Member Education

Friday Oct. 17, 2025 125 Lakeshore Room – University Center		
1:30 to 2:05	**Peter Psarras** Carbon Direct	From Models to Markets: How Boundary Effects Constrain and Inform Problem Solving
2:10 to 2:45	**Angela Wilson** MICHIGAN STATE UNIVERSITY	Periodic beginnings and unexpected elements: A scientific journey
2:50 to 3:30	**Katharaina Domnanich** MICHIGAN STATE UNIVERSITY	An Overview of Isotope Harvesting Research at the Facility for Rare Isotope Beams

<u>From Models to Markets: How Boundary Effects Constrain and Inform Problem Solving</u>
Peter Psarras, PhD
Senior Decarbonization Engineer
Carbon Direct

"All models are wrong, but some are useful". This remains one of the most important lessons encountered on my academic journey. My earliest models were over-simplified and produced odd boundary effects. While those artifacts were frustrating at the time, they proved to be a valuable teacher. They showed me that boundaries don't just constrain models; they also shape the way we think about problems.

That lesson has carried through every step of my career. Under the charge of making models less "wrong" and more "useful" I found myself exploring more than just physical boundaries. Many of the answers I sought lied within the interfacing disciplines, some so obscure and seemingly removed that I have often found myself looking back asking "How did I get here?" I started modeling molecules from first principles, and somehow meandered into the world of techno-economics, carbon accounting, environmental justice and policy. "Am I still a chemist?"

That answer is “yes”, and I’d argue a much better one than when I started. Today, I work at the intersection of science, policy, and industry, helping large carbon management projects navigate the path from concept to final investment decision. My progression illustrates how chemistry does not end at the molecular scale – it evolves through engineering, economics, and policy to shape real-world outcomes. In doing so, chemistry becomes a discipline without hard boundaries, one that connects science to today’s most urgent challenges.

Periodic beginnings and unexpected elements: A scientific journey

Angela K. Wilson
John A. Hannah Distinguished Professor
Department of Chemistry
Michigan State University

With a career start focused on the development of quantum mechanical approaches in theoretical chemistry, I never would have expected that my research would expand to span the Periodic Table, and move into emerging areas like polaritonic chemistry, but also address topics including aging aircraft, drug discovery, and environmental science. Perhaps most surprising has been our partnerships with colleagues from Michigan State University’s Department of Fisheries and Wildlife, to study Great Lakes fish species, and with colleagues from the University of Maine to study dairy cattle.

An Overview of Isotope Harvesting Research at the Facility for Rare Isotope Beams

Katharina Domnanich
Professor Department of Chemistry and Facility for Rare Isotope Beams
Michigan State University

At the Facility for Rare Isotope Beams (FRIB), exotic secondary beams are created by the fragmentation of a high-power primary beam. In this process, however, only a small fraction of the beam products are selected, and co-produced fragments are intercepted by accelerator components, while the unreacted primary beam will be stopped in a water-traversed beam dump. The accumulated radionuclides in all these components represent an invaluable resource and can be collected through targeted isotope harvesting 1.
In the first part of this talk, I will provide an overview of the isotope harvesting process, with a focus on the collection of 62Zn from a stopped 78Kr beam. The 62Zn decays to the short-lived 62Cu (t1/2= 9.7 min), and both find collective application in nuclear medicine for the 62Zn/62Cu PET generator. The developed purification method facilitated the successful isolation of 62Zn 2. Furthermore, we have started to develop the chemistry required to set up a 62Zn/62Cu generator. I will present results from recent experiments, where we successfully isolated 62Zn from proton-irradiated stable copper foil, set up and optimized a 62Zn/62Cu generator system, and demonstrated the high purity of the eluted 62Cu via radiolabeling. We are also expanding our aqueous isotope harvesting research and have begun to focus on the collection and separation of Ni radioisotopes, which are of interest for both astrophysics and technical applications.

In addition, isotope collection from the solid phase is another possible isotope harvesting mode 3. Recently, we have begun exploring the radioisotopes 189Pt and 197Pt, which are relevant for nuclear medicine applications such as radio-cisplatin, as well as 47Ca, which serves as a precursor for the therapeutically valuable 47Sc. I will provide an overview of the initial developments in the solid harvesting approach, including the first completed irradiation experiments, subsequent radiochemical separations, and initial applications of the harvested isotopes.

Radiochemistry is a relatively specialized area within chemistry, yet radioisotopes play a broad role in everyday life—often without us even realizing it. Next to the scientific aspects, this talk will also highlight some educational aspects related to this niche field.

References

1. Abel, E. P. *et al.* Isotope harvesting at FRIB: additional opportunities for scientific discovery. *J. Phys. G Nucl. Part. Phys.* **46**, (2019).
2. Domnanich, K. A. *et al.* Harvesting 62Zn from an aqueous cocktail at the NSCL. *New J. Chem.* **44**, 20861–20870 (2020).
3. Bence, J. A. *et al.* Solid-phase isotope harvesting of 88Zr from a radioactive ion beam facility. *Appl. Radiat. Isot.* **189**, 110414 (2022).