THE USE OF A POLARIZATION METHOD FOR THE DETERMINATION OF THE BOUNDARY OF MULTIPLE SCATTERING BEGINNING AND MAGNITUDE OF MULTIPLE SCATTERING IN DROPLET CLOUDS AND FOGS BY REFLECTED LASER SIGNALS

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ABSTRACT

The determination of the boundary of multiple scattering beginning and magnitude of multiple scattering is one of significant problems of turbid media optics. Up till now the difficulties connected with the determination of these characteristics have not been overcome. The present report suggests a method based on the use of polarization.

Linearly polarized electro-magnetic waves are emitted in a pulse form. When passing through a turbid medium consisting of spherical particles, for example, droplet clouds and fogs, linearly polarized lidar radiation depolarizes. In such media depolarization is caused by multiple scattering alone. Back-scattered radiation is collected by two receivers with polaroids at their inputs, the transmission planes of the polaroids coinciding with a radiated wave polarization plane and orthogonal to it accordingly. Fig. 1 shows oscillograms of signals from the first and second receiver. The second signal was delayed by 0.25 sec relatively to the first one. When reflected from a plane surface signal 2 begins from the dashed line. However, when scattered by clouds of various density signal 2 is obtained from different depths τ, its magnitude and, consequently, its depolarization depending significantly on cloud density.

Fig. 2 shows the dependence of the polarization rate ρ and depth τ from which multiple scattering begins on the attenuation factor α. The results were obtained at 10" beam divergence and 1' angle of the receivers field of view.

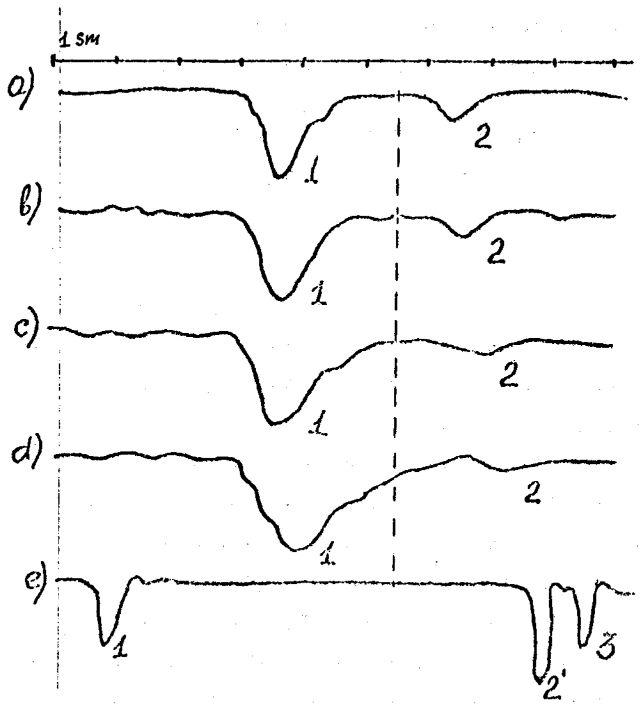

Fig. 1. Oscillograms of signals reflected from doplet clouds at a scan scale of 0.1 sec per 1 cm.
a) $\alpha = 0.112\ m^{-1}$, $P = 0.471$; b) $\alpha = 0.084\ m^{-1}$, $P = 0.554$;
c) $\alpha = 0.049\ m^{-1}$, $P = 0.638$; d) $\alpha = 0.016\ m^{-1}$, $P = 0.861$;
e) $\alpha = 0.004\ m^{-1}$, $P = 1$; 2 and 3 are signals reflected from snow; $P = 0.181$, 0.5 sec per 1 cm.

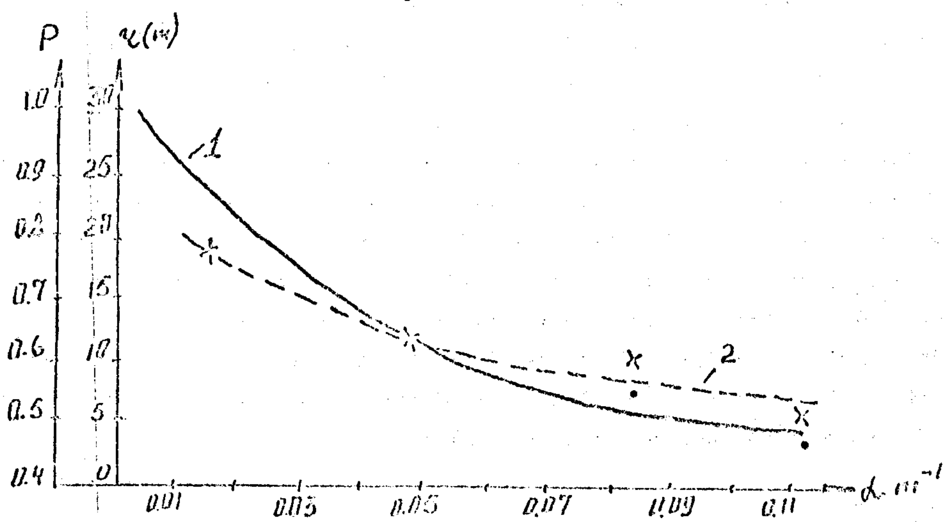

Fig. 2. The dependence of the polarization rate P and distance τ on α.
$1 - P = f(\alpha)$; $2 - \tau = f(\alpha)$.