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Evolution of Spin-Wave Excitations in Ferromagnetic Metallic Manganites J. ZHANG, H. SHA, Florida Intl. Univ., F. YE, J. FERNANDEZ-BACA, ORNL, P. DAI, Univ. of Tenn. and ORNL, J. LYNN, NIST, H. KAWANO-FURUKAWA, Ochanomizu Univ., Japan, Y. TOMIOKA, CERC, Japan, Y. TOKURA, Univ. of Tokyo and CERC, Japan — The deviation of spin dynamics from the Double-Exchange mechanism in the ferromagnetic metallic manganites is an important yet unsettled issue in the understanding of the close coupling behavior between charge, lattice, orbital, and spin degrees of freedom in these doped "colossal" magnetoresistive materials. We have used neutron scattering to systematically study the spin-wave excitations of three ferromagnetic metallic $A_{1-x}A'_x\mathrm{MnO}_3$ manganites (where A and A' are rare- and alkaline-earth ions respectively). By combining with previous work, we elucidate the systematics of the spin-spin interaction and interactions between spin and other degrees of freedom as a function of carrier concentration x, on-site disorder, and strength of the lattice distortion. The long wavelength spin dynamics show only a very weak dependence across the series, while the Curie temperatures vary substantially. The ratio of the fourth to the first neighbor exchange ($J_4 = J_1$) that controls the zone boundary magnon softening changes systematically with x, but does not depend on the other parameters. None of the prevailing models can account for these behaviors. The work was supported by NSF-DMR0453804, NSF-DMR0346826, DE-FG02-05ER46202 and DOE DE-FG02-04ER46125. ORNL is managed by UT-Battelle, LLC, for the U.S. DOE under contract DE-AC05-00OR22725.

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