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Nanoscale objects as promising high frequency acoustic transducers in picosecond acoustics

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Twenty year ago, H. Maris opened up the field of nanoscale acoustics by demonstrating the opportunity of using ultrashort optical pulses for generating and detecting high frequency acoustic waves. Roughly, an optical pulse is converted in a picosecond acoustic pulse through the optical absorption in a thin metallic layer. Since then, this so-called picosecond ultrasonics has known a larger and larger success all around the world. Up to now, picosecond ultrasonics meets two main limitations. First it is difficult to reach the THz range using the usual way of producing the acoustic pulse. Second, in the common geometry only longitudinal waves are excited by the laser. Here we present some results showing that nanoscale objects could help in overcoming both difficulties. We first show that semiconductor quantum dots can be a very efficient emitter of coherent phonons whose frequency can be higher than those obtained in metallic thin films. Second we show that 2D arrays of nanosize metallic dots offers a way of generating and detecting high frequency surface acoustic waves.