AN IMPLEMENTATION OF THE INVARIANT IMBEDDING T-MATRIX SOLUTION TO ELECTROMAGNETIC SCATTERING

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We have implemented the invariant imbedding T-matrix (IITM) method of Johnson (1988) to solve the electromagnetic scattering problem for arbitrarily shaped, inhomogeneous, dielectric objects and have evaluated the strengths and weaknesses of this approach by comparing results with both Mie and discrete-dipole methods for homogeneous and inhomogeneous spherically symmetric objects.

Accurate single-scattering properties of hydrometeors are fundamental and prerequisite to accurate retrievals involving cloud and precipitation. For particles with geometric symmetry to exploit, there exist methods, such as Mie and T-matrix, that are both efficient and accurate. Although we also have multiple solution options, such as discrete (or coupled) dipole approximation (DDA) and finite-difference-time-domain (FDTD), for irregular particles without geometric symmetry, in our opinion neither has achieved sufficient efficiency nor accuracy for the class of problems in which we are interested.

A somewhat less well known solution method, IITM, invented in the late 80's (Johnson 1988) has recently been "rediscovered" (Bi et al. 2013). This method has the promise of being both efficient in usage of computer resources (i.e. RAM memory and computing time) and accurate in solutions due to its semi-analytical nature. However, since there are few records about this method in the literature, its capabilities and limitations in practical matters are largely unknown. In order to obtain such assessment we have independently implemented the method, since no open-source implementation is yet available. We are exploring the boundaries of IITM using our implementation, starting with particles that exhibit axial symmetry. We plan to make our implementation open-source when it becomes satisfactorily robust.