DEPOLARIZATION OF A LASER BEAM IN THE ATMOSPHERE

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ABSTRACT

Experimental and theoretical investigations were performed concerning the depolarization of a laser beam both from the viewpoint of the propagation in the turbulent as well as from the point of view of the scattering atmosphere.

The computations lead to the conclusion, that even in line of sight experiments, where the undepolarized component is due to scattered and non scattered light, the depolarization due to Rayleigh- and Raman-scattering is many orders of magnitude higher than the depolarization expected from turbulence theories.

Experiments over long atmospheric paths (4.5 km and 24.5 km) have been undertaken to examine the turbulence dependence of the depolarization. It turned out, that even under strong turbulence conditions the depolarization was less than 2×10^{-8}, the minimum depolarization detectable with the equipment.

In an other experiment the depolarization ratio of the aerosol scattering coefficient was determined simultaneously for forward and back scattering under various atmospheric conditions. Unlike Raman- or Rayleigh scattering the depolarization ratios for forward and back scattering differ greatly: The average value for forward scattering at $\lambda = 633$ nm was found to 9×10^{-4}, for back scattering 5×10^{-2} compared with 1.5×10^{-2} in the case of Rayleigh scattering.