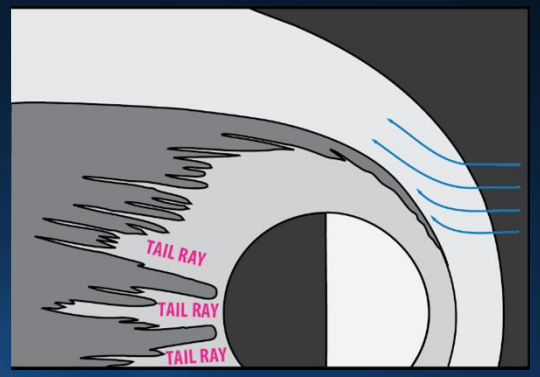
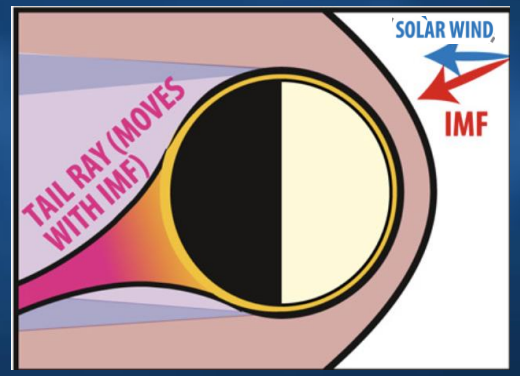
A New Understanding of Venus' Tail Rays from Parker Solar Probe



1982 Pioneer Venus era picture of the structure of the Venusian tail



2021 Post *Parker* 4th flyby picture of the structure of the Venusian tail

Understanding how Venus loses water to space is paramount to understanding how wet Venus may have been in the past and whether it was once habitable.

- NASA's 1979–1991 Pioneer Venus Orbiter mission discovered that Venus has comet-like "tail rays" which are plumes of cold plasma escaping from the ionosphere. However, these tail rays were not detected by ESA's Venus Express (2005–2014).
- On February 20, 2021, NASA's Parker Solar Probe made its fourth close flyby of Venus, spending 10 minutes in the wake on the nightside. For two of these minutes, Parker encountered a plume of cold plasma escaping from Venus with all the properties of a Venusian tail ray.
- The Parker measurements confirm the predictions of recent simulations which predict a single complex tail ray extending away from the nightside of Venus to an altitude equivalent to the radius of the planet (>6,000 km).
- These new observations revolutionize our understanding of the structure of the Venusian magnetosphere and future research into the tail rays may lead to a better understanding of how Venus lost its oceans.

Collinson et al. (2021) *Geophysical Research Letters*