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Special Issue "Diffusion Fundamentals IX",  
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## Foreword

*This Foreword opens a Special Issue:  
A collection of abstracts: invited lectures, workshops and poster presentations*

The Diffusion Fundamentals conference is a well-established biennial event initiated in 2005 - the year of the 150<sup>th</sup> anniversary of Adolf Fick's and the 100th anniversary of Albert Einstein's fundamental papers on diffusion. While the first conference took place in Leipzig, Germany, the subsequent ones were organized in L'Aquila, Italy (2007); Athens, Greece (2009); Troy, NY, USA (2011); Leipzig, Germany (2013); Dresden, Germany (2015); Moscow, Russia (2017) and Erlangen, Germany (2019).

The main objective of the series, which became its hallmark, is to invite world-renowned experts to deliver lectures covering the cutting-edge topics of diffusion theory and related experiments, along with their application in a diverse range of disciplines, spanning from social to exact sciences. As a result, it became a common ground for a broad and interdisciplinary audience. Technically, the conferences have always been run in such a manner that while oral presentations covered exclusively invited lectures, contributions reporting on particular research results were presented as posters. Consequently, no parallel sessions were organized meaning that the conference program was entirely accessible to all participants.

In 2021, the IX<sup>th</sup> edition of the Diffusion Fundamentals conference was intended to take place in Kraków (Poland) but was postponed due to the outbreak of the COVID-19 pandemic. Despite this adversity, the arrangements for the conference were still in motion and it was resolved that the conference will be held from 21<sup>st</sup> to 24<sup>th</sup> of September 2022 - with only one year delay regarding the original schedule. Without any further disturbances, the beginning of the conference was officially inaugurated by the Dean of the Faculty of Physics, Astronomy and Applied Computer Science of the Jagiellonian University in Kraków, Prof. Ewa Gudowska-Nowak, on 21<sup>st</sup> September 2022. The motto of IX<sup>th</sup> edition was chosen to be the adage of Heraclitus of Ephesus (V<sup>th</sup> century BC): "*Everything flows, nothing stands still*".

Kraków, where the conference took place, is a city with county rights, located in southern Poland on the Vistula River, as the second-largest city in Poland both concerning the population and surface area. It is a former capital of Poland, Royal Capital City, and the necropolis of Polish kings, as well as the capital of the Małopolska Region. The Jagiellonian University is, in turn, the oldest higher education institution in Poland and one of the oldest in Europe founded on 12 May 1364 by the Polish king Casimir the Great. The conference was hosted by the Auditorium Maximum - the largest complex of lecture and exhibition halls available in the University.

The IX<sup>th</sup> Diffusion Fundamentals conference was organized jointly by the Faculty of Physics, Astronomy and Applied Computer Science of the Jagiellonian University in Kraków, the Faculty of Materials Science and Ceramics of the AGH University of Science and Technology, Institute of Metallurgy and Materials Science of the Polish Academy of Sciences, Jerzy Haber Institute of Catalysis and Surface Chemistry of the Polish Academy of Sciences, Leipzig University and the Saxon Academy of Sciences and Humanities.

The conference gathered 83 participants from 17 countries who could listen to 20 invited lectures, present their works during two poster sessions and take part in four parallel workshops. The workshops, organized in rooms kindly offered by the AGH University of Science and Technology, were devoted to four "hot topic" areas represented in the conference program:

- 1) Machine Learning in Image Processing;
- 2) Atomic Jumps by Atomistic-Scale Photon Correlation Spectroscopy;
- 3) Spreading Phenomena in Economics and Society;
- 4) Diffusion in Nanoporous Materials { an IUPAC (International Union of Pure and Applied Chemistry) Initiative.

Among over 40 posters presented during the two sessions, three presentations were awarded by the Organizing Committee:

- "FloD: a new method to quantify bulk flow in brain extracellular space" by J. Hrabe and S. Hrabetova, State University of New York and Nathan Kline Institute, Orangeburg, USA;
- "Stability of gene expression patterns in developmental systems with dynamic morphogen sources" by Maciej Majka and Marcin Zagfforski, Jagiellonian University in Kraków, Poland;
- "Cell-cell proximity and motility interdependence in Dictyostelium discoideum amoeba dynamics" by Fereydoon Taheri, Carla C. Kulcsar and Christine Selhuber-Unkel, Heidelberg, University, Germany;

Apart from the scientific part, the conference program included several social events such as the Conference Banquette preceded by an event-tailored musical setting and a visit to the museum of the Jagiellonian University - a unique establishment arranged in the Collegium Maius, the medieval part of the University. The Conference ended on 24<sup>th</sup> September with concluding remarks given by the Conference Chairman, Prof. Rafał Abdank-Kozubski. We are looking forward to the X<sup>th</sup> jubilee edition that will take place in Astana, Kazakhstan in 2023.

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