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Novel Spintronic Device-Terahertz Magnon-Photon Laser BORIS TANKHILEVICH, Terahertz Technologies LLC — A novel spintronic -based method of generating THz radiation is proposed. The method is based on pumping of non-equilibrium electrons into the upper (spin-down) sub-band of spin-polarized half-metallic ferromagnets or ferromagnetic semiconductors, which makes it possible to build tunable, narrow-band, high-power THz sources. Non-equilibrium electrons pumped into the spin-down subband rapidly emit non-equilibrium magnons with THz frequency, pass into highly excited states of the spin-up subband, and fall into the ground state due to interaction with the equilibrium spin-up electrons or by emitting optical phonons. The mechanism of magnon generation is similar to a three-level conventional laser, and at a critical pumping intensity, which depends on the magnon damping, magnon lasing begins. In this regime the number of excited magnons increases exponentially with time. Merging of two THz magnons with frequency f generates a THz photon with frequency 2f. Thus, a magnon laser becomes a THz photon laser. The proposed one-stage device is capable of generating THz power being of orders of milliwatt and is tunable by tuning the magnetic field and/or the bias. The device has nano-dimensions and can be mass produced on a large scale. Recently THz radiation by spin-polarized current in a ferromagnetic structure was observed. However, the material used in this experiment has not met the conditions for magnon lasing.

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