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Room Temperature Monoclinic Phase in $BaTiO_3$ Single Crystals SAVA DENEV, AMIT KUMAR, ANDREW BARNES, EFTIHIA VLAHOS, GABRIELLA SHEPARD, VENKATRAMAN GOPALAN, Pennsylvania State University — $BaTiO_3$ is a well studied ferroelectric material for the last half century. It is well known to show phase transitions to tetragonal, orthorhombic and rhombohedral phases upon cooling. Yet, some old and some recent studies have argued that all these phases co-exist with a second phase with monoclinic distortion. Using optical second harmonic generation (SHG) at room temperature we directly present evidence for such monoclininc phase co-existing with tetragonal phase at room temperature. We observe domains with the expected tetragonal symmetry exhibiting 90° and 180° domain walls. However, at points of higher stress at the tips of the interpenetrating tetragonal domains we observe a well pronounced metastable "staircase pattern" with a micron-scale fine structure. Polarization studies show that this phase can be explained only by monoclinic symmetry. This phase is very sensitive to external perturbations such as temperature and fields, hence stabilizing this phase at room temperature could lead to large properties' tunability.

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