

Abstract Submitted  
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**Axiomatic approach to wave-particle interactions and its applications to waves with trapped particles**<sup>1</sup> I.Y. DODIN, Princeton Plasma Physics Laboratory — A general axiomatic approach is developed that yields ponderomotive Lagrangians for wave-particle collisionless interactions deductively and, often, without even referring to the Maxwell-Vlasov system [PRL **107** (2011) 035005; Phys. Plasmas **12** (2012) 012102, 102103, 102104]. From those, nonlinear dispersion relations and dynamic equations are derived, and, as a spin-off, the long-standing controversies are resolved pertaining to photon properties in dielectric medium. Langmuir waves with trapped electrons are studied as a paradigmatic example. For the case of deeply trapped electrons in particular, action conservation predicts different regimes depending on the energy flux  $S$  carried by trapped particles. For example, the trapped-particle modulational instability (TPMI) can develop just due to large  $S$ , in contrast with the existing theories. Remarkably, this effect is not captured by the nonlinear Schrödinger equation, which is traditionally considered as a universal model of wave self-action.

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