Ultrafast acoustics for modulating matter

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Illumination of matter by intense ultrashort light pulses can lead to launching of coherent phonon pulses through the ultrafast thermal expansion. The duration of these pulses may be as short as a ps and their amplitude may reach one thousandth of a crystal lattice constant. This dynamic change of the lattice can vary the band gap of a semiconductor on corresponding time scales, which can be exploited to modulate light emitters on sub-THz frequencies. Further, in magnetic materials the acoustic pulses can be used to vary the magnetic anisotropy, by which a precession of the magnetization can be triggered. In suitably tailored structures, this precessing magnetization can serve as ultracompact source of microwave radiation with frequencies up to 100 GHz and more, by which high resolution magnetic resonance spectroscopy may be achieved. In this contribution we will discuss the basic principles of ultrafast acoustics of matter and gives examples of applications.

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