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# AMR Newsletter December 2025

Here are the latest updates from the AMR as we head into the new year.

## 2025 AMR Prize in the Mathematics of Artificial Intelligence

The AMR has awarded the second annual $50,000 Prize in the Mathematics of Artificial Intelligence in 2025 to **Arthur Jacot**. Jacot is an Assistant Professor at the Courant Institute of Mathematical Sciences, NYU. Previously he was a PhD student at the EPFL under the supervision of Clément Hongle.

### Prize Citation:

Arthur Jacot is one of the most powerful and creative mathematicians working on understanding and improving artificial intelligence. His most influential contribution to the subject is the development of the *Neural Tangent Kernel* framework. This work, introduced in 2018, provides a rigorous theoretical tool for understanding the behavior of overparameterized or “wide” deep neural networks trained by gradient descent. Jacot and his colleagues proved that as the width of a network approaches infinity, the network's evolution during training becomes linear and deterministic, governed by a fixed, positive-definite kernel known as the Neural Tangent Kernel. This result shows that in this specific "lazy training" regime, the highly non-convex optimization problem of training a deep neural network can be reduced to a well-understood problem in classical kernel methods, allowing researchers to analytically predict generalization and convergence rates without relying on empirical simulations.

Beyond these foundational results, Jacot's research explores the deeper theoretical principles governing high-dimensional machine learning. His work investigates the different regimes of training, distinguishing the "lazy" neural tangent kernel limit from the "feature learning" regime where the network's internal representations genuinely evolve. He also studies the implicit bias of optimization algorithms like Stochastic Gradient Descent, aiming to mathematically explain why overparameterized models successfully generalize rather than simply memorize training data. His efforts focus on the characterization of the geometric structure of the loss landscape and identifying how optimization dynamics naturally push deep neural networks towards finding simplified, low-complexity solutions.

He is a leader in the effort to bridge the gap between the empirical success and the theoretical understanding of modern deep learning.

# Upcoming AMR-RMA Distinguished Lecture

December 9, 2025

8:00 AM (Los Angeles), 11:00 AM (Montreal, New York), 4:00 PM (London), 5:00 PM (Leipzig, Madrid, Paris), 6:00 PM (Tel Aviv).


**Nalini Anantharaman**
**University of Strasbourg**


Title: Optimal spectral gap of the Laplacian for random hyperbolic surfaces


Abstract: Although there are several ways to ”choose a compact hyperbolic surface at random”, putting the Weil-Petersson probability measure on the moduli space of hyperbolic surfaces of a given topology is certainly the most natural. The work of M. Mirzakhani has made possible the study of this probabilistic model: it is one of the only models of ”random Riemannian manifolds” where some explicit calculations are actually possible. One may thus ask questions about the geometry and the spectral statistics of the Laplacian of a randomly chosen surface – in analogy with what is usually asked for models of random graphs. I will be interested in the spectral gap of the Laplacian for a random compact hyperbolic surface, in the limit of large genus (joint with Laura Monk). The zoom link for this talk is:
https://ucdavis.zoom.us/j/91784385662?pwd=eMotc3eAFnE4J4yrt397IKfM65i2UB.1

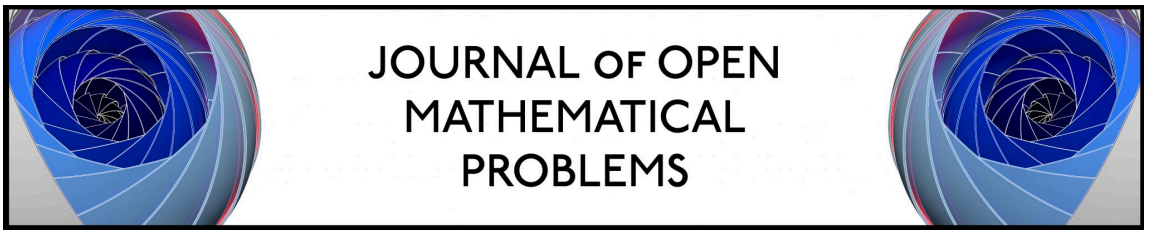

Information on previous AMR-RMA lectures and on how to subscribe to the series is here.

# Updates on Journals

We encourage you to submit your high-quality papers to the **AMR's six Diamond Open Access journals.**

**Editor-in-Chief:** Alex Kontorovich, Rutgers University
**JAMR** publishes research articles in all branches of mathematics at the level of the best specialized journals.


**Editor-in-Chief:** Jacob Tsimerman,University of Toronto
**JXM** publishes research articles in all branches of mathematics that feature experimental results with important implications.




**Editor-in-Chief:** Rob Kirby, University of California, Berkeley
**JOMP** publishes surveys that are centered on notable problems in all areas of mathematics.


**Editor-in-Chief:** Sergei Tabachnikov, Pennsylvania State University
The goal of the **Arnold Mathematical Journal** is to present mathematics in a manner that is understandable and interesting to mathematicians, not confined to experts in specialized research fields.

