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Topological Effect to Surface Plasmon Excitation in Topological Insulator Nanowires MINGDA LI, MIT, WENPING CUI, University of Bonn, JU LI, MIT, YIMEI ZHU, LIJUN WU, QINGPING MENG, BNL, WEISHU LIU, ZHIFENG REN, Boston College, FERHAT KATMIS, PENG WEI, JAGADEESH MOODERA, YONG ZHANG, MIT, LI GROUP, MIT TEAM, CFN, BNL COLLABORATION[1], FBML, MIT COLLABORATION[2], CMSE, MIT COLLABORATION[3], REN GROUP, BC COLLABORATION[4] — We present a theoretical investigation of the surface plasmon at the interface between topologically-non-trivial cylindrical core and topological-trivial surrounding material, from the axion electrodynamics and modified constitutive relations. We find that the topological effect lowers the SP energy in any case, while as the diameter of the core becomes smaller, the topological modification to SP energy is reduced. A qualitative picture based on perturbation theory of shifted boundary is given to explain these phenomena, from which we also infer that in order to amplify the topological effect, the difference between the inverse of dielectric constants of two materials must be increased. We also find that when the surrounding material goes magnetic, the magnetism overcomes topological effect, makes the latter seemingly suppressed. What's more, bulk plasmon energy at 17.5 $\pm$ 0.2eV for semiconducting Bi2Se3 nanoparticle is observed from high-resolution Electron Energy Loss Spectrum Image measurements.

[1]High-resolution EELS measurement
[2]high-quality MBE and cross section samples
[3]TEM characterization
[4]Nanoparticle synthesis

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