DR. ROBERT J. GILLIARD, JR.

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Massachusetts Institute of Technology

Thursday, January 4th

10:30am - 11:30am

Steele 006

"Uncommon Bonds in Boron Heterocycles: From Odd-Electron Molecules to Luminescent Materials"

Biography: Prof. Robert J. Gilliard, Jr. is the Novartis Professor of Chemistry at Massachusetts Institute of Technology (MIT). Prior to joining MIT, he was a member of the faculty at the University of Virginia. He obtained his bachelor's degree in chemistry at Clemson University where he was an undergraduate researcher in the laboratory of Prof. Rhett C. Smith. He earned his doctorate in chemistry at The University of Georgia with Prof. Gregory H. Robinson. Gilliard was a Merck Postdoctoral Fellow and a Ford Foundation Postdoctoral Fellow where he completed his studies working jointly at the Swiss Federal Institute of Technology (ETH Zurich) with Prof. Hansjorg Grutzmacher and at Case Western Reserve University with Prof. John Protasiewicz. He has received several awards and honors. Recent national and international awards include Chemical and Engineering News Talented 12 Scholar, Research Corporation for Science Advancement Scialog Collaborative Innovation Award, National Science Foundation CAREER Award, Alfred P. Sloan Research Fellow, Organometallics Distinguished Author Award, Beckman Young Investigator Award, Packard Fellowship for Science and Engineering, Lloyd N. Ferguson Award for Excellence in Research, and the 2023 ACS Harry Gray Award for Creative Work in Inorganic Chemistry. He also serves on the editorial advisory board for Chemical Communications, Chem Catalysis, Inorganic Chemistry, and Angewandte Chemie.

Abstract: The incorporation of boron into conjugated organic molecules has emerged as a useful strategy to elicit valuable optical and electronic properties which cannot be observed with the analogous all-carbon systems. We have synthesized, structurally characterized, and assessed the aromaticity and optical properties of unusual borafluorene cations, radicals, and anions. Our primary goal has been to isolate molecules in rare electronic states and to provide a link between structure and function. We have now initiated efforts aimed at understanding the chemical reactivity of these 5- and 6-membered boron-containing rings, as well as relevant BN- and BPincorporated analogues. Recently, we discovered that borenium ions can be tailored such that the serve as viable stimuli-responsive materials, possessing thermo-chromic and/or -luminescent properties. In addition to reduced borafluorenes, we have isolated electronically distinct borepin radicals and anions (i.e., 7-membered boron-containing rings). While the anions would formally be 8π electron anti-aromatic systems, the unique non-planar boat-shaped confirmation results in non-aromatic molecules. This lecture will cover our most recent results in these research areas, including our emerging studies on boraacenes and π-extended multi-boron-doped systems.