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Quantum capacitance in thin film vanadium dioxide metal insulator transition[1] ZHE WU, TALBOT KNIGHTON, VINICIO TARQUINI, Department of Physics and Astronomy, Wayne State University, DAVID TORRES, TONGYU WANG, NELSON SEPULVEDA, Electrical and Computer Engineering Department, Michigan State University, JIAN HUANG, Department of Physics and Astronomy, Wayne State University — We present capacitance measurements of the electronic density of states performed in high quality vanadium dioxide (VO_2) thin films on sapphire (Al_2O_3) substrate. These films show the expected metal insulator transition near 60 °C with resistivity changing by 3 orders of magnitude with a hysteresis of 10 °C. To make a capacitive probe, a gate is suspended above the film surface using a flip-chip method with microfabricated supports. The geometric capacitance per-area reached is 40 pF/mm^2. Such a large capacitance can be significantly modified by electron interaction and band charging/discharging which appear as an extra term known as the quantum capacitance (C_q). An AC signal applied to the gate allows measurement of the changing density of states (DOS) across the MIT. The DOS abruptly increases as the sample is heated through the transition point. Conversely the low temperature drop of $\mathrm{d}\mu/\mathrm{d}n$ is consistent with an energy gap opening in the insulating phase. These parameters shed light on the transition mechanism.

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Zhe Wu
Department of Physics and Astronomy, Wayne State University

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