Halide perovskites: Pioneering materials for clean energy and advanced technologies

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In this talk, I will focus on the pioneering work my group has done on halide perovskites and their transformative impact on solar cell technologies and radiation detectors. Our discovery that these materials can be used a solid solar cells in 2012 has revolutionized the field of photovoltaics, enabling solar cells to achieve power conversion efficiencies that rival traditional silicon-based systems. By introducing perovskites with tunable properties, low production costs, and compatibility with flexible, lightweight substrates, we have pushed solar technology into new realms, making renewable energy more accessible and efficient.

Beyond their influence on solar cells, halide perovskites have had a profound impact on radiation detection technology. We successfully leveraged their unique electronic structure to create highly sensitive gamma-ray and X-ray detectors, demonstrating excellent energy resolution for medical imaging, security screening, and nuclear detection applications. These devices have the potential to redefine how we detect and respond to radiation, offering more precise, reliable, and cost-effective solutions.

At the heart of these innovations is chemical synthesis, which plays a fundamental role in advancing society by enabling the creation of new materials with tailored properties. Through careful design and synthesis, we can engineer materials to solve critical global challenges, from clean energy generation to advanced medical technologies. Chemical synthesis not only fuels scientific discoveries but also drives technological advancements that improve the quality of life. In this talk, I will highlight how our work exemplifies the broader importance of chemistry in society, shaping technologies that have the potential to transform industries and provide sustainable solutions to pressing environmental and technological needs.