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Overview on laser acoustics

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Ultrafast lasers can be used to produce sound waves in a medium. Usually, the laser beam is focused onto the sample that partially absorb the light. The transient heating of the sample produces transient mechanical stresses that lead to ultrasonic transduction. Since the discovery of ultrafast lasers, the generated sound waves have reached ultrafast timescales, in the picosecond regime, with corresponding frequencies in the THz range. Right now, lasers can be used to efficiently excite sound waves at any given frequency up to THz. In the THz frequency range, the ultrasonic wavelength is on the order of a couple of nanometers making them suitable for probing nano-objects. This photoacoustic technique perfectly fits the needs for non-contact, non-invavise, non-destructive mechanical probing of samples. Depending on the laser peak energy, the acoustic pressure can be tuned. With extremely powerful lasers the acoustic pressure can reach TPa. In this case, the intense acoustic wave becomes a so-called shock wave. The experiments are carried out on a single shot basis since the shock wave irrevocably damages the sample.
In the present talk, I will review the latest results which we have obtained dealing with ultrafast acoustics and shock waves.

Topics

Session A. Physics of condensed matter and spectroscopy

Primary author: Dr PEZERIL, Thomas (MIT - CNRS)

Presenter: Dr PEZERIL, Thomas (MIT - CNRS)

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