Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

The Physical Origin of the Forward Character of the Electromagnetic Optical Theorem MATTHEW BERG, CHRISTOPHER SORENSEN, AMIT CHAKRABARTI, Kansas State University — Particles or scatterers, both spherical and nonspherical in shape, are often encountered in the natural environment. Examples include atmospheric clouds and aerosols. The scattering of sun light by these particles produces radiative forcing effects that influence the Earth's climate. Additionally, electromagnetic scattering can offer an unintrusive way to study the physical properties of a scatterer including its shape, size and composition. Extinction is the process by which radiant energy is removed from an incident field due to the scattering and absorption of the field by a system of scatterers. The extinction cross section σ^{ext} measures the total power removed from the incident light and hence, is a quantity of interest in many electromagnetic scattering applications. A well-known relationship, called the optical theorem, relates σ^{ext} and the amplitude of the scattered field in the exact forward direction. This work investigates the physical origin of the forward character of the optical theorem using computer simulations of simple scattering systems. The conclusion is that the optical theorem derives its forward character from the interference of the incident and scattered fields. This energy flow is seen to consist of opposing directions of flow that cancel each other in all but the forward direction when integrated to yield σ^{ext}.

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Date submitted: 19 Nov 2006 Electronic form version 1.4