

## Surface state charge dynamics of the high-mobility three dimensional topological insulator strained HgTe

J. N. Hancock<sup>a</sup>, J. L. M. van Mechelen<sup>a</sup>, A. B. Kuzmenko<sup>a</sup>, D. van der Marel<sup>a</sup>, C. Brüne<sup>b</sup>, E. G. Novik<sup>b</sup>, G. V. Astahkov<sup>b</sup>, H. Buhmann<sup>b</sup>, and L. Molenkamp<sup>b</sup>

<sup>a</sup>Département de Physique de la Matière Condensée, Université de Genève, quai Ernest-Ansermet 24, CH 1211 Genève 4, Switzerland

<sup>b</sup>Physikalisches Institut der Universität Würzburg - 97074 Würzburg, Germany

We present a time-domain terahertz magneto-optical study of the three-dimensional topological insulator, strained HgTe. We invoke a technique which capitalizes on advantages of time-domain spectroscopy to amplify the signal from the surface states, delivering valuable and precise information regarding the surface state dispersion within  $<1$  meV of the Fermi level. The method allows us to obtain the parameters describing the topological surface states near the Fermi energy, until now not resolved by other experimental techniques, namely free carrier spectral weight, quasi-particle scattering rate, cyclotron frequency, Fermi velocity and Fermi momentum. Prospects for observing the topological magnetoelectric effect will be discussed.