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**Topological insulators are tunable waveguides for hyperbolic polaritons** JHIH-SHENG WU, DIMITRI BASOV, MICHAEL FOGLER, University of California San Diego — We present a theoretical analysis showing that layered topological insulators, for example, $Bi_2Se_3$ are optically hyperbolic materials in a range of THz frequencies. As such, these topological insulators possess deeply subdiffractional, highly directional collective modes: hyperbolic phonon-polaritons. We predict that in thin crystals the dispersion of these modes is split into discrete subbands and is strongly influenced by electron surface states. If the surface states are doped, then hybrid collective modes result from coupling of the phonon-polaritons with surface plasmons. The strength of the hybridization can be controlled by an external gate that varies the chemical potential of the surface states. We also show that momentum-dependence of the plasmon-phonon coupling leads to a polaritonic analog of the Goos-Hänchen effect. Directionality of the polaritonic rays and their tunable Goos-Hänchen shift are observable via THz nanoimaging.

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