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**Tunnelling in van der Waals heterostructures** ARTEM MISHCHENKO, KOSTYA NOVOSELOV, ANDRE GEIM, School of Physics And Astronomy, The University of Manchester, LAURENCE EAVES, The University of Nottingham, VLADIMIR FALKO, School of Physics And Astronomy, The University of Manchester — When graphene and other conductive two-dimensional (2D) materials are separated by an atomically thin insulating 2D crystal, quantum mechanical tunnelling leads to appreciable current between two 2D conductors due to the overlap of their wavefunctions. These tunnel devices demonstrate interesting physics and potential for applications: such effects as resonant tunnelling, negative differential conductance, light emission and detection have already been demonstrated. In this presentation we will outline the current status and perspectives of tunnelling transistors based on 2D materials assembled into van der Waals heterostructures. Particularly, we will present results on mono- and bilayer graphene tunnelling, tunnelling in 2D crystal-based quantum wells, and tunnelling in superconducting 2D materials. Such effects as momentum and chirality conservation, phonon- and impurity-assisted tunnelling will also be discussed. Finally, we will ponder the implications of discovered effects for practical applications.

Artem Mishchenko
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