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Spin-polarized energy-gap opening in asymmetric bilayer graphene nanoribbons

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Electronic and magnetic properties of bilayer zigzag graphene nanoribbon (bZGNR) are studied using pseudopotential density functional method. The edge atoms in the top and bottom layers of bZGNR make a weak hybridization, which leads to electronic structures different from monolayer ZGNR. For asymmetric bZGNR, where the top and bottom layers have different widths, one edge is pinched by the interlayer bonding and the other sustains antiferromagnetic ordering. A small amount of charge transfer occurs from narrower to wider layer, producing spin-polarized electron and hole pockets. External electric field produces asymmetric energy-gap opening for each spin component, inducing half-metallicity in bZGNR.

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