DPP14-2014-000873

Abstract for an Invited Paper
for the DPP14 Meeting of
the American Physical Society

Stix Award: The ponderomotive effect beyond the ponderomotive force[1]

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The classical ponderomotive effect (PE) is typically understood as the nonlinear time-average force produced by a rapidly oscillating electromagnetic field on a nonresonant particle. It is instructive to contrast this understanding with the common quantum interpretation of the PE as the ac Stark shift, i.e., phase modulation, or a Kerr effect experienced by the wave function. Then the PE is naturally extended from particles to waves and can be calculated efficiently in general settings [1], including for strongly nonlinear interactions and resonant dynamics. In particular, photons (plasmons, etc.) are hence seen to have polarizability and contribute to the linear dielectric tensor exactly like "true" particles such as electrons and ions. The talk will briefly review the underlying variational theory [1-4] and some nonintuitive PE-based techniques of wave and particle manipulation that the theory predicts. It will also be shown that the PE can be understood as *the* cause for the basic properties of both linear and nonlinear waves in plasma, including their dispersion, energy-momentum transport, and various modulational instabilities. Linear collisionless dissipation (both on particles and classical waves, treated on the same footing [2]) also appears merely as a special case of the modulational dynamics.

[1] I. Y. Dodin and N. J. Fisch, Phys. Rev. Lett. **112**, 205002 (2014).
[2] I. Y. Dodin, Phys. Lett. A **378**, 1598 (2014).
[3] I. Y. Dodin, Fusion Sci. Tech. **65**, 54 (2014).
[4] I. Y. Dodin and N. J. Fisch, Phys. Rev. A **86**, 053834 (2012).

[1]The work was supported by NNSA grant DE274-FG52-08NA28553, DOE contract DE-AC02-09CH11466, and DTRA grant HDTRA1-11-1-0037.