Charge density wave behavior and order-disorder in the antiferromagnetic metallic series $Eu(Ga_{1-x}Al_x)_4$

- Antiferromagnetic metals $EuGa_4$ and $EuAl_4$ have similar magnetic and electronic properties as expected due to the similar size and valence state of Ga and Al. However, doping the series $Eu(Ga_{1-x}Al_x)_4$ with $x = 0$ -1 induces striking changes in the magnetic, electronic, and crystallographic features that differ from both parent compounds.

- Because of the nonlinear changes in the *a* lattice parameter, T_N is maximized in $x = 0.50$ and strengthened ferromagnetic correlations are observed. Additionally, charge density wave behavior indicated by anomalous resistivity is reported in $x = 0.50$.

- Possible origins explored to explain these unexpected features in physical properties include relative order-disorder in the series, chemical pressure resulting from *a* contraction, and the degrees of polarization between the Ga-Al covalent bonds in the series.