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Quasi-3D ordered lattice modulations in a bilayer ruthenate with no long-range order[1] ZAHIRUL ISLAM, Argonne National Laboratory (ANL), ZHE QU, Tulane University (TU), YEJUN FENG, JONATHAN LANG, ANL, JIN PENG, ZHIQIANG MAO, TU — Bulk measurements reveal disorder-induced unconventional quantum critical behaviors in $(Sr_{1-x}Ca_x)_3Ru_2O_7$ (SCRO) compounds, in particular, near $x = 0.3$. Here we report X-ray scattering studies on SCRO with $x = 0.3$, as well as those for the end members. We find that at $x = 0.3$ robust 2-unit-cell periodic lattice modulations exist that are characterized by $(\frac{1}{2}, 0, 0)$ and $(0, \frac{1}{2}, 0)$, respectively, even at room temperature. These modulations are transversely polarized and quasi-3D ordered in that they are fully coherent in the basal plane with **c** axis correlations at least one unit cell in extent. These modulations are due to correlated displacements of the O atoms. The displacement pattern is consistent with t_{2g}-modes of distortion of RuO_6 octahedra, signifying the presence of lattice and orbital correlations, although no long-range magnetic or orbital order is present. These modulations are absent in the end members.

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