

Cupid's Boomerang

The first ever planetary atmosphere sample return mission

Mission Concept

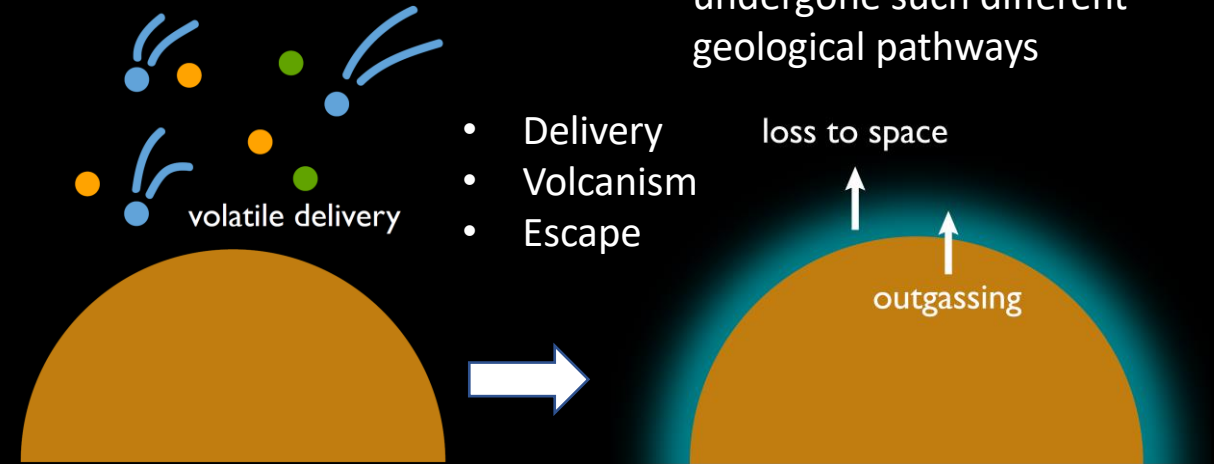
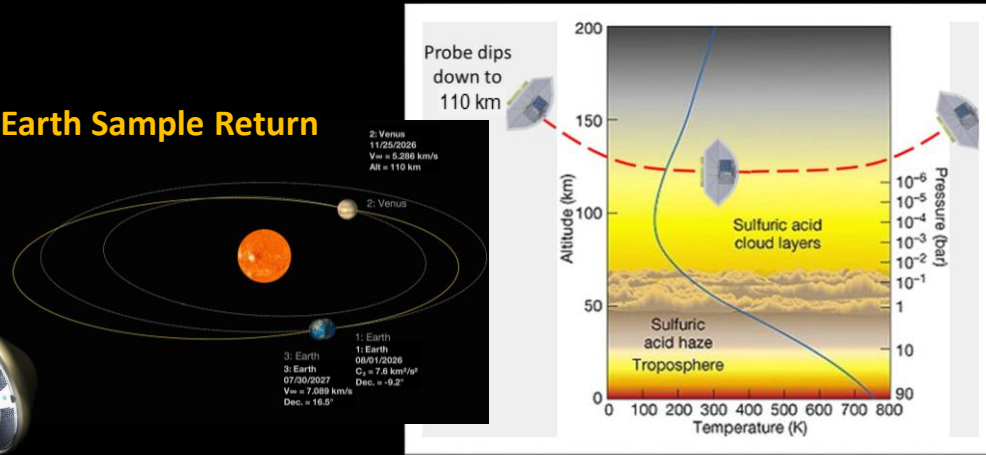
Measuring Venus' atmospheric noble gases

Principal Investigator: Dr. Rita Parai, WUSTL

Science Objectives

Why have Earth and Venus undergone such different geological pathways

Earth Sample Return



Science Implementation

- This mission will further our understanding of how sister planets, Venus and Earth, have undergone such different global evolution
- Multiple atmospheric samples will be collected below the Venus homopause as the spacecraft skims through the atmosphere at ~ 11 km/s
- Samples will be **returned to the Earth** so that state-of-the-art terrestrial noble gas laboratories can analyze the samples
- First returned sample of an extraterrestrial atmosphere
- Analytical precision in terrestrial labs is better (>5x) than precision achieved by in-situ instruments, including those planned for Venus
- *Interpretations of geochemical signatures with Venus in-situ precision are plagued by ambiguity that terrestrial lab measurements could resolve (Venus volatile origins, past geodynamics, atmospheric loss)*

Mission Concept Team (Targeting SIMPLEx Solicitation)

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Technology Needs

- Dual use Thermal Protection System (TPS) – Venus (sample acquisition) and Earth (re-entry)
- Hypersonic guidance during Venus sample acquisition with a non-traditional vehicle geometry – need to target sampling altitude + exit state to return to Earth
- Low leak rate, low contamination sample acquisition tanks, valves, tubing, etc.
- High delta-V SmallSat propulsion (depending on launch vehicle)