

بسمه تعالی

سخنرانی علمی

Anderson impurity model in Dirac materials: from local moment formation to it's quench

Abstract: In this talk, I will introduce the Single Impurity Anderson model (SIAM) and also the notion of Dirac materials; systems which their low energy excitations are described by Dirac equation. Then, considering Dirac material in two dimensions (2D), I will consider point defect and ad-atom in graphene. Our calculation shows that two-sublattice nature of graphene lattice in conjunction with the three-fold rotational symmetry, allows for the p-wave hybridization of impurity state with the Bloch states of carbon atoms. The p-wave hybridization appears when dealing with vacancies, substitutional ad-atoms and the hollow-site impurities. In contrast, the s-wave mixing on graphene lattice pertains only to the top site impurities. We compare the local moment formation in these two cases and find that the local moments formed by p-wave mixing compared to s-wave one are robust against the changes in the parameters of the model.

Considering 3D Dirac material, we have investigated SIAM in bismuth within Hartree approximation. The general picture in a host of a simple one-band metal is that a large Hubbard U in the impurity orbital is prerequisite for the formation of localized magnetic states. Here, we show that such a strong spin-orbit interaction allows to form localized magnetic states even with small values of Hubbard U. Finally we consider Kondo interaction in Weyl semimetal. We show that Kondo temperature can be tuned by chemical potential in the same way as graphene. In addition, by tuning the chemical potential, the bounding energy between the impurity and Weyl quasi-particles passes through a maximum. Therefore, based on our calculation we suggest an optimal doping which corresponds to the most probable doping to observe the Kondo effect in Weyl semimetals.

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