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Atomic Interpretation of Dichroism of the $L_{2,3}$ spectra of the rare earths

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The XMCD spectra of the $L_{2,3}$ edges of the rare earths could in principle be an important probe of the role of the 5d orbital in the magnetism of these elements. A lot of insight has been gained already, but these spectra have defied detailed interpretation so far. We have studied the L-edges of paramagnetic and ferromagnetic rare earth insulators in fields up to 7 Tesla and temperatures down to ~3 K. We obtained high quality spectra showing line shapes that are close to the derivative of the absorption spectrum, independent of temperature. Our data are well described by an atomic model calculation starting from a 4fN 5d0 ground state. In this model, the final state 4f-5d exchange interaction is the single determinant factor responsible for the dispersive shape. It was already realized earlier that the 5d-4f interaction also leads to a spin dependence of the dipole matrix elements. We show that inclusion of such a spin-dependent matrix element in our atomic calculations reproduces quite well the trend in the L3/L2 XMCD branching ratio of literature data for the RE-Fe_2 series.