Spin-Dependent Seebeck Effect in Zigzag Graphene Nanoribbon with Edge Magnetism

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Zigzag Graphene Nanoribbon is an attractive material for electronic and spintronic applications, thanks to its edge magnetism, which was predicated theoretically[1], and confirmed by experiments.[2-4] Depending on the temperature, ribbon width, and carrier density, GNR could be in anti-Ferro, Ferro, or Para magnetic. The previous single conducting channel[3], namely half of the quantum conductance, with a mean-free path up to a few micrometers at room temperature, was explained by spin-protected transport of minority carriers. In contrast, the majority carriers suffer from strong electron-phonon coupling, and have much shorter mean-free paths. Such a strong spin-dependent transport can also be interesting in spin-caloritronics. The Seebeck coefficients can have opposite signs for minority and majority carriers, which allows spatial separation of spin carriers under a temperature gradient.

References

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Figures

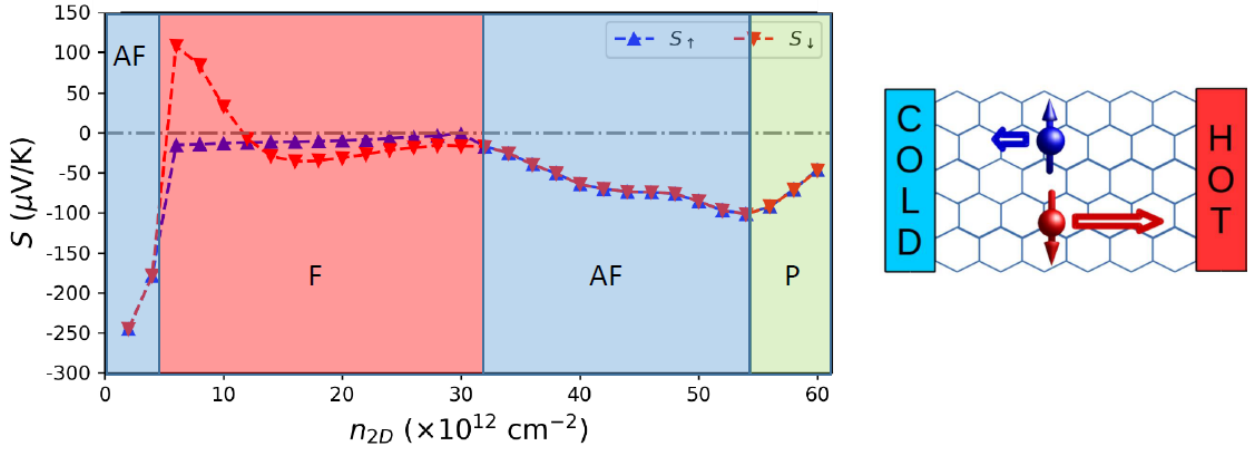

Figure 1: (Left) Seebeck coefficient of zigzag GNR at room temperature. With the increase in carrier density, the GNR undergoes anti-Ferro, Ferro, anti-Ferro, and Paramagnetic states. (Right) In the Ferromagnetic state, the Seebeck effect is spin-dependent and could have an opposite sign, allowing spatial separation of spin carriers using a temperature gradient.