**Spin-orbital-entangled *J*eff =1/2 state in 3*d* transition metal oxide CuAl2O4**

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The interplay of spin-orbit coupling (SOC) and Coulomb correlations have become one of the most active area in condensed matter physics. In particular, the spin-orbital-entangled Kramers pair known as the Jeff=1/2 state has been firstly shown in iridates from the intriguing role of large SOC assisted by small electron correlation. The newly found Jeff=1/2 state has brought about a variety of novel phenomena including the relativistic Mott phase, Kitaev quantum spin liquid, non-trivial topology, and so on. To date, however, most of studies have been limited to 4d and 5d transition metal compounds, where the correlation strength is relatively weak. It is mainly due to the existing consensus that large SOC strength is a prerequisite for this fully relativistic entity. During the long history of the 3d transition metal study, SOC has never been a dominating energy scale, rendering the spin-orbital-entangled state almost impractical. Thus, we are still far from understanding the behavior of the spin-orbital-entangled state under the strong correlation limit. Here we report on the CuAl2O4 spinel as the first example of a Jeff=1/2 Mott insulator in 3d transition metal compounds. Density functional theory combined with dynamical mean field theory calculations reveal that the Jeff=1/2 state survives the competition with the orbital-momentum-quenched S=1/2 state with the help of strong electron correlation. The fully relativistic entity found in CuAl2O4 provides insight into the untapped regime where the spin-orbital-entangled Kramers pair resides with strong electron correlation.