Etude en laboratoire de la rétrodiffusion optique de particules diélectriques d'intérêt atmosphérique

Equipe : Optique, Environnement et Télédétection (OET)

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Scientific context

According to the latest IPCC report [1], atmospheric particles, such as sulfate, desert dust or sea-salt particles, are incriminated for their impact on air quality, public health and climate. Quantifying this effect is however very challenging, due to the complexity of these particles, which present a wide range of sizes and shapes. In particular, mineral dust particles present a very complex morphology, with highly irregular shapes, and are a complex mixture of dielectric and semi-conductor particles. To face such a complexity, the interaction of light with these particles through light scattering is often used. Indeed, light scattering is sensitive to the particles size (through spectroscopy) and shape (through polarization) and can be described in the framework of the scattering matrix formalism [2], suitable for addressing such a statistical particles ensemble. In the absence of analytical solutions to the Maxwell's equations for complex-shaped dielectric particles, scattering by mineral dust particles has been studied in laboratory by our group where a π-polarimeter has been built in the exact backscattering direction ($\theta = 180.0 \pm 0.2°$), particularly sensitive to the particles size and shape, which is a world-first [3]. It has been obtained thanks to a very precise alignment, in the range of 1:10 000.

Objectives of the internship

This experimental set-up has been recently constrained by practical technical reasons (it was sat down due to the so-called plan campus). The main objective of this 2 months-internship is to rebuild the existing experimental set-up. The experiment is planned to be rebuilt at UV and VIS-wavelengths. Setting up a new experimental set-up would be unrealistic in such a short time period. The candidate should have knowledges in light scattering, laser physics, polarimetry and spectroscopy, and should like performing laboratory experiments and precision. He should also ideally have skills on atmospheric aerosols.

References

[1] IPCC, The Physical Basis: Climate Change, (2013).

[2] Mishchenko, M. I., Travis, L. and Lacis, A. : Scattering, Absorption, and Emission of Light by Small Particles, Cambridge, (2002).

[3] A. Miffre, T. Mehri, M. Francis and P. Rairoux, UV-VIS depolarization from Arizona Test Dust particles at exact backscattering angle, *J. Quant. Spec. Rad. Transf.*, **169**, 79-90, (2016).

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