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Room temperature p-orbital magnetism in monoatomic carbon chains

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The study of magnetism without the involvement of transition metals or rare earth ions is considered the key for the next generation spintronic devices. Various recent reports claim that optimizing the occupation number of the mixed p-orbitals is the optimistic way to strengthen the p-orbital magnetism in bulk crystals. We prove experimentally that the kinked monoatomic carbon chains, the so-called linear-chained carbon, allows intrinsic ferromagnetism even above room temperature. According to our ab initio calculations, unconventional magnetism is credited from the p-shells. In contrast, the linear monoatomic carbon chains are non-magnetic. Although the optimized differential spin density of states at the Fermi level (SDOS) of the kinked carbon chains is larger than that of bulk Fe, the magnetic moment is as weak as 0.3μB. In order to reinforce the magnetic response, we tune the p-orbital magnetism by introducing dopants from groups IV to VII of the periodic table. Our best system, the arsenic-doped carbon chain, generates a strong local magnetic moment of 1.5μB, which is comparable to that of the bulk Fe of 2.2μB, with the mean exchange–correlation energy reaching a 63% ratio in comparison to bulk Fe.

Speaker Biography

Wong Chi Ho studied bachelor program in Department of Applied Physics in the Hong Kong Polytechnic University from 2009 to 2011. In 2010, he went to United Kingdom as a research trainee (particle physics) in Lancaster University. In 2011, he obtained full PhD scholarship from Hong Kong. In 2015, he has completed his PhD degree in the field of experimental and computational superconductivity at the age of 28 years from Hong Kong University of Science and Technology. In 2016, he was a postdoctoral researcher in Ural Federal University in Russia. Now he returns to Hong Kong to serves as postdoctoral researcher in Hong Kong University of Science and Technology. He registered two patents in China Patent Office and published many high-impacted journals such as ACS Nano.

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