

## THE OPTICAL CHALLENGE OF DESIGNING A MINIATURIZED LIDAR FOR MARS ATMOSPHERIC RESEARCH (MILI)

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Atmospheric LIDAR instruments use laser light to study aerosol particle size and density in Earth's atmosphere. They cannot be easily used aboard landers for planetary exploration due to they are typically heavy and consume a lot of power. However, MiLi instrument is conceived to be valid for examining atmospheric dust and ice-based clouds on Mars characterizing by two main features: lightweight and low power consumption. Moreover, MiLi configuration proposes to obtain the Particle Backscatter Coefficient (PBC) at two different wavelengths and the depolarization ratio at one of them. These requirements impose that the optical system be divided into two main subsystems: the emitter, responsible for emitting two different wavelengths into the atmosphere, and the receiver, responsible for collecting the LIDAR signal and delivering it to the detector. The need of analysing the polarization degree forces to equip the emitter and receiver unit with polarization analysis devices such as the liquid crystals.

Therefore, the challenge of the optical design lies mainly in designing for two wavelengths in different spectral ranges, visible and infrared, and in collimating an extended sources from diode laser with an emitting area of 235 x 212 microns and a beam spread of 15° x 40°.

The purpose of the emitter unit is to collect the light from a laser and generate a collimating beam with a low beam divergence without exceeding the weight and volume restrictions. The emitter is divided into two channels, one the visible wavelength of 515 nm and the other for the infrared wavelength of 905 nm. The large difference of the resulting optical aperture of one channel with respect to the other, due to the different size of the emitting lasers, implies to separate the channel in two optical subsystem: one responsible for expanding the laser beam of visible wavelength and the other for collimating the light coming from infrared laser.

The receiver is responsible for collecting the faint signal inside the complete field of view of both channels. It is composed of two subsystems common for both channels, a telescope and a collimator, and two different focusers one per each wavelength. The design is based on a Cassegrain telescope with an intermediate image, which will allow to minimize the undesired effect of stray-light, and with a large light collecting capacity. The field of view must be close to twice the collimation degree of the lasers beam, i. e. covers a field of view better than 0.1°. Therefore, the beam divergence of both lasers are better or equal than 0.075°.

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