Transmission in bilayers of graphene and MoTe$_2$

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Two dimensional materials bring about the possibility of a revolution in electronic and optoelectronic devices. On the one hand graphene was the first discovered truly two dimensional material synthesized in the laboratory. It is a zero gap semiconductor with exceptional thermal, structural and electronic properties. On the other hand the absence of a band gap has hindered its use in electronic such as in transistor and led the search for other 2D compounds. In that sense the family of transition metal dichalcogenides (TMDC) could fill the missing gap for specific materials. This family of materials has a band gap in the range of 1-2 eV, they are layered, and are relatively easily exfoliated. While MoS$_2$ is the more widely studied one, MoTe$_2$ could be of significant interest particularly due to the presence of stronger spin orbit effects. In this work we address using a combination of density functional theory and non-equilibrium Green’s functions, the electronic and transport properties of a MoTe$_2$/Graphene heterostructure. In particular the induced effects due to the presence of the TMDC including spin orbit coupling (SOC) on graphene are addressed in the case of different defects. This Lego like arrangement can bring the best properties of each material into play and SOC can have significant effects on localized states close to the defects.