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Geometry-dependent magnetoresistance between edge states of graphene layers VíCTOR MANUEL GARCíA-SUÁREZ, University of Oviedo and CINN, AMADOR GARCíA-FUENTE, DIEGO CARRASCAL, University of Oviedo, ENRIQUE BURZURI, IMDEA Nanoscience, MICHEL CALAME, University of Basel, HERRE VAN DE ZANT, Delft University of Technology, JAIME FERRER, University of Oviedo and CINN, UNIVERSITY OF OVIEDO TEAM, DELFT UNIVERSITY OF TECHNOLOGY TEAM, UNIVERSITY OF BASEL TEAM — We thoroughly characterize the rich transport properties of 2D materials separated by a nanogap and terminated with magnetic edges. We find that the low-bias conductance is spin dependent and varies with the orientation of the magnetic configuration of the edges and their precise geometry. When the edges are straight the $I-V$ curve is perfectly ohmic but the magnetoresistance is negligible because the magnetic states of the borders do not couple to the inner states. The introduction of imperfections such as wedges or protrusions couples the edge states to the inner states and produces a sizeable magnetoresistance effect, which translates into a giant negative magnetoresistance when both sides of the junction have wedges in front of each other. We also find a clear negative differential resistance and a strong spin filtering-rectification for this configuration and also for configurations with wedges facing straight edges. The analysis of the $I-V$ curves allows us then to univocally determine the type of edges and their magnetic properties. We apply our model to the specific case of zigzag graphene edges and find a very good qualitative agreement between our results and the simulated ab-initio results.

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