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Effect of intense laser irradiation on the lattice stability of metals and semi-conductors using ab initio simulations. VANINA RECOULES, JEAN CLEROUIN, GILLES ZERAH, Departement de Physique Theorique et Appliquee - CEA/DAM Ile de France - BP12 - 91680 Bruyeres-Le-Chatel, PIERRE-MATHIEU ANGLADE, CECAM - 46, allee d'Italie - 69007 Lyon, STEPHANE MAZEVET, Los Alamos National Laboratory - NM87544 — We studied the effect of intense electronic excitations on the interatomic forces for electronic temperatures reached under intense laser irradiation and the possible melting of the underlying lattice. We use *ab initio* linear response to compute the phonon spectrum for a semi-conductor (Si) and two metals (Al and Au), using linear response in the Density Functional Theory framework for several electronic temperatures lying from 1 to 8 eV. We found that silicon and gold behave in an opposite ways when increasing electronic temperature: whereas a phonon instability appears in silicon at a electronic temperature of 1.5 eV, gold samples become even more stable with increasing electronic temperature. The Debye temperature was deduced from the phonon spectrum and using the Linderman criterion, we showed that gold undergoes a sharp increase of its melting temperature under intense laser irradiation.

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