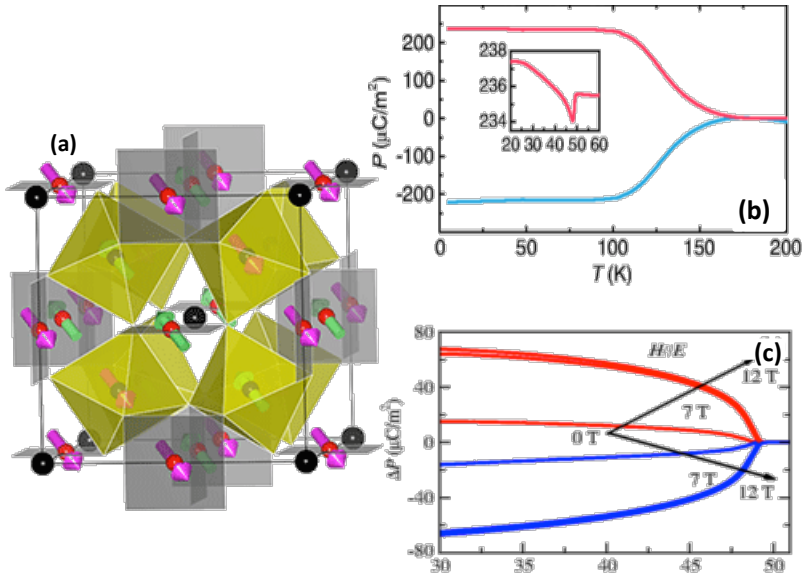
New multiferroic material with a surprisingly highly symmetric crystal structure



Neutron diffraction reveals cubic nuclear structure of LaMn3Cr4O12 hosting the G-type AFM structure of the Cr and Mn sublattice with spin orientation along the [111] direction that lacks an inversion center. The magnetism occurs concurrently with the onset of ferroelectric polarization and is enhanced by the application of a magnetic field.

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Scientific Achievement

$LaMn_3Cr_4O_{12}$ is a new multiferroic material that has a cubic structure that presents a new mechanism of multiferroicity

Significance and Impact

Multiferroics are materials with correlated magnetic and electric subsystems, making them viable for spintronic and other magnetoelectric applications. Cubic crystals have an inversion center, so they are not expected to be multiferroic. In $LaMn_3Cr_4O_{12}$, the magnetization within the cubic material forms a spin pattern that is asymmetric. Thus, a unique mechanism via spin-orbit coupling between the two independent magnetic sites can induce ferroelectricity.

Research Details

– Neutron powder diffraction determine the temperature dependent crystal and magnetic structure

X. Wang, Y. Chai, L. Zhou, H. Cao, C. dela Cruz, J. Yang, J. Dai, Y. Yin, Z. Yuan, S. Zhang, R. Yu, M. Azuma, Y. Shimakawa, H. Zhang, S. Dong, Y. Sun, C. Jin, and Y. Long, Phys. Rev. Lett. **115**, 087601