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THE VALUE OF SPACE APPLICATIONS WITH MINIATURIZED INSTRUMENTS

Abstract

Mass limitations and performance are key drivers for development of spectrometers for space applications. Traditionally, conventional mirror, grating and prism solutions are used for optical space instrumentation. For use in space, also constraints are imposed on the use of certain materials due to the vacuum of space and due to the radiation levels. Micro- and nanophotonic devices have the potential to revolutionize space instrumentation as these chip based devices are orders of magnitudes smaller than conventional instrument designs based on mirrors, gratings and prisms. Also, choosing the materials for the micro- and nanophotonic devices with space qualification in mind, radiation and vacuum tolerance is inherently present. In many cases, the aperture size and the number of field of views of the instrument drive the size and mass. By smart configuration of a large number of micro- and nanophotonic devices, the aperture size and number of field of views can be preserved whilst miniaturizing the instrument part where micro- and nanophotonic devices are employed, with an order of magnitude. Several conceptual designs exist where micro- and nanophotonics are considered to greatly miniaturize the instrument. Examples are, a.o., a daily global coverage imaging spectrometer for air-quality monitoring and a molecular analysis device based on Raman spectroscopy.