# Quantifying the Impact of Imperfect Particle Shape Assumptions on Synergistic Lidar and Polarimeter Aerosol Retrieval Performance

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Within a decade, the NASA led Atmosphere Observing System (AOS) mission plans to fly both a Multiangle, multispectral Polarimeter (MAP) and Elastic Backscatter Lidar (EBL) together on the same satellite platform. Coincident measurements from these two sensors will be combined to produce synergistic aerosol retrieval products simultaneously characterizing aerosol amount, microphysics, and vertical distribution. The increased information content in this synergistic dataset will represent a significant step forward in our ability to remotely sense aerosol from space but, for this additional information to be fully utilized, novel retrieval approaches will need to be developed and evaluated. In this talk we summarize the planned aerosol algorithms and products for AOS, while also highlighting some of the associated challenges. In particular, we will focus on the challenge of finding particle single scattering models that are able to accurately reproduce observations from both MAP and EBL instruments. Retrieval performance under different forward modeling errors is assessed by applying the Generalized Retrieval of Aerosol and Surface Properties (GRASP) algorithm to synthetic top-of-atmosphere polarimetric radiance and attenuated backscatter and depolarization profiles derived using different single scattering optics assumptions. Specifically, we perform retrieval simulations employing spherical, spheroid and hexahedral particle shape assumptions. In many studied scenes, we find that synthetic observations derived using spheroidal optics can differ from their hexahedral counterparts by an order of magnitude more than typical measurement uncertainties. Lidar backscattering and depolarization and Degree of Linear Polarization (DoLP) in MAP radiances all show particularly strong dependence on particle shape. In the retrieval products, the advantages of incorporating these additional measurements over purely passive, intensity only inputs are generally negated by the presence of these particle shape forward modeling errors.

**Keywords**: aerosol retrieval algorithm, multiangle polarimetry, elastic backscatter lidar, nonspherical aerosol, Atmosphere Observing System (AOS)