Topological Metamaterials

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Metamaterial is a material which gains its properties from its structure rather than directly from its material composition. Within the context of photonics, such compounds are engineered composites that exhibit superior, designed properties that are not found in nature and not observed in the constituent materials. They have demonstrated many intriguing properties and applications for control over electromagnetic waves such as negative refraction, superlensing, cloaking devices and they have inspired optical nanocircuits, i.e. circuits with nanometric dimension where the signal is the light.

From another hand, in solid state physics the relevant materials that attracted a lot of attention recently are known as topological insulators (TIs). TIs possess gapless and delocalised surface states protected by time-reversal symmetry. This symmetry implies that the surface states in TIs cannot be localised or removed by defects and non-magnetic impurities as opposed to the case of ordinary insulators. In this project we will merge these two concepts and study the light interaction with a new class of metamaterials, i.e. metamaterials composed with topological insulators\(^1\).