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Magnetically driven spiral ferroelectrics with high transition temperature

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In the past few years, a new class of multiferroics have been discovered, wherein non-collinear spiral magnetic order induces ferroelectricity. In these multiferroics, it is not too much to say that the origin of the ferroelectricity is driven by magnetism and is completely different from that in conventional ferroelectrics. However, most of known magnetically driven spiral ferroelectrics operate only at low temperature [ferroelectric Curie temperature (T_C) < 40K]. To develop magnetically driven ferroelectrics with higher T_C, we combined studies of 'high T_c superconductivity in cuprates' and 'multiferroism'. We propose that cuprates having large magnetic superexchange interactions can be good candidates for magnetically driven ferroelectrics with high T_C. In fact, we demonstrate ferroelectricity accompanied by a spiral magnetic ordering in an simple copper oxide, CuO, which is known as a starting material for the synthesis of high-T_c cuprates. CuO shows a spiral magnetic ordering and multiferroics nature below 230K [1]. This result provides a new route to develop magnetically driven ferroelectrics with high T_C. This work is in collaboration with Y. Sekio, H. Nakamura, T. Siegrist, A. P. Ramirez, W. B Wu, and D. J. Huang.

[1] T. Kimura et al., Nature Mater. 7, 291 (2008).