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Igor Alabugin grew up in Siberia and earned his MSc and PhD degrees in chemistry from Moscow State University. After a postdoctoral study at UW-Madison, he joined faculty of the Florida State University (FSU) in 2000 where he reached the rank of Distinguished Research Professor. His professional efforts are focused on the discovery of new ways to control chemical structure and reactivity. His interests span development of new chemical transformations, radical and photochemistry, design of light- and pH-activated anticancer drugs, construction of carbon-rich nanostructures, and establishing the roles of electron and hole upconversion in catalysis. Underlying much of this chemistry are contributions to a deeper understanding of stereoelectronic effects.

Accumulating and releasing energy to drive chemical reactions:

from stereoelectronic frustration to electron upconversion

Molecules store energy and, as bonds are formed and broken, every chemical process can either store or release energy. This talk will discuss practical ways for incorporating this common knowledge into reaction design and in searching for new physical phenomena.

After introducing familiar textbook functionalities that accumulate more energy than an excited state, I will show how one can make formation of any reactive intermediate thermodynamically feasible and how to control the flow of energy in chemical reactions by coupling unfavorable and favorable elementary steps.

In the final part, I will introduce the phenomenon of electron upconversion, a counterintuitive way to transform weak reductants into strong reductants in a thermodynamically favorable fashion. Such processes enable electrocatalytic transformations where a single electron or hole can drive multiple catalytic cycles.

Selected references:

Alkyne Origami: Folding Oligoalkynes into Polyaromatics. I. V. Alabugin, E. Gonzalez-Rodriguez. *Acc. Chem. Res.*, **2018**, *51*, 1206; *J. Amer. Chem. Soc*. **2022**, *144*, 23448–23464; *J. Amer. Chem. Soc.* **2022,** *144*, 12321–12338; *Nature Reviews Chemistry*, **2023**, 7, 405–423; *J. Amer. Chem. Soc*., **2024**, *146*, 4187–4211

Electron and Hole Upconversion. *Angew. Chem. Int. Ed*., **2019**, *58,* 5532; *J. Amer. Chem. Soc.,* **2017***, 139*, 16210–16221; *J. Amer. Chem. Soc*., **2023**, *145*, 35, 19354–19367.

Stereoelectronic Effects: *Chem. Soc. Rev.* **2021**, *50*, 10212-10252; *Chem. Soc. Rev.* **2021**, *50*, 10253-10345; *J. Am. Chem. Soc.* **2021,** *143*, 6634-6648. Book: *Oxygen: the Key to Stereoelectronic Control in Chemistry*. *ACS in Focus*, **2023**.