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EINLADUNG zum IFP-SEMINAR

On antiferroelectric phase transitions and model antiferroelectric materials

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Host:	Andrei Pimenov
Termin:	Mittwoch, 9. Oktober 2019, 16:00 Uhr
Ort:	Institut für Festkörperphysik, TU Wien
	Wiedner Hauptstraße 8-10, 1040 Wien
	Seminarraum DC rot 07 (roter Bereich, 7. OG)

Abstract:

Antiferroelectricity is a notion that is intuitive and yet surprisingly controversial. There is in fact no consensus on its very definition. The original sin is that no symmetry criterion has been accepted to identify antiferroelectric materials. Instead, antiferroelectric transitions are recognized empirically by a set of experimental signatures, notably by the proximity of a ferroelectric phase that can be induced by application of an electric field, producing a characteristic hysteresis loop. Yet those signatures are also disputable in many cases, and antiferroelectricy remains very loosely defined.

A related concern is to find materials that can serve as simple models for antiferroelectric phase transitions. The classical antiferroelectric perovskite, $PbZrO_3$, is notoriously complex, exhibits multiple structural instabilities, and can hardly serve as a simple model. More generally, all classical antiferroelectric transitions seem to be dominantly of the order-disorder type, and no soft-mode driven transition – like in $PbTiO_3$ for ferroelectrics – could be identified. Recently, we have discovered such an transition in an orthorhombic francisite $Cu_3Bi(SeO_3)_2O_2Cl$. We have measured the lattice dynamics both below and above its phase transition temperature at 115 K respectively with Raman spectroscopy, inelastic X-ray scattering and thermal diffuse scattering. In both cases, a nearly ideal soft-mode behaviour was observed, with a linear dependence of the frequency squared with temperature. This provides us with the very first example of an elementary, Kittel-like textbook antiferroelectric.