PROPAGATION OF ULTRASHORT ACOUSTIC WAVE PACKETS IN $PbMoO_4$

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We present experiments in which the propagation of picosecond acoustic pulses is studied *in* the bulk of a transparent crystal by Brillouin scattering. The ultrashort acoustic pulses are created by absorption of a focused light beam from a Ti:sapphire modelocked laser in a thin-film gold transducer deposited onto a lead molybdate crystal ($PbMoO_4$). The injected acoustic pencil has an initial diameter of 20 μm and is detected by a single mode argon-ion laser beam, employing a scanned quintuple-pass Fabry-Perot interferometer and photon counting.

The obtained spectra show a broad envelope, Doppler shifted by several GHz, and consist of sharp peaks at multiples of the laser repetition frequency (Figure 1). This frequency comb directly proves the presence of a *modelocked* acoustic pulse train in the crystal. The spectral width of the comb can be associated with the limited size of the interaction volume and measures the spatial extent of the acoustic pulse *in* the scattering plane. The dependence of the scattered intensity on excitation power turns out to be quadratic, indicating that the strain generation in the gold film is linear (Figure 2). The observed Brillouin scattering efficiency is of the order of 10^{-8}, which is 10^4 times higher than that of longitudinal thermal phonons at room temperature.

Exciting at the crystal side of the transducer yields a much higher signal than when exciting from the outside. This effect can be traced back to the different shapes of the produced ambipolar wave packets: exciting from the outside leads to a severe destructive interference of the Brillouin signal. Preliminary results on the propagation of the wave packet at room temperature demonstrate the strong damping of the high-frequency components. This leads to a progressive diffraction of the beam, due to the increase of the acoustic wavelength.

Propagation experiments at liquid helium temperatures are in preparation, in which the possibility of observing nonlinear acoustic effects is more likely than in the current experiment, where thermal damping is the dominant effect. Results will be presented at the conference.

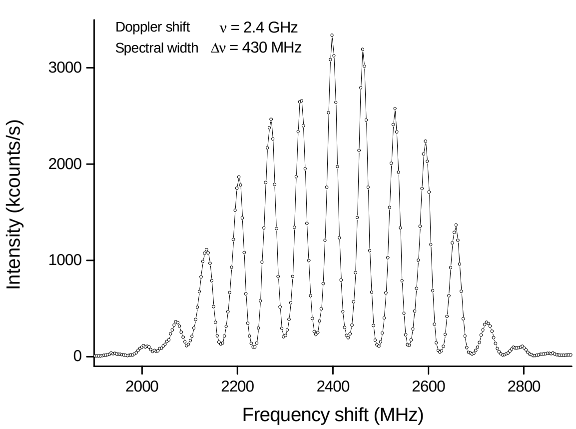

Figure 1. Brillouin spectrum of the modelocked acoustic wavepackets

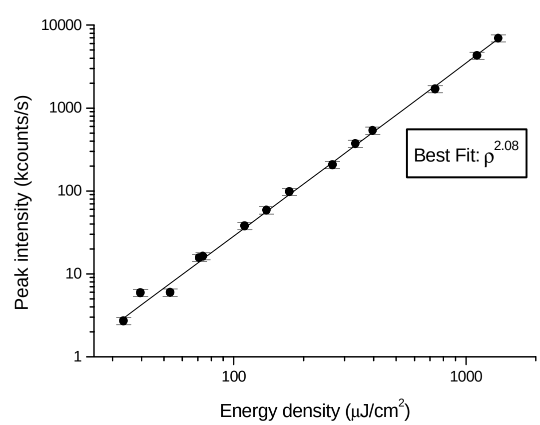

Figure 2. Dependence of the Brillouin scattered light on the excitation energy density