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Electronic tuning of URu_2Si_2 through ligand site substitution (Si $\rightarrow$ Ga and P) R. E. BAUMBACH, A. GALLAGHER, K. W. CHEN, NHMFL-FSU, S. CARY, FSU - Dept Chem. And Biochem., F. KAMETANI, ASC-NHMFL-FSU, D. GRAF, NHMFL-FSU, T. ALBRECHT-SCHMITT, FSU - Dept Chem. And Biochem., S. C. RIGGS, A. SHEKHTER, NHMFL-FSU — Materials that straddle the boundary between itinerant and local electronic behavior are exemplary hosts for novel phenomena, including unconventional superconductivity, anomalous magnetism, non-Fermi liquid behavior, and exotic electronic phases. The $5f$-electron intermetallic URu_2Si_2 is a well-known example, exhibiting an exotic ordered state ("hidden order") and unconventional superconductivity. In spite of intense experimental and theoretical interest, understanding of the origin of these phenomena remains elusive. We report a study of URu_2Si_2 using the new tuning parameter, ligand site substitution Si $\rightarrow$ L (L = Ga and P). While phosphorous substitution quickly suppresses both hidden order and superconductivity, gallium substitution has a mild effect, illustrating the marked difference between electron- and hole-doping on the ligand site for the physics of this compound. In an effort to disentangle these phenomena, we performed electrical transport and thermodynamic measurements. Electrical transport measurements in high magnetic fields are particularly illuminating, and provide insight into the evolution of the anomalous magnetoresistance, Fermi surface topology, electronic effective masses, and g-factor anisotropy. We discuss trends in these quantities for electron- and hole-doping and their implications for unraveling the behavior of URu_2Si_2.

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