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A TRANSDISCIPLINARY APPROACH TO PROTECT THE DARK AND QUIET SKY: A NEW IAA STUDY

Abstract

Astronomers became acutely aware of the impact of satellite constellations with the launch of the first 60 Starlink satellites in May 2019. Thereafter, 150 experts from astronomy, industry, space policy and the wider community conducted months of research before presenting and then publishing on the impact of satellite constellations on astronomy, which ultimately led to the foundation of the IAU Centre for the Protection of the Dark and Quiet Sky From Satellite Constellation Interference (short IAU CPS) in 2022. The IAA Space Traffic Management committee initiated transdisciplinary research on the algorithms, methods, policies, and governance required to successfully achieve the goals of protecting the dark and quiet skies, and to work as a partner of the IAU CPS to transition and integrate the results into its framework. In addition, it bridges with several transdisciplinary communities including the planetary defense, Indigenous groups and Moon farside protection. The status of the study work conducted by experts in various disciplines is presented in this paper. The two main effects of satellites on the dark and quiet sky are the amount of energy they reflect from sunlight (and Earth albedo), and the amount of energy they emit from radio transmissions and thermal radiation. After presenting the state of the current situation, the study reviews the impact of these effects on radio astronomy, planetary defense, Indigenous groups and on space ecology. Satellite producers are in the best position to positively affect these impacts since some part of the prevention or minimization can be accommodated in the very design of the satellite itself. Therefore, technical and design aspects to minimize reflections and radiation are explored, along with concepts such as Circular Space Economy and Extended Producer Responsibility. After evaluating the current legal framework and suggesting avenues for its enhancement, the paper will propose transdisciplinary approaches to address anthropogenic space object impacts and a call to action for stakeholders to protect the dark and quiet sky.