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HUMAN EXPLORATION OF THE SOLAR SYSTEM SYMPOSIUM (A5)
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HUMAN-ROBOTIC INTERACTION FOR LUNAR EXPLORATION IN THE DEVELOPMENT OF A LUNAR FAR-SIDE RADIO OBSERVATORY

Abstract

Space robotics has enabled tremendous discoveries in planetary sciences and has emerged as an incubator of technologies with major impacts on the quality of life for the Earth's growing population and with important commercial potential. The purpose of this research is to develop new paradigms for space robotics, such as quick construction, less expensive components that can be used for different types of robots, and improved user operability, and to determine how robots and humans can best interact in order to add value to human-robotics space missions. The mission-oriented approach adopted in this context consists of the investigation of several lunar exploration scenarios with the purpose of analyzing the appropriate task distribution among humans and robots. Presented in this work is a mission concept study of a lunar far-side radio observatory optimized to observe the neutral 21-cm emission from the intergalactic medium during the dark ages of cosmic structure formation and the early stages of cosmic reionization. The Self-Tending Array Node and Communication Element (STANCE) model is the concept being investigated, which combines four helices into a single interferometer element (stance) with more than 5000 stances deployed in a relatively flat area at least 10 km across on the far side of the Moon. The discussion will illustrate the scientific requirements as well as the technical requirements which they drive. Details will be provided about the elements under study, such as array configuration, deployment, site selection, power systems and thermal management, data transport and transmission to Earth. Finally, the role of astronauts and robots in the implementation of this observatory and its operations will be shown to have an impact on the design of such a complex mission, and it will be seen how this interaction poses further constraints to the different subsystems in terms of mass, power, size, and cost.