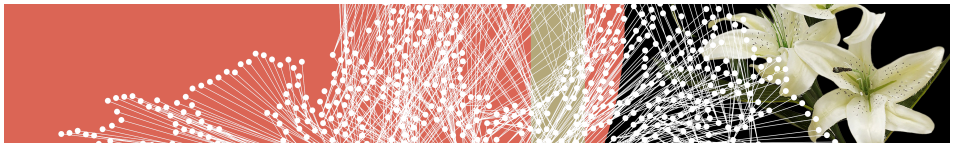
AOWM × IPMU Workshop



Report of Contributions

https://indico.ipmu.jp/e/487

Contribution ID: **1** Type: **not specified**

The Sandpile Model and Its Extensions: Dynamical Structures

Thursday 5 March 2026 13:10 (40 minutes)

The Sandpile Model (SPM) was introduced in 1987 by the physicists Bak, Tang, and Wiesenfeld to study self- organized criticality in dynamical systems. Since then, the model and its extensions have become central topics in contemporary research, particularly in mathematics, computer science, and physics.
This talk presents the SPM and its extensions, focusing on the structure of their state spaces, as well as stability properties and convergence times - fundamental aspects of dynamical systems that provide deeper insight into their behavior.

Presenter: PHAN, Thi Ha Duong (Vietnam Academy of Science and Technology)

Contribution ID: **2** Type: **not specified**

Minimal submanifolds in higher codimension

Thursday 5 March 2026 14:10 (40 minutes)

The study of minimal submanifolds has a long history. They arise naturally and have a lot of applications. There are sharp differences between properties of minimal hypersurfaces and minimal submanifolds in high codimension. For instance, in higher codimension the uniqueness and stability for solutions of Dirichlet problem of minimal surface equation no longer hold, and the solvability and smoothness of solutions are not guaranteed either. We are particularly interested in a special class of minimal submanifolds in higher codimension, called minimal Lagrangian submanifolds. Such examples in R^2n or in a Calabi-Yau manifold are called special Lagrangians. They are always volume minimizing and play an important role in Mirror Symmetry in String theory. We allow singularities in the study.

In the first part of this talk, I will first give an introduction and overview on the subject, including possible methods to study their existence and related results. In the second part, I will focus on the continuity method and my recent project.

Presenter: LEE, Yng-Ing (National Taiwan University)

Contribution ID: **3** Type: **not specified**

Partitions, Eisenstein Series, and Their Applications

Friday 6 March 2026 13:00 (40 minutes)

This talk explores structural connections between integer partitions and Eisenstein series, with an emphasis on the arithmetic implications of modularity and quasi-modularity. As a primary example, we study generating functions arising from MacMahon-type partition variants and show that they admit quasi-modular descriptions. This framework provides effective control over their coefficients and leads to arithmetic applications, including a new expression for prime detection.

Presenter: KANG, Soon-Yi (Kangwon National University)

Contribution ID: **4** Type: **not specified**

Mathematics for Advancing Cardiovascular Medicine —From Hemodynamic Analysis to Clinical Application —

Friday 6 March 2026 14:00 (40 minutes)

In this talk, I discuss how mathematical structures contribute to advances in cardiovascular medicine, based on ongoing interdisciplinary collaborations with cardiovascular surgeons and cardiologists.

Starting from three-dimensional anatomical structures reconstructed from medical imaging, we perform hemodynamic analyses grounded in fluid equations and continuum mechanics. These analyses aim to provide quantitative indicators that support surgical design and clinical decision-making. As a representative example, I will introduce efforts to improve the Fontan procedure through mathematical evaluation of blood flow dynamics and energy-related measures.

Reliable hemodynamic modeling requires more than numerical computation. Its validity depends fundamentally on the mathematical formulation of governing equations, well-posedness considerations, and in particular the appropriate treatment of boundary conditions. Boundary conditions are not merely technical specifications; they determine stability, physical consistency, and interpretability of the results. I will highlight how these theoretical aspects shape clinically meaningful analysis.

Finally, I will briefly discuss how mechanically derived quantities can be connected to predictive frameworks, including AI-based approaches, while preserving mathematical coherence and interpretability.

Through these examples, I aim to demonstrate that mathematics serves not only as a computational tool but as a conceptual and structural foundation for translating medical information into reliable clinical insight.

Presenter: SUGIYAMA, Yoshie (The University of Osaka)

Contribution ID: **5** Type: **not specified**

Mentoring Program

Friday 6 March 2026 15:40 (40 minutes)

We will explain how to organize mentoring program.
Sanoli Gun will explain about it in Indian Women in Mathematics.
Yukari Ito will explain about Heidelberg Laureate Forum and the mentoring program.

Presenters: GUN, Sanoli (IMSc, Chennai); ITO, Yukari (Kavli IPMU, U Tokyo)

Contribution ID: **6** Type: **not specified**

Poster session

1) Saraswati Acharya: Differential equations and their application to human body heat transfer using the finite element method.
2) Editha Jose: Mathematics of Reaction Networks and its Applications
3) Akanksha Gupta: Pellian Polynomials over Integers
4) Yasuko Hasegawa: Applications of Number Theory in Various Fields
5) Suhita Hazra: Structure of Sets With Prescribed Complexity
6) Papiya Sur: Common divisors of totients of polynomials
7) Deep Thakur: Some new results on Hurwitz zeta functions
8) Luyu Zheng: Quiver braid group action for a 3-fold crepant resolution
9) Nao Moriyama: Remarks on the minimal model theory for log surfaces in the analytic setting
10) Naoka Karube: The moduli space of dormant opers on elliptic curves
11) Yukino Yagi: Reconstruction of oriented matroids from Varchenko-Gel'fand algebras
12) Fumika Mizoguchi: Nilpotent and solvable Lie algebras obtained by quivers
13) Gaurav Kumar: Some results on the Lerch Zeta function
14) Hikari Hanaki: The Littlewood-Richardson rule for Schur multiple zeta functions
15) Fumi Ogihara: On the estimation of the sum of a representation function related to square-full numbers in short intervals
16) Jyothsnaa Sivaraman: Counting ideals and its applications
17) Dhananjaya Sahu: On higher order real zeros of Dedekind zeta functions

Presenter: PARTICIPANTS, several