Long lifetime of terahertz magnons in metallic ultrathin ferromagnets

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The lifetime of terahertz magnons in metallic ferromagnets is very short due to their decay into single-particle Stoner excitations, so-called Landau damping. Such a short lifetime seriously hinders the use of terahertz magnons in magnonics.

In this talk, we present the long lifetime of terahertz magnons in ultrathin FePd(001) alloy films grown on a Pd(001) substrate. The results were obtained by means of spin-polarized electron energy loss spectroscopy. It is observed that the magnons' lifetime in ultrathin FePd alloy films is rather long compared to the one in Fe and Fe-based alloy films grown on other substrates, as shown in Fig. 1. On the basis of first-principles calculations, we explain the microscopic nature of the long magnons' lifetime. It mainly originates from the peculiar electronic hybridizations between Fe and Pd atoms. These electronic hybridizations lead to the suppression of the relaxation channels of terahertz magnons and result in a long magnons' lifetime. We anticipate that the long lifetime of magnons in FePd films makes this material a good candidate for terahertz magnonics [1].

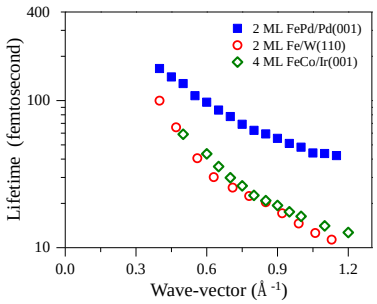

Fig. 1: The experimental magnon lifetime of the FePd alloy film (solid squares) compared with the one of a two-atomic-layer-thick Fe film on W(110) (empty circles) and the one of a four-atomic-layer-thick FeCo alloy film on Ir(001) (empty squares).

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