Conference Information

Organizers:

Ersnt Kuwert (University of Freiburg)

Chong Song (Xiamen University)

Guofang Wang (University of Freiburg)

Chao Xia (Xiamen University)

Conference Venue:

Conference Room S103 at Experiment Building, Haiyun Campus at Xiamen University (in Chinese: 厦门大学海韵园实验楼 S103)

Accommodation:

Joyze Hotel Xiamen, Curio Collection By Hilton, located at No. 6-8 Longhu Shan Road, Zengcuo'an, Siming District, Xiamen (厦门佳逸希尔顿格芮精选酒店, 厦门市思明区曾厝垵龙虎山路 6-8 号).

Program Coordinator:

Tian Ye (tymath2@xmu.edu.cn, 86-592-2580036)

Schedule

March 30th, 2026 (Conference Room S103 at Experiment Building)			Chair
08:50-09:00	**Opening Ceremony**		
09:00-09:50	**Gerhard Huisken** University of Tübingen	Inverse mean curvature flow and concepts of quasi-local mass in General Relativity	**Ernst Kuwert**
09:50-10:20	**Tea Break** **Group Photo**		
10:20-11:10	**Alessandra Pluda** University of Pisa	Inverse mean curvature flow, nonlinear potentials and Hamilton's pinching conjecture	
11:20-12:10	**Wei Wei** Nanjing University	A Yamabe problem for the quotient between the Q curvature and the scalar curvature	
12:30-14:00	**Lunch (at Dafengyuan)**		
14:00-14:50	**Lei Ni** Zhejiang Normal University	Some spectrum estimates and their applications	**Chong Song**
14:50-15:20	**Tea Break**		
15:20-16:10	**Yuchen Bi** University of Freiburg	Quantitative Rigidity of the Clifford Torus as the Willmore Minimizer	
18:00	**Dinner (at Joyze Hotel)**		

March 31st, 2026 (Conference Room S103 at Experiment Building)			Chair
09:00-09:50	**Patrick Dondl** University of Freiburg	A Γ-Expansion of Gauss' Capillary Energy and Dimension Reduction	**Gerhard Huisken**
09:50-10:20	**Tea Break**		
10:20-11:10	**Mattia Fogagnolo** University of Padova	Inverse mean curvature flow and scalar curvature in low regularity	
11:20-12:10	**Fabian Rupp** University of Vienna	Mean curvature flow and the direction energy	
12:30-14:00	**Lunch (at Dafengyuan)**		
14:00-14:50	**Zhichao Wang** Fudan University	Existence of three free boundary minimal disks in strictly convex regions with nonnegative Ricci curvature	**Lei Ni**
14:50-15:20	**Tea Break**		
15:20-16:10	**Jiawei Liu** Nanjing University of Science and Technology	The conical Kähler-Ricci flow and its limit behavior	
18:00	**Dinner (at Dafengyuan)**		

April 1st, 2026 (Conference Room S103 at Experiment Building)			Chair
09:00-09:50	**Georg Weiss** University of Duisburg-Essen	On global solutions of the Bernoulli problem	**Knut Smoczk**
09:50-10:20	**Tea Break**		
10:20-11:10	**Jiayu Li** University of Science and Technology of China	On symplectic mean curvature flows	
11:30-14:00	**Lunch (at Dafengyuan)**		
14:00-18:00	**Free Discussions**		
18:00	**Dinner (at Joyze Hotel)**		

April 2nd, 2026 (Conference Room S103 at Experiment Building)			Chair
09:00-09:50	**Giovanni Alberti** University of Pisa	Frobenius theorem in a non-smooth context	**Georg Weiss**
09:50-10:20	**Tea Break**		
10:20-11:10	**Jintian Zhu** Westlake University	Recent Progress on Mass Inequalities for Asymptotically Flat Manifolds with Arbitrary Ends	
11:20-12:10	**Xuwen Zhang** University of Freiburg	Bounding the area of surfaces with prescribed boundary	
12:30-14:00	**Lunch (at Dafengyuan)**		
14:00-14:50	**Martin Man-Chun Li** The Chinese University of Hong Kong	Free boundary minimal surfaces via Allen-Cahn approximation	**Chao Xia**
14:50-15:20	**Tea Break**		
15:20-16:10	**Jie Zhou** Capital Normal University	Three circles theorem for Willmore surfaces	
18:00	**Dinner (at Joyze Hotel)**		

