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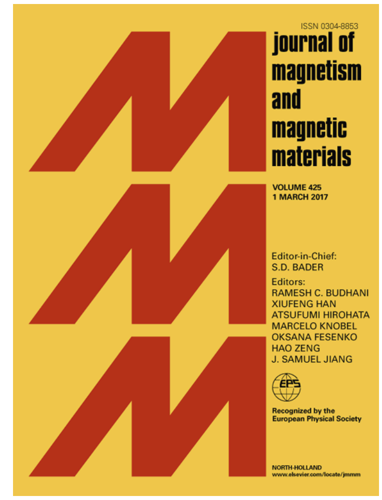

Invalidity of the Fermi liquid theory and magnetic phase transition in quasi-1D dopant-induced armchair-edged graphene nanoribbons

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Invalidity of the Fermi liquid theory and magnetic phase transition in quasi-1D dopant-induced armchair-edged graphene nanoribbons

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Abstract

Based on theoretically tight-binding calculations considering nearest neighbors and Green's function technique, we show that the magnetic phase transition in both semiconducting and metallic armchair graphene nanoribbons with width ranging from 9.83 $\AA$ to 69.3 $\AA$ would be observed in the presence of injecting electrons by doping. This transition is explained by the temperature-dependent static charge susceptibility through calculation of the correlation function of charge density operators. This work showed that charge concentration of dopants in such system plays a crucial role in determining the magnetic phase. A variety of multicritical points such as transition temperatures and maximum susceptibility are compared in undoped and doped cases. Our findings show that there exist two different transition temperatures and maximum susceptibility depending on the ribbon width in doped structures. Another remarkable point refers to the invalidity (validity) of the Fermi liquid theory in nanoribbons-based systems at weak (strong) concentration of dopants. The obtained interesting results of magnetic phase transition in such system create a new potential for magnetic graphene nanoribbon-based devices.

Keywords: Armchair graphene nanoribbons; Magnetic phase transition; Static susceptibility; Electron injection

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