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Bilayer manganites reveal polarons in the midst of a metallic breakdown[1] F. MASSEE, S. DE JONG, Y. HUANG, W. K. SIU, I. SANTOSO, A. MANS, Van der Waals-Zeeman Institute, University of Amsterdam, 1018XE Amsterdam, The Netherlands, A. T. BOOTHROYD, D. PRABHAKARAN, Clarendon Laboratory, Oxford University, OX1 3PU Oxford, UK, R. FOLLATH, A. VARYKHALOV, BESSY GmbH, Albert-Einstein-Strasse 15, 12489 Berlin, Germany, L. PATTHEY, M. SHI, Paul Scherrer Institute, Swiss Light Source, CH-5232 Villigen, Switzerland, J.B. GOEDKOOP, M.S. GOLDEN, Van der Waals-Zeeman Institute, University of Amsterdam, 1018XE Amsterdam, The Netherlands — Just what tips the balance between the wealth of competing phases and textures in spin, charge and orbital degrees of freedom in the CMR manganites such as $La_{2-2x}Sr_{1+2x}Mn_2O_7$ (LSMO)? Combining ARPES and STM/S measurements on bilayered LSMO ($0.30 \leq x < 0.5$), we arrive at a compelling explanation for the seemingly contradictory data on the electronic structure of bilayered LSMO that has appeared in the literature. We show that the true signature of bilayered (N=2) LSMO is that of a gapped non-metal on the verge of a metallic breakdown. All the former confusion stems from the intrinsic presence of stacking faults leading to either more gapped single layer (N=1) LSMO or sharply peaked, N>2 slabs displaying true metallic double-exchange.

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