

Foreword: Special issue “Diffusion Fundamentals XI

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The Diffusion Fundamentals XI Conference “Spreading in Nature, Technology and Society” took place June 30 to July 2, 2025, on the campus of Northwestern University in Evanston, IL, USA. This international conference has been held every two years since the first conference in 2005 with the goal of bringing together researchers interested in a broad range of diffusion and spreading phenomena, ranging from diffusion of molecules in nanopores to spreading of viruses across the globe. Attendees included scientists, engineers, mathematicians, and social scientists, and oral presentations aimed to address this broad, interdisciplinary audience.

Diffusion Fundamentals XI featured 6 keynote lectures and a pre-dinner general interest talk.

Keynote Lectures

- Stefano Brandani, University of Edinburgh, "The Ruthven number: An essential quantity in determining diffusion coefficients in nanoporous materials using uptake experiments"
- Charles Nicholson, New York University, "Diffusion properties of brain interstitial space."
- Monica Olvera de la Cruz, Northwestern University, "Dynamics of Simple and Complex Electrolytes in Confinement"
- Mary Silber, University of Chicago, "Semi-Arid Self-Organizing Vegetation Patterns"
- Alberto Striolo, University of Oklahoma, "Interrogating Transport Mechanisms in Crowded Narrow Pores Using Molecular Simulations"
- Eric Vanden-Eijnden, New York University, "Some Applications of Machine Learning in Active Matter"

Pre-Dinner Talk

Julio Ottino, Northwestern University, "Determinism, Chaos, and Probability: Newton, Poincaré, and Maxwell"

The conference also included 19 contributed talks and 18 poster presentations. Ample time was given to the poster sessions, mostly presented by students and post-docs. The 62 registered participants (Figure 1) came from 11 countries around the world.



Fig. 1. Participants in Diffusion Fundamentals XI.

A highlight of the conference was a presentation on the recently completed report [1] from the International Union of Pure and Applied Chemistry (IUPAC) on best practices in experimental measurements of diffusion in porous solids, a topic of great importance in developing materials for applications in sustainability such as batteries, hydrogen storage, and carbon capture.

This volume of the *Diffusion Fundamentals* journal includes a subset of the presentations from the conference.

Acknowledgments

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The organizers are also grateful to Springer Nature Publishing for supporting the Best Poster Prize winners with copies of the book *Diffusive Spreading in Nature, Technology and Society* [2].

The organizers thank Baylee Byers for her expert assistance with conference logistics, Prof. Jörg Kärger for support and advice throughout the planning of the conference, and the Saxon Academy of Science and Humanities for their continued support of this conference series.

References

- [1] J. Kärger, R. Valiullin, S. Brandani, J. Caro, C. Chmelik, B. Chmelka, M.-O. Coppens, S. Farooq, D. Freude, H. Jobic, M. Kruteva, E. Mangano, R. Pini, W. S. Price, A. Rajendran, P.I. Ravikovitch, G. Sastre, R.Q. Snurr, A.G. Stepanov, S. Vasenkov, Y. Wang, B.M. Weckhuysen, Diffusion in nanoporous materials with special consideration of the measurement of determining parameters (IUPAC Technical Report), *Pure & Applied Chem.* 97 (2025) 1-89.
- [2] A. Bunde, J. Kärger, J. Caro, G. Vogl (Eds.), *Diffusive Spreading in Nature, Technology and Society*, 2nd Edition, Springer, Cham, 2023.