HOLOGRAPHICAL RECORDING OF MOVING WATER AEROSOL

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ABSTRACT

It is of special interest for meteorology to investigate atmospheric precipitations and fogs by means of ground-based observations. Such investigations can be carried out successfully by a method of pulsed holography /1,2/. The method allows to determine not only particle size, but also a particle advance velocity vector. In the Central Aerological Observatory a holographical system for contactless determination of rain droplet size was constructed by the authors of the report. The laboratory version of the system records reliably particles with linear dimensions of 10 μ and over with an accuracy of up to 10%.

The optical scheme of the system is linear /1,2/. The use of a linear scheme was conditioned by the following:

1) simplicity and compactness;
2) low requirements for radiation coherency;
3) the capabilities of recording holograms on photographic emulsions with relatively low resolution;
4) lower values of aberrations relatively to other recording systems;
5) a great depth of the field.

As far as the requirements for coherency in linear recording schemes are low / spectral width of an order of 5 cps /, it proved feasible to use ruby lasers as sources of radiation in a free generation mode. The arrangement of laser elements was chosen experimentally.

The recording scheme was preliminarily calibrated. The calibration was conducted firstly with fixed and then with moving glass balls. Balls of three sizes were used: 500 μ, 150 μ, and 40 μ. It was found that the movement of the balls does not change their size and form. After that the authors proceeded to holographical recording of a real ensémble of water aerosol particles which were produced by means of a special droplet generator. The particle concentration was equal to 10^2 cm^{-3} and the volume containing aerosols was limited by 5 × 5 × 5 cm^3. As a result of the experiment the authors managed to obtain photographs of high quality

from which linear dimensions and velocity of the particles were determined. The velocity values estimated from the tracks do not exceed 10 m per sec.

In the report the estimation of major shortcomings of a one-beam scheme will be presented and ways of their reduction discussed.

BIBLIOGRAPHY

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