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**Thickness tunable quantum interference between surface phonon and Dirac plasmon states in thin-films of the topological insulator  $\text{Bi}_2\text{Se}_3$** <sup>1</sup>  
YURI GLINKA, SERCAN BABAKIRAY, TRENT JOHNSON, DAVID LEDERMAN, Department of Physics and Astronomy, West Virginia University — Raman scattering has been applied to study thin films of the topological insulator  $\text{Bi}_2\text{Se}_3$ . We observed a more than 100-fold enhancement of Raman responses if laser photon energy switches from 2.33 eV (532 nm) to 1.58 eV (785 nm), which is due to direct optical coupling to Dirac surface states (SS) at the resonance energy of about 1.5 eV (a thickness-independent enhancement) and due to nonlinearly excited Dirac plasmon (a thickness-dependent enhancement). Owing to the direct optical coupling, we were able to monitor an in-plane phonon mode of hexagonally arranged Se-atoms associated with a continuous network of Dirac SS. This mode revealed a Fano lineshape for films below 15 nm thick, resulting from quantum interference between surface phonon and Dirac plasmon states.

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