CHARISMA: A space telescope for planetary science

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The Caroline Herschel high-Angular Resolution In-Space assembled Multi-Aperture (*CHARISMA*) telescope is a future mission concept being advocated by the U.S. planetary science community. The telescope addresses the US National Academy Committee on Astrobiology and Planetary Science (CAPS)'s recommendation to study a large/medium-class dedicated space telescope for planetary science. The concept ensures that the high-resolution, high-sensitivity observations of the solar system in visible and UV wavelengths revolutionized by the Hubble Space Telescope will continue after its expected end in the near future. Scientific objectives critically dependent on UV capabilities include studies of exospheric and auroral emissions in planetary atmospheres and plumes. *CHARISMA* will have the greatest impacts on science objectives particularly sensitive to dynamically evolving phenomena with fine-scale structures in planetary rings, active plumes/volcanism, atmospheric energy/momentum transport, and aurora. *CHARISMA* will also revolutionize our understanding of time-dependent phenomena in our solar system currently not supported by programs (in operation or under implementation) intended to observe and visit new targets. The time-domain phenomena to be explored by *CHARISMA* include: interaction of planetary magnetospheres with the solar wind, Venus and giant planet atmospheric dynamics, icy satellite geologic activity and surface evolution, cometary evolution, and evolving ring phenomena. *CHARISMA* also enables a comprehensive survey of the spectral characterization of minor bodies across the solar system, which requires a large time allocation not supported by existing facilities.

CHARISMA's 10-meter class aperture is enabled by advanced in-Space Assembly (iSA) technologies developed at NASA Langley Research Center (LaRC) and the in-space servicing technologies developed at NASA Goddard Space Flight Center (GSFC). The telescope will be robotically assembled in orbit and will adopt a sparse, distributed-aperture architecture, which is inherently modular in design and conducive to iSA. We will also examine the potential for future servicing and upgrades enabled by the iSA technologies. *CHARISMA* will take advantage of LaRC's leading role in the Orbital Servicing, Assembly and Manufacturing (OSAM) efforts to perform a series of trade studies spanning a variety of variables. Our design will also utilize lessons from the on-going Astrophysics Decadal Mission Study of a future 20-meter in-Space Assembled Telescope (iSAT) that covers the same wavelength range as *CHARISMA* between FUV and NIR. *CHARISMA* will help mature the technologies identified by the iSAT final report to construct a 20-meter telescope. Thus, while serving as a fully functional, dedicated telescope for planetary science, *CHARISMA* also provides an early demonstration of key technologies needed for future astrophysics telescopes. The *CHARISMA* mission concept has excellent synergy with astrophysical facilities (e.g., JWST, ALMA and SKA). *CHARISMA* will be able to place planetary discoveries made by astrophysics assets in temporal context, and *CHARISMA* discoveries of time-dependent phenomena may trigger detailed observations using larger telescopes. *CHARISMA* will also support future missions to the Ice Giants, Ocean Worlds, and minor bodies across the solar system by placing the results of such targeted missions in the context of longer records of temporal activities and larger sample populations. The CHARISMA notional design, estimated cost, and science objectives will be presented.

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