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Chirality of Bloch domain walls in exchange biased CoO/Co bilayer seen by waveguide-enhanced neutron spin-flip scattering

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The magnetic state of exchanged biased CoO(20nm)/Co(d_F) bilayers (d_F=5-20nm) was studied by means of polarized neutron reflectometry. By introducing a Nb(20nm) spacer layer between the CoO/Co bilayer and the Al_2O_3 substrate, we designed a resonator structure with significantly enhanced intensity of the spin-flip (SF) scattering at the position of the optical resonances. For the trained sample with thinnest Co layer (d_F = 5nm), we detected strong SF scattering at the resonance position to the amount of 30\% the incoming intensity, pointing to a high degree of non-collinearity of the magnetization. With increasing d_F, the intensity of the SF scattering decreases linearly. Furthermore, an unconventional asymmetry of up-down and down-up scattering channels at the resonance positions was observed, which we ascribe to the out-of-plane magnetic stray field generated by chiral Bloch domain walls. This field leads to Zeeman splitting of the neutron energies depending on the initial neutron spin polarization. The chirality of the domain walls is assigned to Dzyaloshinskii-Moriya interaction emerging at the CoO/Co interface. Our observations might prove useful for the design of spintronic devices based on the exchange bias effect.

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