April 3rd, 2026 (Conference Room S103 at Experiment Building)			Chair
09:00-09:50	**Knut Smoczyk** Leibniz University Hannover	Graphical Mean Curvature Flow Beyond Codimension One	**Guofang Wang**
09:50-10:20	**Tea Break**		
10:20-11:10	**Mao-Pei Tsui** Taiwan University	Entire Minimal Graphs from an Evolving-Plane Ansatz	
11:20-12:10	**Kai Zheng** University of Chinese Academy of Sciences	On the structure of compete G2-solitons	
12:30-14:00	**Lunch (at Dafengyuan)**		
14:00-18:00	**Free Discussions**		
18:00	**Dinner (at Joyze Hotel)**		

Title and Abstracts

Frobenius theorem in a non-smooth context

Giovanni Alberti（University of Pisa）

Frobenius theorem states that there exists no k-dimensional surface which is tangent to a non-involutive distribution of k-planes V. Motivated by questions in Geometric Measure Theory, we ask to which extent this statement can be generalized to weaker notions of surfaces, such as rectifiable sets and currents.

Following the work of Z. Balogh and S. Delladio, we consider first the class of contact sets (namely the set of points where a k-dimensional surface S of class C^1 is tangent to the V) and ask whether such sets are k-negligible. It turns out that a complete answer depends on a combination of the regularity of S and of the boundary of E (intended in a Sobolev sense).

Along the same line, one expects that the existence of a (nontrivial) k-dimensional currents T tangent to V is related to the regularity of the boundary of T; and indeed, an integral current cannot be tangent to V. However, the answer for normal currents is more interesting.

This is part of a joint project with A. Massaccesi (University of Padova), A. Merlo (University of the Basque Countries) and E. Stepanov (Steklov Institute, Saint Petersburg, and University of Pisa).

Quantitative Rigidity of the Clifford Torus as the Willmore Minimizer

Yuchen Bi（University of Freiburg）

Let Σ be a smooth embedded closed surface in the three–sphere, with genus at least one. Suppose its Willmore energy is at most $2\pi^2$ plus a small error. We prove a quantitative rigidity result: after applying a suitable conformal transformation of the three–sphere, Σ is close to the Clifford torus with a

linear bound in the size of the energy excess. More precisely, after an appropriate normalization, Σ admits a conformal parametrization from the flat two–torus that is W^{2,2}–close to a standard parametrization of the Clifford torus, and the W^{2,2} distance is bounded by a constant times the square root of the Willmore energy excess. The associated conformal factor is controlled with the same linear rate.

A Γ-Expansion of Gauss' Capillary Energy and Dimension Reduction

Patrick Dondl（University of Freiburg）

We study the asymptotic behavior, via Γ-convergence, of Gauss' capillary energy for a liquid confined between two rough plates as their separation tends to zero. The energy is defined on sets of finite perimeter in a thin domain and involves the perimeter of the wetted region together with a boundary adhesion term.

The central result is a Γ-expansion that yields a hierarchy of reduced two-dimensional problems: the leading-order Γ-limit selects configurations that are constant in the thin direction, reducing the problem to an optimal wetting problem on the plates, while the first-order correction is a weighted perimeter functional with weights depending on the gap profile and the adhesion coefficients on each plate.

The analysis draws on geometric measure theory in variable domains, including the behaviour of sets of finite perimeter and their traces under the thin-domain rescaling.

Inverse mean curvature flow and scalar curvature in low regularity

Mattia Fogagnolo（University of Padova）

I’ll present recent results and works in progress involving the inverse mean curvature flow in 3-manifolds endowed with metrics of nonnegative scalar curvature. I’ll discuss applications to quasi-local and global mass lower

bounds, that will be shown to be stable under uniform limits of the metric tensor. Finally, I will touch upon refined results in progress on the well posedness of the inverse mean curvature flow in such limit spaces, together with applications. The talk is based on joint works and projects with Antonelli, Benatti, Gatti, Mazzieri, Nardulli, Pluda and Pozzetta.

Inverse mean curvature flow and concepts of quasi-local mass in General Relativity

Gerhard Huisken（University of Tübingen）

A central aim in mathematical relativity concerns the geometric description of classical physical concepts such as mass in the context of a curved space-time. The lecture discusses some new ideas for the mass of a local region in an asymptotically flat 3-manifold together with lower bounds that can be derived using the inverse mean curvature flow.

