

# High-Definition Differential Ion Mobility Spectrometry for Proteomics, Metabolomics, and Structural Biology

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## Abstract:

Complex biological and environmental samples generally require separations prior to mass spectrometry (MS), traditionally pursued via chromatography or electrophoresis in solution. Those approaches are now supplemented or replaced by ion mobility spectrometry (IMS) in gases, which provides the speed and distinct selectivity. While the original IMS was based on absolute ion mobility, new nonlinear methods including the differential IMS or FAIMS capture its evolution as a function of electric field. We will cover the development of high-resolution FAIMS coupled to MS and further instrumental stages such as electron transfer dissociation (ETD) and ozone-induced dissociation (OzID) for ultimate specificity. We will then showcase the applications to peptides, lipids, and proteins, focusing on the separation and characterization of structural isomers such as histone proteoforms, other PTM localization variants, and D/L epimers, lipid isomers of various types (sn regio, double bond position, and cis/trans), and protein conformers. Novel differential IMS techniques relying on the dynamic pendular alignment of macromolecular dipoles in strong electric fields will be discussed.

## Speaker Bio:

Alex Shvartsburg grew up and received his undergraduate education in Russia. He started in analytical chemistry in US, earning an M.S. from the University of Nevada (1995) and Ph.D from Northwestern (1999). After an NSERC postdoctoral fellowship at York University (Toronto, Canada) and stint at the US Food and Drug Administration in Jefferson (Arkansas), he moved to the Pacific Northwest National Laboratory (Richland, WA) in 2003 and academia in Wichita State in 2014. He also runs a start-up Heartland MS that makes the FAIMS and ion funnel systems for mass spectrometry available to other researchers. His awards include the John Polanyi Prize of Ontario, M.T. Thomas Award of PNNL, Federal Laboratory Consortium and two R&D 100 awards, WSU Excellence in Research and Faculty of Distinction Awards, and the NSF CAREER and US Presidential Early Career Award for Scientists and Engineers (PECASE).