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Antiferromagnetically assisted electron-phonon coupling as a mechanism of Fe-based superconductivity

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While there is still no self-consistent theory on the mechanism in iron-based superconductors, we develop a novel theoretical ab-initio approach that allows us to explicitly calculate the superconducting transition temperatures (Tc) of $LaFeAsO_{1-x}F_x$, $SmFeAsO_{1-x}F_x$ and $NdFeAsO_{1-x}Fx$ that perfectly agree with experiments. We consider recent evidence that electron-phonon coupling may have been previously underestimated where the hidden force owing to anti-ferromagnetism can greatly enhance the electron-phonon coupling through the localized orbitals of iron d-like xz or yz orbitals. We then include the contribution of these localized orbitals in a McMillan formalism with modified pairing potential that additionally considered the dipole-dipole attraction between the spin-polarized electrons on the Fermi surface and the iron orbitals in combination with the exchange Hamiltonian. With this approach we can not only calculate a theoretical Tc of $LaFeAsO_{0.9}F_{0.1}$ as a series of pressure corresponding to the experimental values, but also get the correct doping dependence.

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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