

Coherent broadband THz spectrometer using photomixers for accurate determination of complex dielectric function

Tuesday, 24 July 2012 20:00 (2 hours)

Roggenbuck, Axel [1,2]
Langenbach, Malte [1]
Schmitz, Holger [1]
Vidal, Ernesto [1]
Deninger, Anselm [2]
Cámara Mayorga, Iván [3]
Güsten, Rolf [3]
Hemberger, Joachim [1]
Grüninger, Markus [1]

Affiliations:

[1] : II. Physikalisches Institut, Universität zu Köln, Zùlpicher Strasse 77, 50937 Köln, Germany,
[2] : TOPTICA Photonics AG, Lochhamer Schlag 19, D-82166 Gräfelfing, Germany
[3] : Max-Planck-Institute for Radio Astronomy, Auf dem Hùgel 69, D-53121 Bonn, Germany

We discuss the development of a cw THz spectrometer for solid-state spectroscopy at low temperatures as well as high magnetic fields. The spectrometer is based on the principle of THz generation using frequency mixing of two near-infrared distributed feedback diode lasers with frequency stabilization [1]. The laser beat is converted into THz radiation by a photomixer, which efficiently generates THz radiation from 60 GHz to 1.8 THz. The THz radiation is detected by a second photomixer via homodyne mixing of the THz signal and the laser beat. A fast phase modulation technique using fiber stretchers is used to determine the amplitude and the phase at a given frequency with excellent reliability [2].

More recently, we have implemented a third laser which increases the phase accuracy by enabling a correction for phase drifts mainly caused by thermal fluctuations. Thus, the complex dielectric function can be determined very accurately with a very high frequency resolution. Furthermore, the performance of the photomixers at low temperatures down to 5 K and high magnetic fields up to 8 T has been tested extensively to integrate this spectrometer within a commercial magneto-cryostat for spectroscopic investigations. Various aspects of the above-mentioned developments will be outlined.

[1] A. Roggenbuck, H. Schmitz, A. Deninger, I. Cámara Mayorga, J. Hemberger, R. Güsten, and M. Grüninger, New J. Phys., 12, 043017 (2010).

[2] A. Roggenbuck, K. Thirunavukkuarasu, H. Schmitz, J. Marx, A. Deninger, I. Cámara Mayorga, R. Güsten, J. Hemberger, and M. Grüninger, J. Opt. Soc. Am. B, in print (2012).

Primary author: THIRUNAVUKKUARASU, Komalavalli (II. Physikalisches Institut, Universität zu Köln)

Presenter: THIRUNAVUKKUARASU, Komalavalli (II. Physikalisches Institut, Universität zu Köln)

Session Classification: Poster Session 2

Track Classification: New Techniques