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THE ARCANUM TELESCOPE: A SPACE OBSERVATION PLATFORM ON THE OUTER SOLAR SYSTEM

Abstract

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Taking into consideration the wide-ranging science next-generation launch vehicles will enable, the Arcanum mission is a proposed L-class spacecraft for the Neptunian system consisting of a Neptunian orbiter and a Triton lander and surface penetrators. This mission aims to answer several questions about Neptune, Triton and KBOs, as well as to constrain the known properties of exoplanets and cosmic dust. One of the orbiter's key instruments is the Arcanum Telescope; an off-axis three-mirror anastigmatic medium size instrument (0.5-2m primary mirror), operating in the visible and near-infrared spectrum making observations from a highly-elliptic Neptunian orbit. Observations from such a vantage point are unique and invaluable to efforts of further understanding bodies beyond Neptune's orbit, mainly as they do not suffer from inner Solar System interference. This paper adds to a series on the Arcanum mission; specifically addressing the design and development of a space observatory to be placed in the outer Solar System, and includes innovative approaches such as generative design analysis and instrument-level design, used to significantly reduce system masses. Features of the Arcanum Telescope are relevant for the development of other next-generation space telescopes with enhanced capabilities and which can operate further from Earth's lagrangian points.

Conex Research, a portmanteau of Conceptual and Exploration, was founded in April 2020 during the first COVID-19 lockdown as a platform for early-career professionals - mainly consisting of current undergraduate and recently graduated students - to develop their skills in research and space mission proposal

writing. Since then the small group has grown, with participants spread across six continents and bringing experience in astrodynamics; astronautical, electrical, design, mechanical and nuclear engineering; planetary science; graphic design and project management.

Keywords: Neptune, Triton, KBO's, TMA, outer solar system, exoplanets, generative design