Evaluating the Origin of Life on Exoplanets

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Background

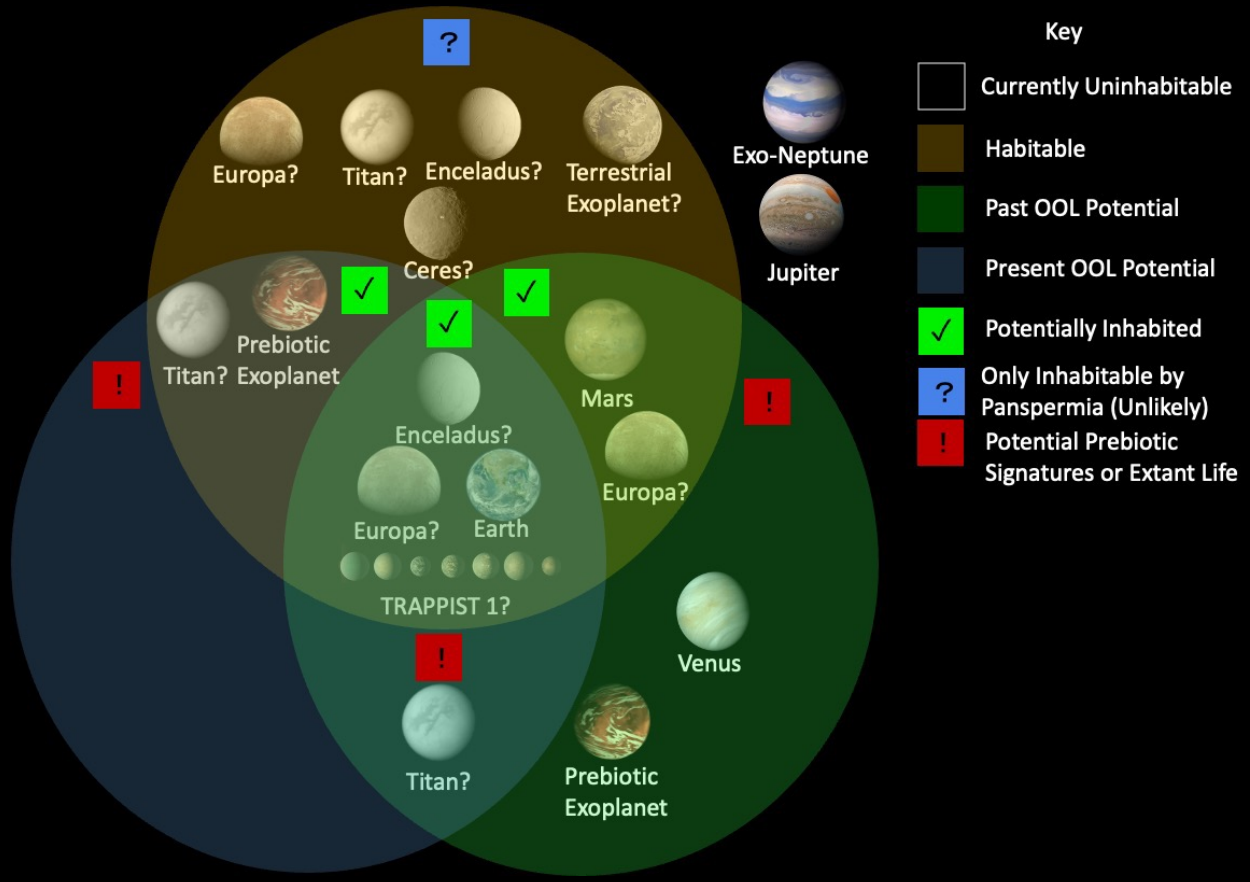
- Origin of life potential distinguishes habitable and inhabited planets, yet the term origin of life is never mentioned in *Pathways to Discovery in Astronomy and Astrophysics for the 2020s*.
- Ensuring that future facilities like the Large Interferometer For Exoplanets and the Habitable Worlds Observatory have the capacity to constrain origin of life conditions is necessary in the search for life beyond the solar system.

Origin of Life Questions and Conditions

- For life to start, an environment must contain a solvent (water, methane), components (CHNOPS, metals), energy (photosynthesis, chemosynthesis, radiolysis), and prolonged exposure to these factors.
- These factors depend on the environment life began in (alkaline hydrothermal vents or surface hotsprings) and its metabolism (autotrophic or heterotrophic).

Origin of Life Observables

- Direct Detection of Solvents (solvent, relevant to all origin of life conditions and scenarios)
- Stellar Radiation (photosynthesis, radiolysis, prebiotic feedstock)
- Atmospheric Characterization (biosignatures, radiolysis, photosynthesis)
- Volcanism/Tidal Heat Calculations (chemosynthesis)



The position in present origin of life potential, past origin of life potential, and habitability space for solar system objects and (hypothetical) exoplanets. Many of these objects could be in different positions depending on what origin of life theories are viable.