

Young Researchers' Mini-Workshop on Flexibility and Rigidity of Solutions to PDEs

16 July 2026 | Beijing

Elliptic equations | Fluid dynamics | Concentration phenomena

Invited Speakers

Wei Dai

Beihang University

Shaolong Peng

Beihang University

Rui Li

Peking University

Heming Wang

AMSS, CAS

Junhong Fan

AMSS, CAS

Qing Guo

Minzu University of China

Meeting Information

Date	16 July 2026
Venue	Room N613, South Building
Address	Academy of Mathematics and Systems Science, CAS 55 Zhongguancun East Road, Haidian District, Beijing
Organizers	Daomin Cao and Guolin Qin (AMSS, CAS)
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South Building, AMSS, CAS

Welcome!



AMSS

中国科学院数学与系统科学研究院
Academy of Mathematics and Systems Science, CAS

Schedule

16 July 2026 | Room N613, South Building, AMSS, CAS

Time	Programme	Chair
09:00-12:00	Registration	
12:00-14:00	Break	
14:00-14:45	Wei Dai (Beihang University) Existence and stability of non-radial solutions to the critical weighted quasi-linear p -Laplacian equations	Daomin Cao AMSS, CAS
14:45-15:30	Shaolong Peng (Beihang University) On rigidity results for solutions to semilinear and quasilinear elliptic equations	Guolin Qin AMSS, CAS
15:30-16:15	Rui Li (Peking University) Helical Kelvin Waves for the 3D Incompressible Euler Equations	Guolin Qin AMSS, CAS
16:15-16:45	Heming Wang (AMSS, CAS) Blow-up solutions for asymmetric sinh-Poisson equations on Riemann surfaces with boundary	Guolin Qin AMSS, CAS
16:45-17:15	Junhong Fan (AMSS, CAS) Finite-time and global-in-time orbital stability of simply connected V-states in a disk	Guolin Qin AMSS, CAS
17:15-18:00	Qing Guo (Minzu University of China) Concentration and coupling mechanisms in critical Lotka-Volterra systems	Guolin Qin AMSS, CAS
18:00-20:00	Free Discussion	

All times are shown in 24-hour format.

Wei Dai

Beihang University

Existence and stability of non-radial solutions to the critical weighted quasi-linear p -Laplacian equations

In this talk, we will show the existence of non-radial solutions for the critical quasi-linear Henon equation involving the p -Laplace operator ($1 < p \leq N$). Our results extend the classical work of F. Gladiali, M. Grossi, and S. L. N. Neves [Adv. Math. 2013] concerning the Laplace operator (the case $p = 2$) to the more general setting of the nonlinear p -Laplace operator ($1 < p \leq N$). We will also discuss sharp gradient stability for a class of Hardy-Sobolev-Mazya inequalities, whose extremal functions are non-radial solutions to critical quasi-linear p -Laplacian equations with partially stronger singular weights.

Shaolong Peng

Beihang University

On rigidity results for solutions to semilinear and quasilinear elliptic equations

In this talk, we study rigidity results, including classification and Liouville results, for solutions to semilinear and quasilinear elliptic equations. We first derive the equivalence between a PDE system and the corresponding integral-equation system. Applying the method of moving spheres (or scaling spheres) in integral form together with integral inequalities, we obtain, under suitable assumptions, a complete classification or a Liouville theorem for classical solutions to mixed-order elliptic systems. We then study classification results for solutions to quasilinear elliptic equations. Using vector-field and integration methods, we derive a classification result for the n -Laplacian Liouville equation with a positive nonlinear Neumann boundary condition on the half-space.

Rui Li

Peking University

Helical Kelvin Waves for the 3D Incompressible Euler Equations

m -fold symmetric vortex patch solutions form a particularly important class of vortex solutions for the incompressible Euler equations. In the two-dimensional case, numerous results are known. For example, the characteristic function of a disk centered at the origin is a trivial vortex patch solution, while the Kirchhoff vortex patch is another classical example. For the three-dimensional incompressible Euler equations, several results have been established for solutions whose vorticity is highly concentrated along helically symmetric curves with small cross-sections, but helical solutions with large cross-sections remain scarce. This talk presents joint work in which the Crandall-Rabinowitz bifurcation theorem is applied to prove the existence of m -fold symmetric helical vortex patch solutions, also known as m -fold Kelvin waves, whose cross-sections approximate disks. This is joint work with Daomin Cao, Boquan Fan, and Guolin Qin.

Heming Wang

Academy of Mathematics and Systems Science, CAS

Blow-up solutions for asymmetric sinh-Poisson equations on Riemann surfaces with boundary

We study the existence of blow-up solutions for asymmetric sinh-Poisson-type equations with homogeneous Neumann boundary conditions on compact Riemann surfaces. These equations arise as boundary mean-field equations for equilibrium turbulence vortices with variable intensities and are also of interest in the Keller-Segel system for chemotaxis collapse. Using the Lyapunov-Schmidt reduction method, we establish sufficient conditions for the existence of solutions that blow up at any prescribed number of distinct points, which may lie either in the interior of the surface or on its boundary. This is joint work with Mohameden Ahmedou and Zhongwei Tang.

Junhong Fan

Academy of Mathematics and Systems Science, CAS

Finite-time and global-in-time orbital stability of simply connected V-states in a disk

We study the orbital stability of simply connected m -fold rotating vortex patches, $m \geq 2$, for the two-dimensional incompressible Euler equations in the unit disk. We consider V-states sufficiently close to a centered disk of radius b in $(0,1)$, and prove stability under small m -fold symmetric patch perturbations. The proof is based on a constrained variational energy argument. For general admissible parameters covered by our hypotheses, we obtain orbital stability on every prescribed finite time interval. For a special class of parameters, the localization required in the variational argument can be controlled uniformly in time, yielding global-in-time orbital stability.

Qing Guo

Minzu University of China

Concentration and coupling mechanisms in critical Lotka-Volterra systems

We investigate a critical Lotka-Volterra elliptic system featuring non-variational symmetric couplings. The interplay among critical Sobolev growth, loss of compactness, and these non-variational interactions creates major difficulties in controlling the scaling, location, and interaction of concentration phenomena. We construct positive solutions concentrating at distinct interior points for dimensions $3 \leq N \leq 6$, revealing a strongly dimension-dependent structure. In dimension three, a higher-order projection is required, leading to weak, critical, and strong coupling regimes, side selection, and a saddle-node phenomenon. In dimension four, the two components may have independent exponential concentration scales. Dimensions five and six exhibit different effective coupling laws, allowing, respectively, critical growth of the coupling parameter and a fixed small-coupling regime. The proofs combine non-variational Lyapunov-Schmidt reduction, refined Green and Robin function expansions, sharp interaction estimates, local Pohozaev identities, weighted linear theory, duality arguments, and Brouwer degree theory.