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## **【116】 Mixed singlet and triplet two-hole states in $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_{8+\delta}$ unveiled by cluster modeling of the d-d excitations observed by Resonant Inelastic X-Ray Scattering**

We studied the d-d excitations in  $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_{8+}$  by Cu  $L_3$ -edge Resonant Inelastic X-ray Scattering with azimuthal rotation of the polarizations in the sample space, and analyzed the experimental response with a single cluster model. Utilizing group theory classification to incorporate two-hole Coulomb interactions via a Green's function approach, the calculations suggest that the d-d excitations can be described by a two-hole ground state composed of a Hund's triplet mixed with a Zhang-Rice singlet state in all the studied doping regions. Our results highlight the existence of the spin-triplet two-hole state for doped cuprates, and that Hund's triplet physics could play a role in the optimally doped and over-doped regions.

### **Theoretical Work**

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