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Magnetically driven metal-insulator transition in NaOsO3[1]

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The metal-insulator transition (MIT) is one of the most dramatic manifestations of electron correlations in materials, enjoying interest both for its fundamental nature and technological application. Various mechanisms producing MITs have been extensively considered over the years, including the Mott (electron localization via Coulomb repulsion), Anderson (localization via disorder) and Peierls (localization via distortion of a periodic one-dimensional lattice). One additional route to a MIT proposed by Slater in 1951, in which long-range magnetic order in a three dimensional system drives the MIT, has received relatively little attention, particularly from an experimental viewpoint. Using neutron and x-ray scattering we have shown that the MIT in $NaOsO_3$ is coincident with the onset of long-range commensurate magnetic order at 410 K. Whilst candidate materials have been suggested, our experimental methodology allows the first definitive demonstration of the long predicted Slater MIT. We discuss our results in light of recent work on other 5d systems that contrastingly have been predicted to host a Mott spin-orbit insulating state.

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