Diffuse Scattering Study of 2D Superstructure in a T' Electron-Doped Cuprate Superconductor


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It is well-known that electron-doped superconductor Nd$_{0.85}$Ce$_{0.15}$CuO$_4$ can be reversibly rendered a superconductor or non-superconductor by appropriate high-temperature treatments in reducing or oxidizing environments, respectively. We find that superconducting samples exhibit diffuse (0, 0, L) rods of scattering at superlattice positions in the (H, K, 0) plane corresponding to a larger $2\sqrt{2} \times 2\sqrt{2}$ unit cell. We present a synchrotron x-ray diffuse scattering analysis of this rod scattering in related compound Pr$_{0.88}$LaCe$_{0.12}$CuO$_4$ (PLCCO) and demonstrate that it arises from a two-dimensional superstructural distortion of the CuO$_2$ sheets rather than from cubic Nd$_2$O$_3$ (bixbyite) impurities.

Keywords: diffuse scattering, superconducting oxides, superstructure