## Abstract Submitted for the MAR13 Meeting of The American Physical Society

Transient Surface Photoemission Involving Nonlinear Surface Sheet Polarization Developed on the Doped Bi<sub>2</sub>Se<sub>3</sub> Topological Insulator<sup>1</sup> YUKIAKI ISHIDA, HIROAKI KANTO, WALID MALAEB, SHUNTARO WATAN-ABE, ISSP, Univ. Tokyo, CHUANGTIAN CHEN, TIPC, CAS, AKIKO KIKKAWA, YASUJIRO TAGUCHI<sup>2</sup>, YOSHINORI TOKURA<sup>3</sup>, CERG, RIKEN ASI, SHIK SHIN<sup>4</sup>, ISSP, Univ. Tokyo — Time- and angle-resolved photoemission spectroscopy is performed on the doped Bi<sub>2</sub>Se<sub>3</sub>topological insulator. We observe unusual variation in the efficiency of photoemission from femto-to-picosecond non-equilibrium particularly when two-dimensional electron gas (2DEG) states are developed on surface, while the surface confinement potential is virtually unchanged. The results indicate that a surface sheet polarization, which is induced nonlinearly by both the photon field and inversion-symmetry-breaking field, grows in magnitude as the 2DEG states become pronounced and opens a so-called surface photoemission channel, div A, that can be varied transiently. Matrix element effects investigated by linearly-polarized angle-resolved photoemission also supports the presence of div A. The asymmetric charge distribution developed around vacuum-surface interface is considered as a key to understand and control Rashba splitting of the 2DEG states.

<sup>1</sup>This research is partially supported by KAKENHI(23740256) and by the JSPS through its "FIRST Program" <sup>2</sup>also at CMRG, RIKEN ASI <sup>3</sup>also at CMRG, RIKEN ASI and Dept. Appl. Phys., Univ. Tokyo <sup>4</sup>also at CREST, JST

> Yukiaki Ishida ISSP, Univ. Tokyo

Date submitted: 09 Nov 2012

Electronic form version 1.4