

Title: “Geometric Deformation in the Design of Biphilic Organophosphorus Catalysts”

Abstract: My research group is interested in the design of new nonmetal catalysts in which main group elements fulfill uncommon roles. Specifically, we have been invested in the discovery of organophosphorus catalysts that behave as more than just Lewis bases. By enforcing nontrigonal geometries on tricoordinate P(III) compounds, we attempt to access structural and electronic conditions that facilitate catalytic cycling in the P(III) \rightleftharpoons P(V) redox couple. Through this approach, we have developed several catalytic atom transfer and bond activation methods in which organophosphorus catalysts make and break bonds via two-electron changes in formal oxidation state, in some sense behaving more like transition metals than ordinary phosphine Lewis bases. In describing the synthetic and mechanistic aspects of these reactions, I hope to illustrate the many as-yet-unrealized opportunities enabled by ‘nonmetal redox’ as an activation mode in catalysis.