

The effect of the probe magnetic moment orientation of magnetic resonance force microscope on the spectra of spin wave resonances

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Magnetic resonance force microscopy (MRFM) is a powerful method for investigation of local ferromagnetic resonance (FMR) [1,2]. We use MRFM for the study of FMR in the array of permalloy microstrips with a size of $3000 \times 500 \times 30 \text{ nm}^3$ arranged on a rectangular lattice of $3.5 \times 6 \mu\text{m}^2$ under the conditions of strong probe-sample interaction. This interaction leads to complex modification of the FMR spectra expressed both in splitting lines and in changes in the shape of spectra. Dependences of the MRFM spectra of the sample on the probe-sample distance and the orientation of the probe magnetic momentum are analyzed.

Magnetic resonance may appear in the spectrum as a peak or a dip. It is determined by sign of interaction force between probe and sample [3]. Figure 1 shows the MRFM spectra depending on the mutual direction of the magnetic momentum of probe of the microscope and the external magnetic field. It is seen that the change of direction of the external magnetic field relative to the magnetic momentum of the probe leads to replacement of the dips on the peaks and, on the contrary. The interaction force sign between the probe and the sample has a different sign in these experimental configurations.

Figure 2 shows the MRFM spectra for different distances between probe and sample and for different the magnetic momentum of probe orientations: magnetic momentum is directed along the sample surface (Fig. 2a) and perpendicular to sample surface (Fig. 2b). It is seen that orientation of probe magnetic momentum has a big influence on MRFM spectrum.

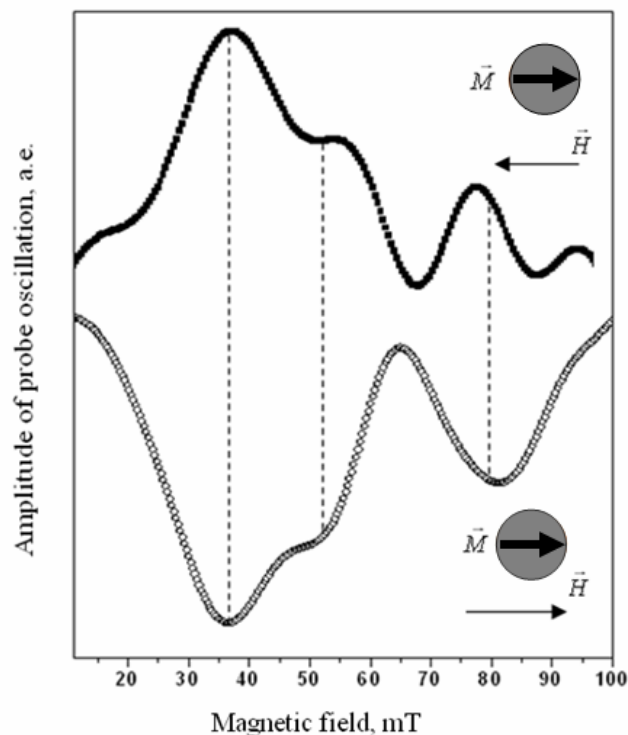


Figure 1. FMR MRFM spectra of permalloy microstripe for the case when the probe is magnetized along the surface of the sample. The external magnetic field is directed as well as the magnetic moment of the probe (light circles) and in the opposite direction (black circles). The distance between the probe and the sample surface is $3 \mu\text{m}$.

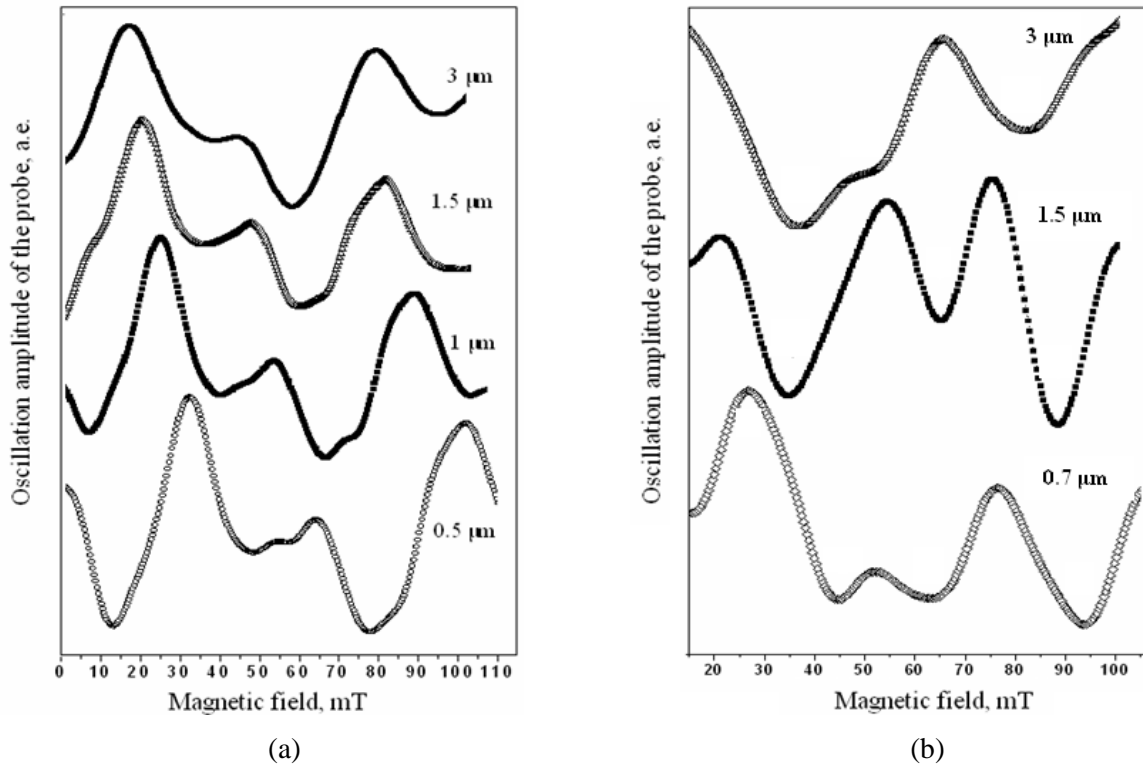


Figure 2. MRFM spectra of microstripes. The magnetic momentum of probe is directed along the sample surface (a) and perpendicular to sample surface (b).

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