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2015 SEMINAR SERIES PRESENTS

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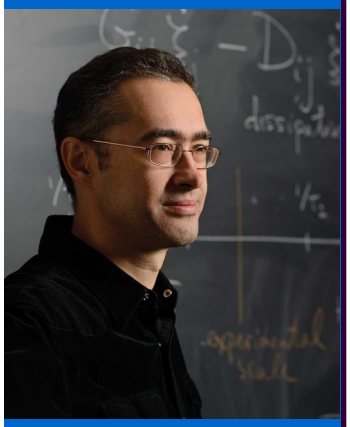
Propulsion of a domain wall in an antiferromagnet by magnons



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Domain walls in ferromagnetic nanowires can be used to store bits and perform logical operations on them, as demonstrated by IBM's racetrack memory. In recent years, there have been proposals to use antiferromagnets for the same purpose. These materials can offer some advantages, such as a lack of stray magnetic fields and higher propagation speeds, as well as challenges: how do we propel domain walls in them? Whereas mechanisms of propulsion in ferromagnets have been studied for decades and are well understood, antiferromagnets are the new frontier for both theorists and experimentalists.

I will compare and contrast the mechanisms of domain wall propulsion in ferro- and antiferromagnets. To that end, I will discuss simple models of a domain wall in one spatial dimension. In an easy-axis magnet, a domain wall resembles a bead on a string in that it has two degrees of freedom: position and orientation. In a ferromagnet, the "bead" behaves in a curious way: when pushed it rotates and when twisted it moves. Hence the idea of using "spin transfer torque" as a means of propelling domain walls, typically realized by sending a spin-polarized electric current through the wire. In an antiferromagnet, the "bead" behaves in a familiar way, accelerating when pushed and spinning up when twisted. Thus one needs to apply a force, rather than a torque, to move a domain wall in an antiferromagnet. I will discuss how a flux of magnons can exert a force on a domain wall and thus propel it.

Oleg Tchernyshyov is a professor in the Department of Physics and Astronomy at Johns Hopkins University, where he has been a faculty member since 2002. He received his Ph.D. in 1998 from Columbia University and his M.Sc. in 1990 from the Moscow Institute of Physics and Technology. Prior to joining Johns Hopkins, he worked as a postdoctoral fellow at Princeton University and the Institute for Advanced Study. His research topics include magnetism and topological defects.

Host:
Professor Kirill Belashchenko

Department of Physics & Astronomy

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Wednesday, November 4, 4:00 pm
136 Jorgensen Hall
3:45 – refreshments in Jorgensen Atrium