Weyl semimetals: the case of CeAlGe

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Chemistry Seminar on *Weyl semimetals*

4:00 p.m.
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***via* Zoom**

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Abstract: Single crystals have played an important role in technological advances. One notable example is silicon which is widely used nowadays in transistors, solar cells, semiconductor detectors, and most importantly integrated circuits (chips) used in the computer. Up until now, the scaled size, capacity, and speed of those chips have progressed immensely due to technological advances and have been roughly following Moore's law. In order to achieve a further continued technology scaling of integrated circuits or replace them with new devices, new materials are necessary. New materials are especially important for the next generation of computers-quantum computers.

Weyl semimetals are among the materials proposed to have significant potential in informational technologies and to harbor the necessary elements for quantum computing. They host Weyl nodes at specific points in their Brillouin zone, a pair of relativistic fermions with different chirality, Weyl fermions. The nontrivial momentum-space topology due to the Weyl nodes leads to various fascinating phenomena, such as the chiral anomaly, chiral magnetic effect, anomalous magnetoresistance and Hall effect, large nonsaturating thermopower and ultrafast photocurrents just to name a few. The essential ingredients for the realization of the Weyl semimetal are the absence of inversion symmetry and or time-reversal symmetry. The *R*Al*X* (where*R*=Rare Earth and *X*=Ge, Si) family has been recently identified as a large class of Weyl semimetal based on systematic first-principles band structure calculations. In this respect, I will present details and importance of crystal growth of non-centrosymmetric CeAlGe single crystals, their physical properties, anomalous magnetotransport, and discuss the future implications of our findings and the tunability of RAlGe and RAlSi families.

About the speaker: Halyna Hodovanets was born in a small town in the Carpathian Mountains, Ukraine. Since she wanted to be a teacher, after graduating high school, she applied to Drohobych State Pedagogical University, Ukraine, where she received her B.S. degree majoring in Physics and minoring in English language. Afterward, she taught Physics and mathematics for one year in a medical college. Wanting to learn English better and continue her Physics education, she applied to Minnesota State University, Mankato, where she received her M.S. degree in Physics. She continued her graduate education at Iowa State University, earning her Ph.D. in Condensed Matter Physics. She did postdoctoral training and was promoted to Assistant Scientist at the Maryland Quantum Materials Center at the Department of Physics, University of Maryland. Before coming to Missouri S&T, she was an Assistant Professor at Texas Tech University.

Hodovanets is a recipient of Dr. Glenn and Mrs. Helen Erikson Physics Scholarship, Minnesota State University, Mankato 2007-2008 and the 2012 Iris Ovshinsky student travel award for material physics, APS Physics.

Hodovanets' research focuses on the synthesis and discovery, characterization, and optimization of novel quantum materials (e.g. Weyl semimetals, superconductors, antiferro- and ferromagnets, magnetocaloric, and thermoelectric materials) in a single crystalline form. Her interest is in the exotic electronic and quantum states of matter that are realized in quantum materials and can be tuned with chemical substitution, magnetic field, or application of pressure.