Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Ultrafast carrier dynamics in Bi2Se3 thin films KELIANG HE, LIGUO ZHU, CHEN XIA, BRIAN KUBERA, JIE SHAN[1], Department of Physics, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH 44106, U.S.A. — Bismuth Selenide (Bi2Se3), a group V-VI narrow gap layered semiconductor, is a well-known efficient solid thermoelectric material at room temperature. It has recently also attracted much research attention due to its interesting topological properties. The carrier dynamics and charge transport, electron-phonon coupling, and its role in the transport properties in Bi2Se3 are fundamental issues in understanding its thermoelectric and topological properties. In this work, we employ the optical-pump terahertz-probe technique to study the transient photoconductivity in Bi2Se3 thin crystalline films as a function of the pump-probe delay time and the excitation fluence. The photoconductivity spectrum ranging from 0.3 to 1.9 THz reveals both a Drude and a Lorentz contribution. The former is attributed to a free electron response with a scattering time of 0.7 ps; and the latter, with both its amplitude and peak frequency dependent on the carrier density, arises from a coupled LO phonon-plasmon mode. The nature of this mode and its role in transport will be discussed.

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Date submitted: 24 Nov 2010 Electronic form version 1.4