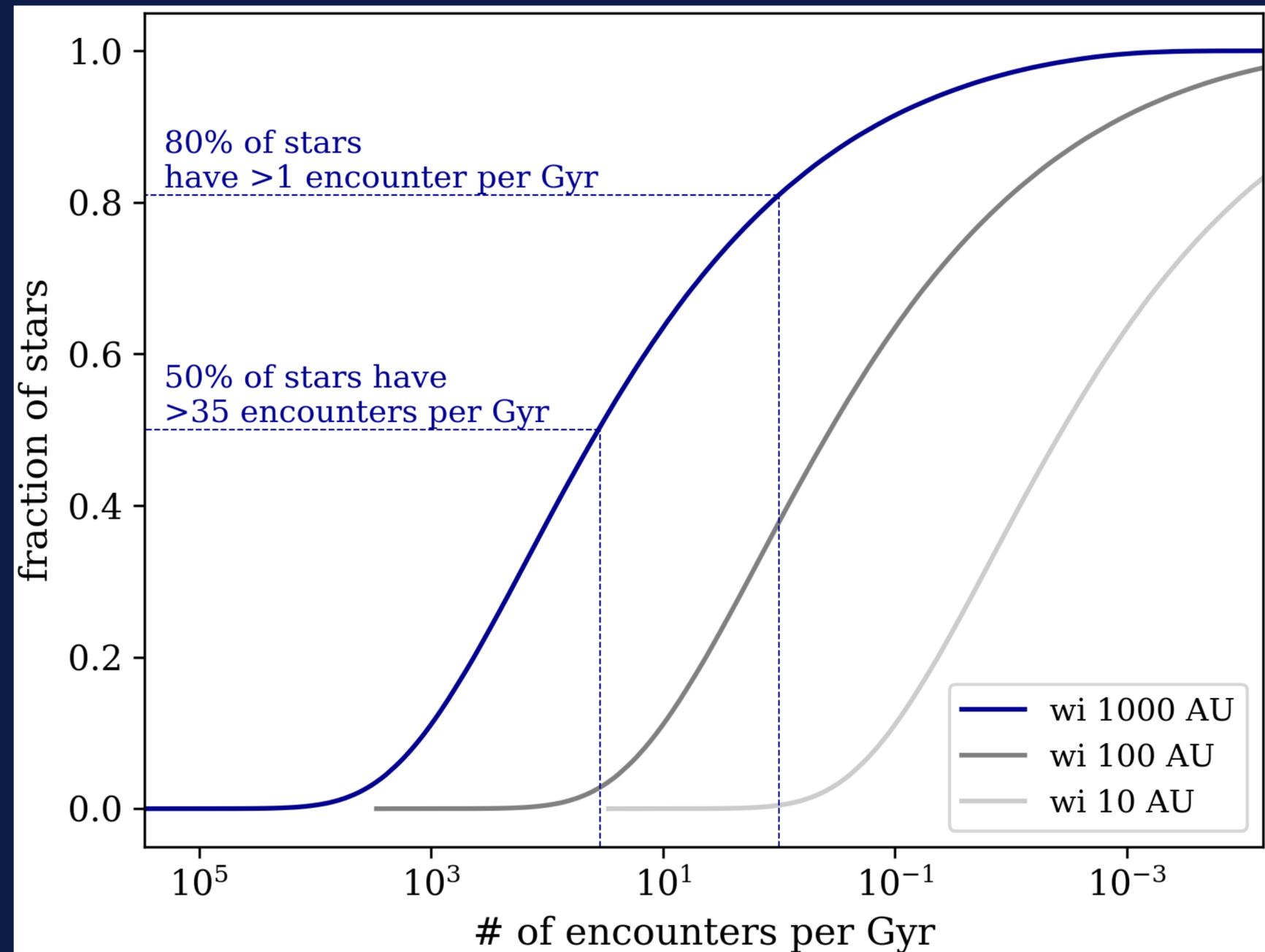


chemistry & worldbuilding.

- * **Metallicity** = abundance of elements heavier than Helium
 - * decreases moving towards edge of galaxy; lower for older stars
- * Most directly affects environment
 - * stars with more metals tend to have more planets (especially gas giants)
 - * determines planet composition \implies natural resources
- * In fiction
 - * Naquadah in Stargate franchise

stellar velocities & encounters

- * Compare speeds of stars *with* planets to speeds of stars *without* planets
 - * No difference after accounting for selection effect
- * Simulate orbits of stars in MW bulge
 - * 80% have encounters within 1000 AU every billion years
 - * Encounters can rip planets from their host stars or destabilize their orbits



stellar motion & worldbuilding.

* Environment

- * dense stellar environments can provide dangerous radiation

- * unstable orbits can yield unpredictable weather (less predictable over time)

* Biology

- * more potential for interstellar pollination

* Culture

- * more potential for interstellar civilization

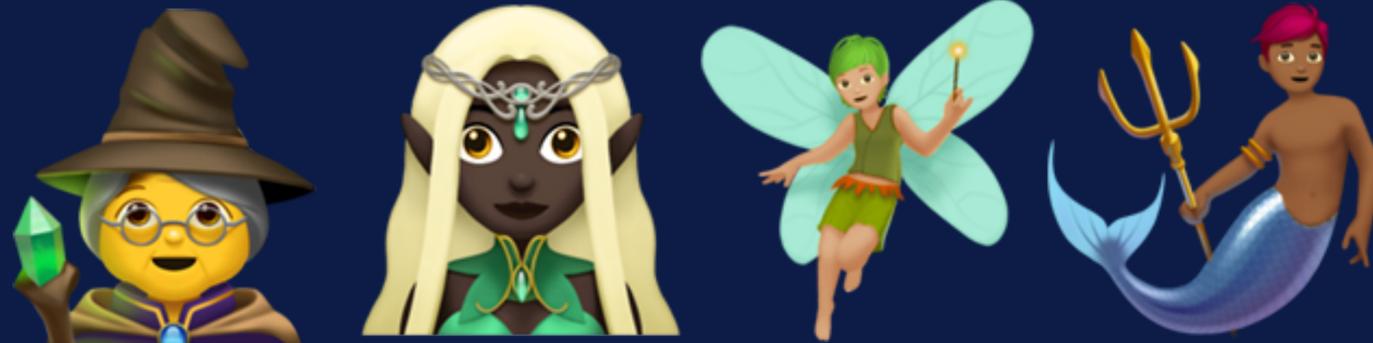
- * Worldbuilding episode coming soon!

what to expect from Season 2.

* 3 part worldbuilding!

* More how-tos

* More fantasy



* At least as many facts!