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**Unconventional Transport of Spin Bipolarons on an Antiferromagnetic buckled hexagonal lattice of half-filled *d*-band $Mn^{2+}$ ions**[1]

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$CaMn_2Sb_2$ presents a magnetic system with a buckled hexagonal lattice of half-filled *d*-band $Mn^{2+}$ ions. AC resistivity and susceptibility exhibit non-monotonic temperature dependence at 85-210 K. Below 85 K it has an antiferromagnetic (AF) phase with an activation energy of 28 meV, and above 210 K a paramagnetic phase. Using Raman spectroscopy we find a mode at 32 meV which develops below the AF transition. We attribute this excitation to the activation energy associated with the motion of spin bipolarons. Here, hybridization between Sb and Mn results in extra electrons for the Mn 3*d*-shells. It is energetically favorable for these extra carriers to form spin-singlets. These spin-bipolarons cover two Mn sites with a binding energy of ∼80 meV and conduction proceed via photo-assisted hopping with an activation energy of ∼32 meV. This spin bipolaron model explains the spectroscopic features providing a self-consistent picture of this conductivity mechanism that also clarifies reported unusual temperature-dependent magnetic and transport data.

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