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GMAG Dissertation Award: Magnetoelectric and Magnetodielectric effects in REMn_2O_5

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Recently there have been renewed interests in multiferroics, simultaneously possessing ferroelectricity and magnetic ordering. The understanding of this remarkable occurrence remains a scientific challenge. Despite the possible coexistence of ferroelectricity and magnetism, any profound interplay between them has been rarely observed. This fact has largely prevented the realization of devices with a previously unavailable functionality, which these multiferroics could make possible. We have discovered astonishing interplay between ferroelectricity and magnetism, demonstrated by polarization reversal by magnetic fields and colossal magneto-dielectric effect in REMn_2O_5 (RE: rare earths) as well as intriguing magnetoelectric coupling effects in other multiferroics. Our results point to new device applications such as magnetically recorded ferroelectric memory and important means to tune dielectric properties with external parameters.