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On the Life and Death of High Energy Surface Magnons

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Surface magnons may be excited by inelastic scattering of low energy electrons. They are distinguished from surface phonons of similar energy by using spin-polarized primary electrons. We studied high-energy magnons with large wavevector, for which no other analysis technique exists. For fcc Co films on Cu(100) and hcp Co films on W(110) we found the dispersion to be determined by the surface Brillouin zone. By Fourier analysis of the energy- and momentum-distribution of experimental spectra we found the magnons to be short lived (of order of a few 10 fs). During their lifetime they move in real space by about 1 nm. Thus we probe elementary magnetic excitations on a linear space-time scale of 10 yocto-metersec. This puts the applicability of the conventional picture of spinwaves into question. * This work was done in collaboration with R. Vollmer, M. Etzkorn, A. Kumar, and H. Ibach.