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Reduction of the low-temperature bulk gap in the topological Kondo insulator samarium hexaboride under high magnetic fields[1]

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The mixed-valent insulator samarium hexaboride exhibits a narrow bandgap at low temperatures, formed by strong-correlation interactions between itinerant d electrons and f states localized to the Sm ions, and surface states accessible to transport below about 2 K. Spectroscopic measurements of the bandgap suggest a gap size of 15-20 meV, but transport measurements of thermally-activated carriers suggest the Fermi energy is about 3 meV below the conduction band edge. Here, we study the activated transport gap in pulsed magnetic fields up to 60 T between 1.5 K and 4 K. The magnetoresistance of the surface states, which has only very weak temperature dependence, is distinct from that of the bulk states, which exhibit thermally-activated behavior. The activation energy shrinks by 50% at fields up to 60 T. Data up to 93 T suggest that the transport gap continues to close, but is only fully-closed at even higher fields. We compare the measured reduction to theoretically-expected behavior due to Zeeman shifts of the Sm ion f-state transition energies. Meanwhile, the surface state shows no hints of Shubnikov–de Haas oscillations, which places constraints on any 2D surface carrier's mobility.

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