Abstract Submitted
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Two-photon absorption in plasmas. STEPHANIE B. HANSEN, Sandia National Laboratories, R. MORE, RMorePhysics, J. BAILEY, Sandia National Laboratories, J.-C. PAIN, CEA-Bruyeres, T. NAGAYAMA, Sandia National Laboratories — In the early days of quantum electrodynamics, Maria Goeppert-Mayer predicted quantum two-photon processes. Two-photon emission was observed in accelerator beam-foil spectroscopy and both two-photon absorption and Raman scattering of visible light are well-known in nonlinear optics. Recent opacity measurements at the Sandia Z-machine found opacities larger than code predictions for Fe foils at temperatures ˜200 eV. We investigate the question whether two-photon effects can increase the opacity of hot plasmas containing many-electron ions. Our calculations use second-order perturbation theory. Dipole transition matrix-elements involving continuum states are obtained by analytic continuation of bound-bound matrix elements, a method recently shown to be very accurate. We present results for various plasma conditions and some cases find large extra opacity. The theory can be tested by opacity measurements and also by experiments with X-ray free-electron lasers. If the results are substantiated, two-photon opacity is likely to be important for stellar interiors. Sandia National Laboratories is a multi-mission laboratory managed and operated by NTESS LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. DOE's NNSA under contract DE-NA0003525.

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