On symplectic mean curvature flows

Jiayu Li（University of Science and Technology of China）

This is a survey talk on symplectic mean curvature flows. The results are mainly obtained by our research group. We prove that the symplectic property is preserved along the mean curvature flow in K¨ahler-Einstein surface, which we call “Symplectic mean curvature flow”. It was proved that there is no Type I singularity for the symplectic mean curvature flow. Then, we mainly study the Type II singularity. As an important model of a Type II singularity of the mean curvature flow, the translating soliton is studied mainly. We prove that the symplectic translating soliton must be a plane under some natural assumptions, which we demonstrate is a necessity through an exploration of compelling examples. Furthermore, we derive a necessary condition for the translating soliton to be a blow-up limit of the symplectic mean curvature flow.

Free boundary minimal surfaces via Allen-Cahn approximation

Martin Man-chun Li（The Chinese University of Hong Kong）

In this talk, we will report on some recent progress on a series of joint work with Davide Parise (Imperial College London) and Lorenzo Sanartaro (University of Toronto) regarding the existence and regularity of free boundary minimal hypersurfaces via the study of a semi-linear elliptic Allen-Cahn equation arising in phase transition theory. This work is substantially supported by research grants from the Hong Kong Research Grants Council.

The conical Kähler-Ricci flow and its limit behavior

Jiawei Liu（Nanjing University of Science and Technology）

In this talk, I will recall some results on conical Kähler-Ricci flow and then discuss its limit behavior as the cone angle tends to 0. More precisely, as the cone angle tends to zero, the conical Kähler-Ricci flow converges to a unique Kähler-Ricci flow, which is smooth outside the divisor and admits a cusp singularity along the divisor.

Some spectrum estimates and their applications

Lei Ni（Zhejiang Normal University）

Inverse mean curvature flow, nonlinear potentials and Hamilton' s pinching conjecture

Alessandra Pluda（University of Pisa）

A Riemannian manifold $(M,\ g)$ is Ricci–pinched if $\mathrm{Ric} \geq 0$ and there exists a constant $\varepsilon > 0$ such that $\mathrm{Ric} \geq \varepsilon \mathrm{R} g$. Hamilton's pinching conjecture states that a complete, connected, Ricci–pinched Riemannian 3−manifold must be compact or flat. This conjecture has been addressed by Chen and Zhu, Lott, and Deruelle-Schulze-Simon, with a complete proof ultimately provided by Lee and Topping, relying on Ricci flow. Huisken and Körber have achieved an alternative proof using extrinsic geometric flows with an additional volume growth condition. Their approach is based on the monotonicity of the Willmore functional along the inverse mean curvature flow in Ricci–pinched manifolds. Rather than using the inverse mean curvature flow, one could consider p−harmonic potentials with $p \in (1, 2]$ and replace the Willmore functional with a suitable proxy, still achieving the conjecture under the extra growth condition.

In the talk, I will highlight the similarities and differences between these two methods, describe a version of the result for manifold with boundary and provide a unified perspective on a broad family of monotonicity formulas in (non) linear potential theory and along the inverse mean curvature flow.

Mean curvature flow and the direction energy

Fabian Rupp（University of Vienna）

Mean curvature flow is classically understood as the L2 -gradient flow of the volume functional. In the non-compact setting, however, this variational interpretation degenerates, since the volume is infinite and the associated energy identity becomes vacuous. In this talk, we present a new variational framework for non-compact mean curvature flow by interpreting it as the gradient flow of a direction energy. Although this functional differs from

the volume by a formal null-Lagrangian, it can be finite for noncompact hypersurfaces, and enables us to study the behavior of global solutions.
This is joint work with T. Miura (Kyoto).

Graphical Mean Curvature Flow Beyond Codimension One

Knut Smoczyk（Leibniz University Hannover）

In this talk, we review classical results on graphical mean curvature flow and discuss recent progress on entire graphs in higher codimension. Particular emphasis is placed on maximum principle techniques for complete and properly immersed submanifolds and their role in deriving global growth estimates. We explain how these ideas lead to
preservation results for natural geometric conditions and, in codimension two, for uniformly area decreasing graphs.

