Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Control of a Two-Dimensional Electron Gas on $SrTiO_3$ (111) by Atomic Oxygen SIOBHAN MCKEOWN WALKER, A. DE LA TORRE, F.Y. BRUNO, A. TAMAI, University of Geneva, T.K. KIM, M. HOESCH, Diamond Light Source, M. SHI, Swiss Light Source PSI, M.S. BAHRAMY, QPEC University of Tokyo, RIKEN (CEMS) Japan, P.D.C. KING, University of St Andrews, F. BAUMBERGER, University of Geneva, Swiss Light Source PSI, University of St Andrews — We report on the formation of a two-dimensional electron gas (2DEG) at the bare surface of (111) oriented $SrTiO_3$. Angle resolved photoemission experiments reveal highly itinerant carriers with a 6-fold symmetric Fermi surface and strongly anisotropic effective masses [1]. The electronic structure of the 2DEG is in good agreement with self-consistent tight-binding supercell calculations that incorporate a confinement potential due to surface band bending. Our measurements provide insight into the nontrivial consequences of quantum confinement along the [111] direction which is directly relevant to an understanding of electronic structure at (111) orientated interfaces. We further demonstrate that alternate exposure of the surface to ultraviolet light and atomic oxygen allows tuning of the carrier density and the complete suppression of the 2DEG. [1] S. McKeown Walker et al., Phys. Rev. Lett. 113, 177601 (2014)

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Date submitted: 14 Nov 2014 Electronic form version 1.4