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Direct measurement of voltage-controlled reversal of the antiferromagnetic spin structure in magnetoelectric Cr_2O_3[1] JUNLEI WANG, CHRISTIAN BINEK, University of Nebraska-Lincoln — The frequency dependence of the electric field induced magneto-optical Faraday effect is investigated in the magnetoelectric antiferromagnet chromia. Two electrically induced Faraday signals superimpose in proportion to the linear magnetoelectric susceptibility and the antiferromagnetic order parameter. The relative strength of these contributions is determined by the frequency of the probing light beam. It allows tuning the Faraday signal between extreme characteristics which follow the temperature dependence of the magnetoelectric susceptibility or solely that of the antiferromagnetic order parameter. The frequency dependence is analyzed in terms of electric dipole transitions of perturbed Cr^{3+} crystal-field states. The results lead to a table-top set-up allowing to measure voltage-controlled selection and temperature dependence of the antiferromagnetic order parameter. The Faraday rotation per applied voltage is independent of the sample thickness making the method scalable and versatile for thin film investigations. Scalability, compactness, and simplicity of the data analysis combined with low photon flux requirements make the Faraday approach advantageous for the investigation of the otherwise difficult to access voltage-controlled switching of antiferromagnetic domain states in magnetoelectric thin films.

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