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Observation of strong spin-orbital entanglement in Sr_2RuO_4 ANDREA DAMASCELLI, C.N. VEENSTRA, Z.-H. ZHU, B. LUDBROOK, A. NICOLAOU, M. RAICHLE, I.S. ELFIMOV, Quantum Matter Institute, UBC, Canada, M.W. HAVERKORT, MPI, Stuttgart, Germany, B. SLOMSKI, G. LANDOLT, J.H. DIL, PSI, Switzerland, S. KITTAKA, Y. MAENO, Kyoto University, Japan — Sr_2RuO_4 stands out even amongst the unconventional superconductors. The relativistic spin orbit interaction causes a momentum dependent entanglement of orbital and spin quantum numbers. Using circularly polarized light combined with spin and angle resolved photoemission spectroscopy, we directly observe this entanglement in good agreement with relativistic band-structure calculations. The presence of spin-charge entangled states inherently has a profound influence on the description of the superconducting state. These entangled states are not well described by a product of an orbital and spin wave-function, thereby blurring the distinction between triplet and singlet states.

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