UNIPRESS Münster (upm)
Presse- und Informationsstelle der Universität
Münster, Schlossplatz 2, 48149 Münster
Tel.: 0251 83-22232/33, Fax: 0251 83-22258
E-Mail: pressestelle@uni-muenster.de
Redaktion: Norbert Robers (verantw.)

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Cluster of Excellence "Mathematics Münster: Dynamics – Geometry – Structure"

Funding Line: Cluster of Excellence

Spokespersons: Prof. Christopher Deninger und Prof. Mario Ohlberger; both Faculty of Mathematics and Computer Science

Participating Institutes: Institute for Analysis and Numerics, Institute for Mathematical Stochastics, Institute for Mathematical Logic and Foundations of Mathematics, Mathematical Institute

Status: 2018 approved as part of the Excellence Strategy

Brief description of the project: Mathematics is a key technology for scientific and economic progress. New discoveries in mathematics are not only interesting in themselves, but they often lead to unexpected breakthroughs in other sciences as well. Traditionally, physics is inspired by mathematics and vice a versa. Nowadays, the life- and social sciences are further driving forces. Innovations and breakthroughs in mathematical research often result from unexpected collaboration between mathematical disciplines as well as their interaction with neighbouring sciences.

The cluster of excellence „Mathematics Münster: Dynamics, Geometry, Structure“ aims at the development and application of unified methods for the solution of mathematical problems by connecting theoretical and applied mathematical research.

Our research programme focuses on the problem oriented development of comprehensive dynamic, geometric and structural techniques to tackle fundamentally important mathematical problems in three major research areas, namely Arithmetic and Groups (A), Spaces and Operators (B), and Models and Approximations (C). Understanding the deeper underlying structures of a difficult mathematical problem is key to our approach. The theories we will build in this way will not only help solve the problems under consideration but also many others of a similar nature.

Looking at problems from a geometric viewpoint has a psychological and a technical advantage — psychologically, because after phrasing an abstract structure in geometric terms, one can often see a path to the solution, and technically, because of a plethora of broadly applicable methods exists in mathematical geometry.

Investigating the dynamics of semi-group and group actions is a powerful tool that can be used to analyse mathematical structures. Non-reversible dynamics describes the evolution of systems. Reversible dynamics in the form of group actions is equivalent to symmetry, a valuable simplifying principle that plays an important role in our research.

In order to reach the scientific and structural goals of the cluster, we will follow three key principles: (i) Connecting Mathematical Fields, by providing broad mathematical training, establishing new Bridging the Gaps professorships and enhancing international exchange across mathematical disciplines, (ii) Early Career Support by offering attractive programmes on the master's, PhD and independent early career levels, (iii) Increasing Equal Opportunity by implementing targeted initiatives to balance family and career and to increase the proportion of women in mathematical research.