Exact Calculations of Optical Forces and Optical Binding in Single and Multiple Beam Optical Traps

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We present essentially exact multi-pole multi-scattering techniques for carrying out optical force calculations in a wide variety of optical trapping situations involving either isolated particles or collections of simultaneously trapped particles.

We illustrate that our exact techniques [1] can quite readily be applied to a variety of trapping situations and particle types for which popular approximate techniques (Rayleigh, geometric optics, Born approx. etc.) are either inapplicable or exceedingly difficult to carry out.

In particular, we highlight the use of our techniques to investigate the intriguing optical binding and optical "crystallization" observed in multiple-beam interferential optical traps [2–4].

We also rapidly illustrate applications of our techniques to the widely employed single-beam optical traps known as optical tweezers. In particular, we discuss the techniques which we have developed in order to model the extremely tightly focused beams which are essential to standard optical tweezers.

REFERENCES

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