INTERNATIONAL SOLVAY INSTITUTES BRUSSELS

New Horizons Solvay Lectures in Chemistry

Prof. Danna Freedman

(Massachusetts Institute of Technology, USA)

Danna is the F. G. Keyes Professor of Chemistry at MIT. After high school, Danna performed research in Prof. Hongkun Park's laboratory studying defect engineering in single-walled carbon nanotubes at Harvard. During her time as an undergraduate researcher she learnt about magnetic molecules through a fortuitous collaboration between Prof. Park and Prof. Jeffrey R. Long. After graduation, Danna decided to pursue her interest in magnetic molecules and moved across the country to obtain a Ph.D. in Prof. Jeffrey Long's lab at the University of California, Berkeley. During her time at Berkeley, Danna studied fundamentals of magnetic anisotropy in both polynuclear clusters and mononuclear single-molecule magnets. After studying zero-dimensional magnetism for six years, Danna decided to make a serious change and transitioned to two-dimensional magnetism for her postdoctoral research. She moved back to Cambridge, MA to work in Prof. Daniel G. Nocera's laboratory at the Massachusetts Institute of Technology. She worked on geometric spin frustration in Kagomé lattices and quantum spin liquids. During her time at MIT, Danna used X-ray scattering techniques to provide evidence that a compound previously synthesized in Prof. Nocera's laboratory may be an exotic form of matter known as a spin liquid. She recently moved to MIT. Her laboratory's research focuses on applying inorganic chemistry to address challenges in physics.

Chemistry for the Second Quantum Revolution

Abstract: The unique combination of atomic-scale tunability, reproducibility, and chemical specificity make paramagnetic molecules a paradigm-shifting category of materials for quantum information science. This capability has the potential to be transformative for developing a bespoke quantum ecosystem, as, for example, the requirements for a node within a quantum communications network are distinct and potentially orthogonal to those for a quantum sensor. Our team imbued molecular qubits with the same read-out approach as defect-based systems. To achieve this, we envisioned an inverse design problem whereby we mimicked the electronic structure with an orthogonal physical structure. Using transition metal chemistry, we designed the ground state, excited states and dynamics based on straightforward ligand field analysis. By coupling optical read-out with spatial precision, we seamlessly integrated a new class of materials with existing read-out technology.

Tuesday 12 December 2023 at 4.00 pm.

COFFEE AND TEA WILL BE SERVED AT 3:45 P.M IN FRONT OF THE SOLVAY ROOM

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