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标题: Frequency comb generation at terahertz frequencies by coherent phonon excitation in silicon
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摘要: High-order nonlinear light-matter interactions in gases enable the generation of X-ray and attosecond light pulses, metrology and spectroscopy(1). Optical nonlinearities in solid-state materials are particularly interesting for combining optical and electronic functions for high-bandwidth information processing(2). Third-order nonlinear optical processes in silicon have been used to process optical signals with bandwidths greater than 1 GHz (ref. 2). However, fundamental physical processes for a silicon-based optical modulator in the terahertz bandwidth range have not yet been explored. Here, we demonstrate ultrafast phononic modulation of the optical index of silicon by irradiation with intense few-cycle femtosecond pulses. The anisotropic reflectivity modulation by the resonant Raman susceptibility at the fundamental frequency of the longitudinal optical phonon of silicon (15.6 THz) generates a frequency comb up to seventh order. All-optical > 100 THz frequency comb generation is realized by harnessing the coherent atomic motion of the silicon crystalline lattice at its highest mechanical frequency.
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