Coherent broadband THz spectroscopy in high magnetic fields and low temperatures: a fiber-based setup using photomixers

K. Thirunavukkuarasu[a], M. Langenbach[a], A. Janssen[a], H. Schmitz[a], I. Cámara Mayorga[b], R. Güsten[b], A. Roggenbuck[a, c], A. Deninger[c], M. Grüninger[a], and J. Hemberger[a]

[a]II. Physikalisches Institut, Universität zu Köln, D-50937 Köln, Germany
[b]Max-Planck Institute for Radio Astronomy, Auf dem Hügel 69, D-53121 Bonn, Germany
[c]TOPTICA Photonics AG, Lochhamer Schlag 19, D-82166 Gräfelfing, Germany

We present the first successful results of the integration of a continous-wave THz spectrometer into a magneto-cryostat for operation at low temperatures and/or high magnetic fields. The spectrometer employs photomixing of two NIR lasers for generation and phase-sensitive detection of THz radiation from 60 GHz to 1.8 THz. A fast phase-modulation technique using two fiber stretchers is used to accurately determine the amplitude and the phase at a given frequency. Thus, the complex dielectric function can be determined with a very high resolution in the MHz range. This spectrometer in combination with the magneto-cryostat is one of the very few compact experimental setups that allow for THz spectroscopic investigations at high magnetic fields up to 8 T and low temperatures down to 3 K with excellent reliability. The response of the photomixers and the general operation of the spectrometer in these experimental conditions will be outlined. Thus, a new door is opened for exploring low-energy electronic excitations of novel materials, lying in the sub-phonon energy regime.