



# Differential Ion Mobility Spectrometry: Nonlinear Ion Transport and Fundamentals of FAIMS

By Alexandre A. Shvartsburg

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Over the last decade, scientific and engineering interests have been shifting from conventional ion mobility spectrometry (IMS) to field asymmetric waveform ion mobility spectrometry (FAIMS). **Differential Ion Mobility Spectrometry: Nonlinear Ion Transport and Fundamentals of FAIMS** explores this new analytical technology that separates and characterizes ions by the difference between their mobility in gases at high and low electric fields. It also covers the novel topics of higher-order differential IMS and IMS with alignment of dipole direction.

The book relates the fundamentals of FAIMS and other nonlinear IMS methods to the physics of gas-phase ion transport. It begins with the basics of ion diffusion and mobility in gases, covering the main attributes of conventional IMS that are relevant to all IMS approaches. Building on this foundation, the author reviews diverse high-field transport phenomena that underlie differential IMS. He discusses the conceptual implementation and first-principles optimization of FAIMS as a filtering technique, emphasizing the dependence of FAIMS performance metrics on instrumental parameters and properties of ion species. He also explores ion reactions in FAIMS caused by field heating and the effects of inhomogeneous electric field in curved FAIMS gaps.

Written by an accomplished scientist in the field, this state-of-the-art book supplies the foundation to understand the new technology of nonlinear IMS methods.

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**Differential Ion Mobility Spectrometry: Nonlinear Ion Transport and Fundamentals of FAIMS** By Alexandre A. Shvartsburg **Bibliography**

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### Editorial Review

#### Review

This book is a compendium of achievements in differential ion mobility spectrometry with special respect to nonlinear ion transport.

?Jörg Ingo Baumbach in *International Journal for Ion Mobility Spectrometry*

... a very well written book ... filled a void in my library ....

?Randy W. Purves, National Research Council of Canada, in *Journal of The American Society for Mass Spectrometry*, 2010

... this is a very well written book, and the author's interest and enthusiasm in the technique comes across in his work. The book has filled a void in my library as a valued reference for FAIMS. I would recommend this book to those currently working with FAIMS technology

and especially to researchers with plans to advance further the technology. I look forward to the release of the second volume.

?Randy W. Purves, Plant Biotechnology Institute, National Research Council of Canada, in the *Journal of the American Society for Mass Spectrometry*

... an excellent reference on the topics of both linear and nonlinear modes of ion mobility measurements ...

The writing style is very personal: you can almost hear the author speak to you as you read the text. ... At the end of the book, you will feel that the story of nonlinear ion mobility measurements is just unfolding and it should have many interesting new applications and discoveries.

?Peter de Boves Harrington, Ohio University, in *Journal of the American Chemical Society*, 2010, 132

#### About the Author

Pacific Northwest Laboratory, Richland, WA USA

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