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Valley filters, accumulators, and switches induced in graphene quantum dots by lines of adsorbed hydrogen atoms

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We present electronic structure and quantum transport calculations that predict conducting channels induced in graphene quantum dots by lines of adsorbed hydrogen atoms to function as highly efficient, experimentally realizable valley filters, accumulators, and switches. The underlying physics is an interesting property of graphene Dirac point resonances (DPRs) that is revealed here, namely, that an electric current passing through a DPR mediated conducting channel in a given direction is carried by electrons of only one of the two graphene valleys. Our predictions apply to lines of hydrogen atoms adsorbed on graphene quantum dots that are either free standing or supported on a hexagonal boron nitride substrate.

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