Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

A ferroelectric quantum phase transition inside a superconducting dome WILLEM RISCHAU, ESPCI Paris, XIAO LIN, ESPCI Paris Universitt zu Kln, CHRISTOPH P. GRAMS, DENNIS FINCK, STEFFEN HARMS, JOHANNES ENGELMAYER, THOMAS LORENZ, Universitt zu Kln, YANN GALLAIS, Universit Paris Didrot, BENOT FAUQU, ESPCI Paris, JOACHIM HEMBERGER, Universitt zu Kln, KAMRAN BEHNIA, ESPCI Paris — $SrTiO_3$, a quantum paraelectric, becomes a metal with a superconducting instability after removal of an extremely small number of oxygen atoms. It turns into a ferroelectric upon substitution of a tiny fraction of strontium atoms with calcium. The exceptionally dilute superconductor and ferroelectric are both percolative orders, which may be accidental neighbors or intimately connected, as in the picture of quantum critical ferroelectricity. We find that in $Sr_{1-x}Ca_xTiO_{3-\delta}$ ($0.002 < x < 0.009$, $\delta < 0.001$) the ferroelectric order coexists with dilute metallicity and its superconducting instability in a finite window of doping. At a critical carrier density, which scales with the Ca content, a quantum phase transition destroys the ferroelectric order. We detect an upturn in the normal-state scattering and a significant modification of the superconducting dome in the vicinity of this quantum phase transition. The enhancement of the superconducting transition temperature with calcium substitution documents the role played by ferroelectric vicinity in the precocious emergence of superconductivity in this system, restricting possible theoretical scenarios for pairing.

Willem Rischau
ESPCI Paris

Date submitted: 14 Nov 2016 Electronic form version 1.4