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Maser Generation of Hypersound From Heat Through Adiabatic Demagnetization of a Paramagnetic Crystal MICHAEL VAISFEL'D, Kingsborough College of CUNY — It has been shown in our earlier work on thermal masers [Sov. Phys. - JETP (USA), v. 57, No. 6, pg. 1263-9 (1983)] that the energy of thermal phonons of a crystal like $La_2Mg_3(NO_3)_{12}$*$24H_2O$ (LaMN) doped with $^{59}Co^{2+}$ (ions A) and Ce^{3+} (ions B) can be converted directly into the energy of coherent microwave radiation. Maser action has been observed at liquid helium temperatures in the 0.18-T static magnetic field after termination of the 1-T magnetic field pulse (which is applied for the adiabatic cooling of the electron spins $1/2$ of the ions B). A partial population inversion is achieved in the system of hyperfine magnetic spin sublevels of the ions A as a result of the fast resonant thermal mixing between the nuclear spins I = 7/2 of the ions A and the cooled spins B. Our device acts as a *quantum heat engine*, without any microwave or optical pumping. Here we propose an analogous easily tunable pulsed *phonon* maser. The laser crystals of $KY(WO_4)_2$ [Eur. Phys. J. **B55**, 388-395 (**2007**)] doped with $^{168}Er^{3+}$ and $^{171}Yb^{3+}$ ($I = 1/2$) or $^{173}Yb^{3+}$ (I = 5/2) ions are proposed as working substances (instead of the crystal hydrate of LaMN:Ce^{3+}: $^{59}Co^{2+}$).

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