# A Far-UV Micromirror Integral Field Spectrograph for Planetary Science

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**Target:** Titan, Venus, gas/ice giant planets, Ocean Worlds; flyby or orbiter missions; Discovery, New Frontiers and/or Flagship class

## Science:

- Atmosphere characterization, in particular using stellar occultations. A highlight of the proposed concept is that the array allows for the potential to observe ***several stellar occultations simultaneously***, to probe atmospheric composition, density and temporal variations
- Studies of faint, extended emission features such as atmospheric airglow or plumes will benefit from the wide field of view, as the data can be collected at once rather than integrated over multiple orbits or flybys.
- Thin atmosphere and plume characterization will be useful at upcoming comet missions, an Enceladus orbiter, and perhaps even a Kuiper Belt Object (KBO) mission.
- The UV capabilities and enhanced observing efficiency of the instrument will also allow for critical surface composition characterization in addition to the study of gases, particularly useful on asteroid (including Ceres) and Trojan missions, for instance.
- For a mission to Uranus and/or Neptune, a capable UV instrument will be of extreme value for studying atmospheric composition as well as for addressing questions about the moons of these planets and whether they harbor subsurface oceans.
- The digital micromirror array integral-field spectrograph presented in this proposal will change the paradigm of spacecraft slewing and/or including a scan mirror, by enabling efficient broadband spectral multiplexing over a large FOV

## Objectives:

- Functionalize commercial off the shelf (COTS) micromirror arrays
- Assemble testbed instrument
- Integrate digital micromirror arrays (DMA) into optical testbed
- Demonstrate optical performance
- Publish results

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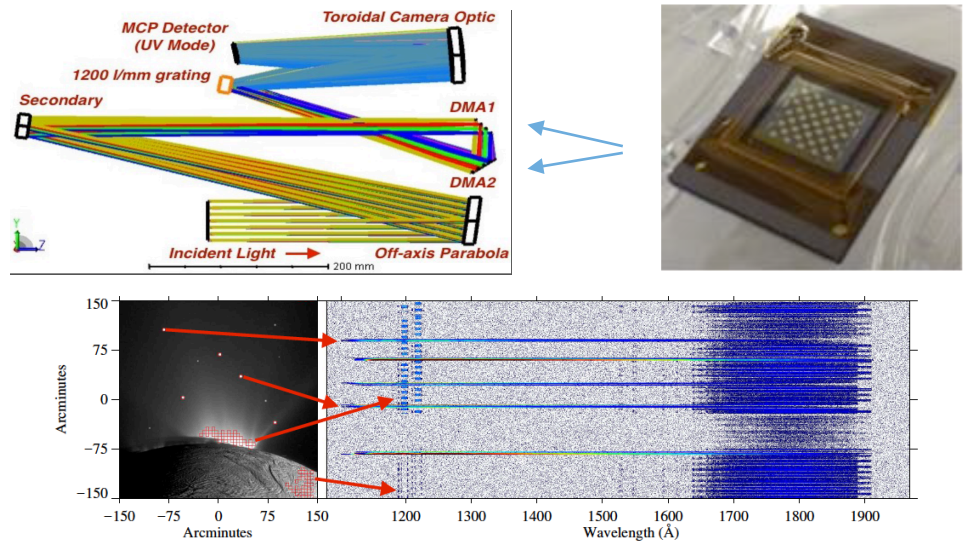


The use of digital micromirror arrays (DMA) in a UV spectrograph critically allows for wide-field planetary science. Here (lower panel) we use the Enceladus plume as an example. Our integral field spectrograph enables simultaneous stellar occultations by different parts of the plume, allowing for mapping of the density, composition and temporal variations within the plume. At the same time, the surface reflectance can be observed to probe surface composition.

## Key Milestones:

- Year 1: Order DMAs; begin functionalization; begin testbed assembly
- Year 2: UV testing in testbed
- Year 3: Trade studies; environmental tests; produce final report

**TRL 2 to 4**