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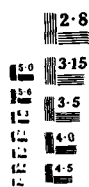
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THE OPTICAL PROPERTIES OF AEROSOLS

Principal Investigator: F. Borghese

Contractor: V. Grasso

Contract Number DAJA45-86-0003

First Periodic Report

May 1987 - August 1987

*Richard L. ...*

The research reported in this document has been made possible through the support and sponsorship of the US Government through its European Research Office of the US Army. ~~This report is intended only for the internal management use of the contractor and of the US Government.~~

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↓ This report

Since the award of the present contract the group at University of Messina started a series of discussion aimed at planning the details of the research to be performed in the next three years. After considerable discussion our attention focused on two points: 1) interpretation of the experimental data now available on the scattering properties of single clusters; 2) extension of our present formalism for the macroscopic optical constants of a dispersion of scatterers to the high-density limit. These two points will now be described in some detail.

1) Interpretation of experimental data.

At present there exist a large quantity of experimental data on the scattering properties of single cluster of known geometry and dielectric properties. In view of the difficulty of handling small clusters such as those actually forming the aerosols, the experiments are performed by means of a microwave device using as a target an arrangement of spheres reproducing on an appropriately large scale the cluster of interest. As the refractive index is a function of the frequency, the raw results obtained in this way are appropriately scaled down to yield those for a microscopic cluster illuminated by infrared radiation. A typical example of this procedure is described in the report of Schuerman and Wang<sup>(1)</sup>.

We already performed some calculation aimed at reproducing theoretically the data of reference 1. Our preliminary results are in fair agreement with those of Schuerman and Wang but we had

to discontinue our efforts because the computer now available in Messina cannot handle the enormous memory requirements necessary for a thorough calculation. Therefore we plan to resume this kind of research as soon as we will be able to buy the hardware to connect our University to the supercomputer at CRDEC.

2) Extension of our formalism to high-density dispersions of scatterers.

The formalism we developed in the last few years is suitable to calculate the macroscopic optical constants of a random dispersion of scatterers only in the low-density limit. In spite of the interesting results obtained until now, our formalism is in no way applicable to the high-density limit because of the neglect of the multiple scattering processes among different particles. Presently there exist a few attempts to describe the optical constants of a high-density dispersion of scatterers based on statistical considerations to simulate the actual dispersion. Among these attempts the most interesting from a computational point of view is that of Varadan, Bringi and Varadan<sup>(2)</sup> who use the quasi-crystalline approximation of Lax<sup>(3)</sup> to get solvable equations.

Our idea is to go beyond this approximation with the use of a more sophisticated kind of statistics. The research on this line is already in progress and will require several months to put the necessary formalism into appropriate shape. As for the related calculations we plan to start as soon as the hardware for the connection of our University to the supercomputer at CRDEC will

be available.

I cannot conclude this report without calling your attention on the fact that, in view of the schedule of the payments, we will not be able to buy the hardware necessary for this research before July 1988. In fact, an initial sum of \$ 15.000 is necessary to effect the purchase of the minimal configuration of the hardware.

REFERENCES

- 1) D.W. Schuerman and Ru T. Wang: "Experimental results of Multiple Scattering ", Chem. Systems Lab. Report ARCSL-CR-81003, November 1981.
- 2) V.K. Varadan, V.N. Bringi and V.V. Varadan: Phys. Rev. D19, 2480 (1980).
- 3) M. Lax: Phys. Rev. 85, 621 (1952).

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