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Vertical transport in graphene/h-BN/graphene structures: multiple negative differential conductance regions and phonon assisted tunneling BRUNO AMORIM, Inst Superior Tecnico (IST), RICARDO RIBEIRO, NUNO PERES, Center of Physics and Department of Physics, Universidade do Minho — Van der Waals (vdW) structures - formed by stacking different layers of two-dimensional crystals, which are held together via interlayer vdW interactions - have emerged in recent years as a route to create systems with tailored properties. Among the many possibilities, graphene/hexagonal boron nitride (h-BN)/graphene structures have received considerable attention, having been shown to operate as transistors and to display negative differential conductance. In this work, we study in detail the effect of the rotational alignment between the h-BN spacer and the graphene layers in the vertical current of a graphene/h-BN/graphene device. We show that for small rotation angles, the transference of momentum by the h-BN crystal lattice to the tunneling electrons leads to multiple peaks in the I-V curve of the device, with associated multiple negative differential conductance regions. We also study the effect of scattering by phonons in the vertical current and see how the spontaneous emission of optical phonons opens up new inelastic tunneling channels, which give origin to sharp peaks in the second derivative of the current with respect to the bias.

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