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Measurement of the velocity dispersion and attenuation in a liquid metal at GHz frequencies

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Ultrashort optical pulses are used to excite and interferometrically detect picosecond longitudinal acoustic pulses in thin films of liquid mercury sandwiched between sapphire plates. By analysing consecutive acoustic echoes we derive the dispersion of the ultrasonic attenuation and sound velocity for this liquid at frequencies up to 10 GHz. Two types of optical detection, from the same side of the film as the excitation light and from the opposite side to the excitation light, are presented. Significant effects of structural relaxation are observed and are compared to a simple model that indicates the presence of picosecond relaxation times in mercury.