

Workshop on Frontiers in Quantum Materials



September 1 – 5, 2025

ICTP-SAIFR, São Paulo, Brazil

Venue: Principia Institute

ID: 862 8678 4162

Password: quantum

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Invited Speakers

Registration

Program

GROUP 1 (Monday and Thursday)

- **Rabelo, Lucas Gabriel** (Instituto de Física da Universidade de São Paulo, Brazil): *Kondo screening and random singlet formation in highly disordered systems*

In this work, we introduce the two-impurity Kondo problem as a minimal model to capture the anomalous low-temperature thermodynamics of doped semiconductors, such as Si:P, across the metal-insulator transition (MIT). In particular, we consider pairs of local magnetic moments coupled to a highly disordered, non-interacting electronic bath that undergoes a MIT as a function of doping. Using a large-N variational mean-field approach, we capture both the inhomogeneous local Fermi-liquid and the insulating random-singlet phase and find that the local moment susceptibility exhibits a robust power-law behavior, $\chi(T) \propto T^{-\alpha}$, with α evolving smoothly from 0.8 to 0.6 as doping increases before saturating in the metal. Our results highlight the competition between Kondo screening and random singlet formation as the key ingredients in constructing a complete theory for the low-temperature behavior of strongly disordered interacting systems.