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Optical properties of topological insulator nanoparticles[1] GLEB SIROKI, DEREK LEE, PETER HAYNES, VINCENZO GIANNINI, Imperial College London — Topological insulators are materials that have metallic surface states protected by time-reversal symmetry. Such states are delocalised over the surface and are immune to non-magnetic defects and impurities. Building on previous work [1] we have studied the interaction of light with topological insulator nanoparticles. Our main finding is that the occupied surface states can lead to charge density oscillations akin to plasmons in metallic nanoparticles. Furthermore, these oscillations can couple to phonons forming a previously unreported excitation [2]. Because the states are localised at the surface a small number of them is enough to change the absorption spectrum of a particle containing many thousands of atoms. We are going to show how the effect can be adjusted by varying the particle's size and shape. Furthermore, we will discuss the robustness of the effect in the presence of disorder. In conclusion, topological nanoparticles can be used as a highly-tunable building block to create a metamaterial operating in THz range. This may be interesting for plasmonics and metamaterials communities as well as researchers working on cavity electrodynamics and quantum information.
[1] Imura et al, PRB 86, 235119 (2012)
[2] Siroki et al, Nat. Comm. 7, 12375 (2016)

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Gleb Siroki
Imperial College London

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