



Contribution ID: 1

Type: **Talk**

## Hidden Charge Order in an Iron Oxide Square-Lattice Compound

*Tuesday 7 December 2021 16:15 (25 minutes)*

Since the discovery of charge disproportionation in the  $\text{FeO}_2$  square-lattice compound  $\text{Sr}_3\text{Fe}_2\text{O}_7$  by Mössbauer spectroscopy more than fifty years ago, the spatial ordering pattern of the disproportionated charges has remained “hidden” to conventional diffraction probes, despite numerous x-ray and neutron scattering studies. We have used neutron Larmor diffraction and Fe  $K$ -edge resonant x-ray scattering to demonstrate checkerboard charge order in the  $\text{FeO}_2$  planes that vanishes at a sharp second-order phase transition upon heating above 332 K. Stacking disorder of the checkerboard pattern due to frustrated interlayer interactions broadens the corresponding superstructure reflections and greatly reduces their amplitude, thus explaining the difficulty of detecting them by conventional probes. We discuss the implications of these findings for research on “hidden order” in other materials.

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**Session Classification:** Structure Research

**Track Classification:** Structure Research