A new issue is now available:

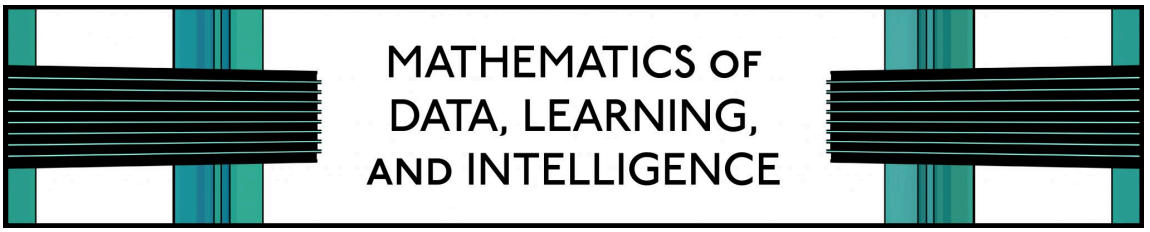
Discretization of the sub-Riemannian Heisenberg Group
E. G. Malkovich

Circumscribed Circles in Integer Geometry
O. Karpenkov, A. Pratoussevitch, R. Sheppard

Arithmetic on $q$-deformed rational numbers
T. Kogiso, K. Miyamoto, X. Ren, M. Wakui, K. Yanagawa

Ancient curve shortening flow in the disc with mixed boundary condition
M. Langford, Yu. Liu, G. McNamara

Bouncing Outer Billiards
A. Gogolev, L. Keck, K. Lewis




**Editor-in-Chief:** Lev Reyzin, University of Illinois Chicago
MDLI publishes research articles at the intersection of any branch of mathematics with data science, machine learning, or artificial intelligence. **MDLI is now accepting submissions.**


**Editors-in-Chief:** Martin Helmer, Swansea University and Vidit Nanda, Oxford University
ACTG publishes research papers at the intersection of computational mathematics and geometric/topological methods, with a particular focus on algorithmic and applied aspects of algebraic geometry and algebraic topology. **ACTG is now accepting submissions.**

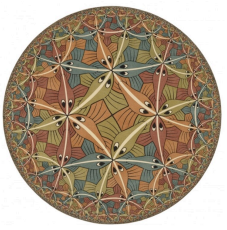
# AMR at the International Congress of Mathematicians

The AMR is planning to have a booth at the ICM and we encourage everyone to stop by to say hello! And come hear the AMR's incoming President Alex Kontorovich's special plenary lecture at the 2026 ICM.

# Images of Mathematics

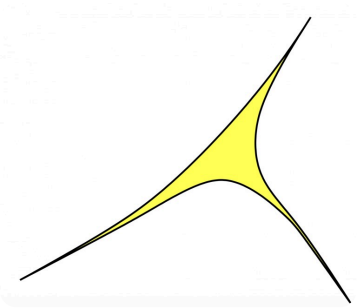
We are pleased to announce a new collaboration between the AMR and Image des Mathématiques. Images des Mathématiques (IdM) is a French website published by the CNRS and dedicated to popularizing mathematics. It has a variety of engaging materials related to all aspects of mathematics. Its slogan is "Mathematical research in words and images". Some articles are color-coded, according to their technical difficulty, similarly to downhill slopes (from green to black diamond). The site follows several print journals of the same name, published at different times by the CNRS. The editorial board was headed by Étienne Ghys from 2009 to 2014, by Fabrice Planchon from 2015 to 2018, and since 2019,

by Aurélien Alvarez. The AMR will publish translations into English of selected pieces that have appeared in IdM over the years. We shall select the ones that are most suitable for our audience comprising professional mathematicians, from beginners to more experienced. The Images of Mathematics website is here. Here are descriptions and links to the first three translations in this series:



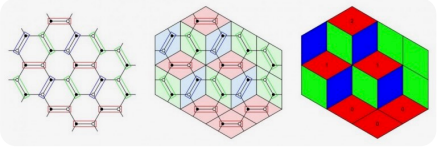
### A bit of geometric group theory

by Gilbert Levitt
Translated by R. Matveev



### Triangles after Euclid, Gauss and Gromov

by Etienne Ghys
Translated by S. Matveev



### Dimers

by Adrien Kassel
Translated by O. Kravchenko

## Membership Milestone

We are delighted to announce that the AMR now has over 1000 members. Welcome to all our new members! Please encourage your colleagues to join us, and to participate in all our activities!

## AMR Endowment Fund

The AMR does not have membership fees, nor do we charge for journal subscriptions or author page charges. The books we publish are available at no cost. At the start of 2025 we established a permanent operating endowment to provide financial stability for our mission to support mathematical research and scholarship. The income from this fund will be used for our journals, website, publications, lecture series and future activities. The AMR Endowment Fund is invested in the Vanguard Total Stock Market Index and as of early December holds $45,070.32. It represents the AMR Board's commitment to support mathematics into the future. If you wish to donate to the endowment please contact any of the AMR board members for information on how to do so, or go to our donation page and specify that you wish to have your donation directed to the endowment. We are grateful for all contributions and to our sustaining members for their support. The AMR is a 501(c)(3) non-profit organization and donations are tax deductible as allowable by law.

Best wishes for a restful and joyous holiday season from the AMR Board.