replacing MAR16-2015-004532. Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Links in Superconducting, ferroelectric & antiferrodistortive instabilities in pristine & ion implanted $SrTiO_3$ by studying JT lattice distortions, Cubic-Tetragonal phase transition, incoherent lattice fluctuations & Phonons using RBS-Ion Channeling, XPS & Raman Scattering.

KALYAN SASMAL, VIKTOR HADJIEV, QUARK CHEN, WEI-KAN CHU, Texas Center for Superconductivity Dept of Physics,University of Houston,TX, USA

— Perovskite $SrTiO_3$ is quantum paraelectric.Cubic-tetragonal phase transition at 105K,driven by condensation of zone corner phonon involving rotation of oxygen octahedra.Jahn-Teller centers allows dynamical charge transfer & polaron-bipolaron formation.Dynamical covalency elicit structural instability in layered superconductor approach ferroelectric.MeV He^+ RBS-Axial Ion Channeling,ultrafast real-space probe of sub-picometre atomic displacement is used to probe JT effect & incoherent lattice fluctuations as a function of temperature in ion implanted STO lattice. Critical channeling angle ψ_c & ratio of minima of Angular ICh–RBS spectral yield χ_{min} for Sr & Ti sub lattices determine lattice distortion.Cr & Fe impurities mostly distort Ti sublattice.Displacements of Ti^{4+} are calculated. Similar values of $\psi_{1/2}$ for Sr sublattice indicates no displacement of Sr.Actually Cr/Fe located in Ti positions.JT Cr^{4+},Cr^{5+}& Fe^{4+} impurity could induce Raman-active localized oxygen vibrational mode, which doesn't involve motion of nearest Fe or Ti ions.Displacive phase transition provides direct evidence of changes with temperature in thermal vibrational amplitude of lattice atoms across structural phase transition.Interplay of ferroelectric, antiferrodistortive distortions & superconducting order are discussed.

Kalyan Sasmal
Texas Center for Superconductivity
Dept of Physics,University of Houston,TX, USA

Date submitted: 06 Nov 2015 Electronic form version 1.4