Magnetic Phases of \( \lambda\)-(BETS)\(_2\)FeCl\(_4\) investigated by proton NMR spectroscopy. GUOQING WU, W.G. CLARK, P. RANIN, S.E. BROWN, UCLA Physics and Astronomy, L. BALICAS, NHMFL Tallahassee, L.K. MONTGOMERY, Indiana U. Chem. — The organic conductor \( \lambda\)-(BETS)\(_2\)FeCl\(_4\), is of interest because of its unusual phases, which include a paramagnetic metal (PM), an antiferromagnetic insulator (AFI), and a field-induced superconducting phase. Important drivers for these phases are the 3d \( Fe^{3+} \) moments (spin \( S_d = 5/2 \)) from the \( FeCl_4^- \) anions and the \( \pi \) conduction electrons (spin \( S_\pi = 1/2 \)) in the BETS donor molecules, which generate a correlated \( \pi\)-d electron system. Here, we report a proton NMR spectroscopy study of these phases in a small (~3 \( \mu \)g) single crystal of \( \lambda\)-(BETS)\(_2\)FeCl\(_4\) using an applied field of 9 T over the temperature \( (T) \) range 2-180 K. The results show a complex spectrum that broadens and is shifted as \( T \) is lowered in the PM phase, and additional changes associated with the PM-AFI transition. The main spectral features at all \( T \) are attributed to the large dipolar field from the 3d \( Fe^{3+} \) ions at the proton sites. A phenomenological model provides a reasonable fit to them. On lowering \( T \) through the PM-AFI transition at 3.5 K, the spectrum smears and its second and first moments change discontinuously. These features indicate that the transition is first order and that the \( \pi\)-d interaction is important for its properties. The work at UCLA is supported by NSF Grants DMR-0334869 (WGC) and 0203806 (SEB).

Guoqing Wu
UCLA Physics and Astronomy