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Scaling of the anomalous Hall effect in $SrRuO_3$ NOAM HAHAM, YISHAI SHPERBER, MOTY SCHULTZ, NETANEL NAFTALIS, EFRAT SHIMSHONI, Department of Physics, Nano-magnetism Research Center, Institute of Nanotechnology and Advanced Materials, Bar-Ilan University, Ramat-Gan 52900,Israel, JAMES REINER, Department of Applied Physics, Yale University, New Haven, CT 06520-8284, LIOR KLEIN, Department of Physics, Nano-magnetism Research Center, Institute of Nanotechnology and Advanced Materials, Bar-Ilan University, Ramat-Gan 52900,Israel — Being one of the most intriguing manifestations of a transport phenomenon that is sensitive to spin and topology, the anomalous Hall effect (AHE) is at the focus of considerable theoretical and experimental efforts. $SrRuO_3$ has played a pivotal role in the study of the AHE and numerous attempts have been made to elucidate its complicated behavior. By using $SrRuO_3$ films with a wide range of thicknesses that vary considerably in the temperature-dependence of their resistivity, we show that the AHE scales with resistivity. The scaling provides a compelling piece of evidence that resistivity, *irrespective of its sources or nature (elastic or inelastic)*, determines the AHE of $SrRuO_3$ in the entire ferromagnetic phase. This observation strongly suggests that changes in Berry phase due to assumed temperature-dependent exchange splitting cannot explain the complicated temperature dependence of the AHE. On the other hand side jumps mechanism combined with Karplus-Luttinger (Berry phase) mechanism that takes into account effects of finite scattering time may explain the observed behavior.

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