

Abstract Submitted
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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 $\text{La}_2\text{Mg}_3(\text{NO}_3)_{12}\cdot 24\text{H}_2\text{O}$ (LaMN) doped with $^{59}\text{Co}^{2+}$ (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 $\text{KY}(\text{WO}_4)_2$ [Eur. Phys. J. **B55**, 388-395 (2007)] doped with $^{168}\text{Er}^{3+}$ and $^{171}\text{Yb}^{3+}$ ($I = 1/2$) or $^{173}\text{Yb}^{3+}$ ($I = 5/2$) ions are proposed as working substances (instead of the crystal hydrate of $\text{LaMN}:\text{Ce}^{3+}:\ ^{59}\text{Co}^{2+}$).

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