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Author: Ms. Eva Fernandez Rodriguez
Netherlands Organisation for Applied Scientific Research (TNO), The Netherlands

Mr. Zachary Rowland
Delft University of Technology (TU Delft), The Netherlands
Dr. Roderik Overzier
Netherlands Organisation for Applied Scientific Research (TNO), The Netherlands

ON THE FEASIBILITY OF LASER SATELLITE COMMUNICATIONS FROM THE MARTIAN SURFACE

Abstract

Free space optical (FSO) communication using lasers is a rapidly developing field in telecommunications that can offer advantages over traditional radio frequency technology. For example, optical laser links may allow transmissions at far higher data rates, require less operating power and smaller systems and have a far smaller risk of interception. In recent years, several technology demonstrators have tested FSO laser links in a range of environments and scenarios. These include FSO links for terrestrial communication, between ground stations and cubesats in low Earth orbit, between ground and satellite in lunar orbit, as part of scientific or commercial space relay networks, and deep space communications beyond the moon. The possibility of FSO links from and to the surface of Mars could be a natural extension of these developments. In this paper we evaluate the effects of the Martian atmosphere on the propagation of optical communication links. A parameterisation of the Martian environment in terms of its atmospheric composition and certain characteristic weather patterns is used to calculate link budgets and availability statistics. These results could furthermore be used as constraints for designing communication terminals suitable to the Mars environment. The outcomes of this study are relevant to potential future missions to Mars that may require laser communications to or from its surface.