EARTH OBSERVATION SYMPOSIUM (B1)
Earth Observation Sensors and Technology (3)

Author: Dr. Yunlong Lin
York University, United States, Yunlong.frank.lin@gmail.com

APPLICATION OF IMAGING SPATIAL HETERODYNE SPECTROSCOPY IN THE NEW HIGH SPECTRAL RESOLUTION LIDAR FOR FUTURE SPACE-BASED CLIMATE STUDY

Abstract

High spectral resolution lidars (HSRLs) designed for climate study are increasingly being deployed on aircraft and called for on future space-based missions in aerosol and cloud remote sensing. The HSRL technique relies on spectral discrimination of the atmospheric backscatter signals to enable independent, unambiguous retrieval of aerosol extinction and backscatter. A compact, monolithic field-widened spatial heterodyne interferometer is being proposed and developed as the spectral discrimination filter and light detector for a new HSRL system. The spatial heterodyne interferometer consists of a cubic beam splitter, two differential solid prism arms, two gratings replacing the mirrors, and a camera system to register lights at the exit of the interferometer. The differential arms are designed to optimize thermal compensation such that the maximum interference can be obtained with great precision to the transmitted laser wavelength. In this paper, a comprehensive optical design of the field-widened spatial heterodyne interferometer for the HSRL is presented. The design includes the simulation of the angular distribution and finite cross sectional area of the light source, reflectance of all surfaces, loss of absorption, and lack of parallelism between the two differential arms, etc. The new design can also be used to assess the performance of the spatial heterodyne interferometer and thus it is a useful tool to evaluate performance budgets of the new filter and detector and to set optical specifications for new designs of the HSRL.