Entire Minimal Graphs from an Evolving-Plane Ansatz

Mao-Pei Tsui（Taiwan University）

We introduce an evolving-plane ansatz for constructing entire minimal graphs of odd dimension n \ge 3 and codimension m \ge 2. By allowing the slope of an (n-1)-plane to evolve in time, the minimal surface equation reduces to a geodesic equation on the Grassmannian of (n-1)-planes, expressed in affine coordinates. This reduction transforms the nonlinear PDE governing minimal graphs into a finite-dimensional geometric flow on the Grassmannian.
The method yields a large and explicit family of entire minimal graphs. Moreover, the conormal bundle of each such graph defines an entire special Lagrangian graph in \mathbb{C}^{n+m}.
This is joint work with Chung-Jun Tsai, Mu-Tao Wang, and Jingbo Wan.

Existence of three free boundary minimal disks in strictly convex regions with nonnegative Ricci curvature

Zhichao Wang（Fudan University）

We show that any three-ball with mean convex boundary contains an embedded free boundary minimal disk. Moreover, when the three-ball is a strictly convex domain with nonnegative Ricci curvature (for instance, a compact convex domain in Euclidean three-space), we prove the existence of at least three embedded free boundary minimal disks. Our approach is based on a multiplicity-one theorem in the free boundary Simon-Smith min-max theory. This is a joint work with L. Sarnataro, D. Stryker and X. Zhou.

A Yamabe problem for the quotient between the Q curvature and the scalar curvature

Wei Wei（Nanjing University）

We introduce the following Yamabe problem for the quotient between the Q curvature and the scalar curvature R: Find a conformal metric g in a given conformal class $[g_0]$ with \[Q_g/ R_g=const.\] We first prove a new Sobolev inequality between the total Q-curvature and the total scalar curvature on $\mathbb S^n$, for any g in the conformal class of the round metric $\g_{S^n}$ with positive scalar curvature, with equality if and only if g is also a metric with constant sectional curvature. With this inequality we introduce a new Yamabe constant $Y_{4,2}(M,[g_0])$ and prove the existence of the above problem provided that $Y_{4,2}(M,[g_0]) <Y_{4,2} (\mathbb S^n, [g_{\mathbb S^n}]).$ This strict inequality is proved if (M,g) is not conformally equivalent to the round sphere. Finally, we prove that on a closed n-dimensional Riemannian manifold (M,g_{0}) with semi-positive Q-curvature and non-negative scalar curvature, the above Yamabe problem is solvable. This is a joint work with Prof. Yuxin Ge and Prof. Guofang Wang.

On global solutions of the Bernoulli problem

Georg Weiss（University of Duisburg-Essen）

While global solutions of the obstacle problem have recently been completely characterized (Eberle-Figalli-Weiss 2025), the class of global solutions to the Bernoulli problem is, by a result of M. Traizet (2013), much richer and closely related to minimal surfaces.

In this talk, we explain why a frequency formula of the type used in the obstacle problem is unlikely to be valid for the Bernoulli problem. We also present progress on a different approach—one that does not rely on complex analysis—which appears to be a promising alternative for studying global solutions of the Bernoulli problem.

Bounding the area of surfaces with prescribed boundary

Xuwen Zhang（University of Freiburg）

Given an (m-1)-dimensional, embedded, compact submanifold \Gamma in R^n, consider any compact, immersed m-dimensional submanifold whose boundary is exactly given by \Gamma. In this talk, we show how the area of such an m-submanifold is controlled in terms of its curvature energy. The talk is based on joint work with Ernst Kuwert.

On the structure of complete G2-solitons

Kai Zheng（University of Chinese Academy of Sciences）

In this talk, we prove compactness theorems for complete gradient G_2-solitons. Our results rely on a scalar curvature bound together with growth conditions on the potential function defining the gradient vector field.

Three circles theorem for Willmore surfaces

Jie Zhou（Capital Normal University）

We talk about the compactness of Willmore surfaces without assuming the convergence of the induced complex structures. By proving some three circles theorems, we compute the energy loss in the neck and we prove that the limit of the image of the Gauss map is a geodesic and compute the length. This is based on a joint work with Yuxiang Li and Hao Yin.

Recent Progress on Mass Inequalities for Asymptotically Flat Manifolds with Arbitrary Ends

Jintian Zhu（Westlake University）

In this talk, I will survey the current state of research on mass inequalities for asymptotically flat manifolds with arbitrary ends. I will also present my recent work on the mass-capacity inequality and the positive mass theorem, which is joint with Yuchen Bi, Tianze Hao, Shihang He, and Yuguang Shi.