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12.27 Towards Direct DC Conductivity of Warm Dense Matter Measured by Single-Shot THz Spectroscopy

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We present a method for direct measurement of DC conductivity of warm dense matter using single-shot terahertz time-domain spectroscopy (SS-THz-TDS). SS-THz-TDS is a promising tool for characterizing properties of materials undergoing irreversible changes (e.g. the complex refractive index or conductivity). Furthermore, as the period of THz pulses is slow compared to the expected electron-electron collision time, THz pulses can be considered effectively constant and hence probe the near-DC properties of materials. The drawback to this is the low signal-to-noise ratio. Maximizing this is important for studies of irreversible processes with small signals or modulation. Our investigation focuses on a method for balancing shot-to-shot fluctuations of single-shot THz measurements based on (a) simultaneous detection of single-shot traces, and (b) the use of correlation functions. The method is compared to the state of the art polarization-gated balancing scheme. We use our technique to determine the conductivity of a gold thin film using a transmission configuration. Finally, we present preliminary results on laser heated gold films.

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