Geometric Analysis
Analyse géométrique
(Org: **Siyuan Lu** (McMaster University) and/et **Xiangwen Zhang** (University of California, Irvine))

MIN CHEN, McGill University
Alexandrov-Fenchel type inequalities for hypersurfaces in the sphere

The Alexandrov-Fenchel inequalities in the Euclidean space are inequalities involving quermassintegrals of different orders and are classical topics in convex and differential geometry. Brendle-Guan-Li proposed a conjecture on the corresponding inequalities for quermassintegrals in the sphere. In this talk, we introduce some new progress on this Conjecture.

EDWARD CHERNYSH, McGill
A Struwe-Type Decomposition for Weighted p-Laplace equations of the Caffarelli-Kohn-Nirenberg Type

In this talk, we establish a Struwe-type decomposition result for a class of critical p-Laplace equations of the Caffarelli-Kohn-Nirenberg type in smoothly bounded domains $\Omega \subset \mathbb{R}^n$ for $n \geq 3$. More precisely, we investigate the relative compactness of Palais-Smale sequences associated to the critical elliptic problem

$$\begin{cases} -\operatorname{div}\left(|\nabla u|^{p-2}\,\nabla u\,|x|^{-ap}\right) = |u|^{q-2}\,u\,|x|^{-bq} & \text{in } \Omega, \\ u = 0 & \text{on } \partial\Omega. \end{cases}$$

Here, $1 < p < n$ and $q := np/(n - p(1 + a - b))$ under suitable conditions for a, b. In doing so, we highlight crucial differences between the weighted setting and the pioneering work of Michael Struwe in the unweighted model $p = 2$ case.

TRISTAN COLLINS, University of Toronto
Uniqueness of Cylindrical Tangent Cones to some Special Lagrangians

I will explain a proof of the following result: if an exact special Lagrangian $N \subset \mathbb{C}^n$ has a multiplicity one, cylindrical tangent cone of the form $\mathbb{R}^k \times C$ where C is a special Lagrangian cone with smooth, connected link, then this tangent cone is unique provided C satisfies an integrability condition. This applies, for example, to the Harvey-Lawson T^{m-1} cones for $m \neq 8, 9$. This is joint work with Y. Li.

ROBERT HASLHOFER, University of Toronto
Free boundary minimal disks in convex balls

We prove that every strictly convex 3-ball with nonnegative Ricci-curvature contains at least 3 embedded free-boundary minimal 2-disks for any generic metric, and at least 2 solutions even without genericity assumption. Our approach combines ideas from mean curvature flow, min-max theory and degree theory. We also establish the existence of smooth free-boundary mean-convex foliations. This is joint work with Dan Ketover.

FANG HONG, McGill University
Sharpened Minkowski Inequality in Cartan-Hadamard Spaces

Minkowski inequality describes the relationship between total mean curvature of a surface and its area. Extension of Minkowski inequality to hyperbolic space and finding the sharp inequality have been a long standing problem. We will discuss a recent paper by M. Ghomi and J. Spruck and sharper inequality we get based on their proof, in which we generalized Minkowski inequality to general spaces with non-positive curvature via harmonic mean curvature flow.

CHAO-MING LIN, Ohio State University
On the solvability of general inverse σ_k equations

In this talk, first, I will introduce general inverse σ_k equations in Kähler geometry. Some classical examples are the complex Monge–Ampère equation, the J-equation, the complex Hessian equation, and the deformed Hermitian–Yang–Mills equation. Second, by introducing some new real algebraic geometry techniques, we can consider more complicated general inverse σ_k equations. Last, analytically, we study the solvability of these complicated general inverse σ_k equations.

SEBASTIEN PICARD, UBC
Strominger system and complex geometry

The Strominger system is the set of fundamental equations of supersymmetric heterotic string theory over a Calabi-Yau threefold. It combines the Yang-Mills equation on a vector bundle with a constraint equation on the Riemannian curvature tensor. We will survey current developments on these equations.

LING XIAO, University of Connecticut
Generalized Minkowski inequality via degenerate Hessian equations on exterior domains

In this talk, we will talk about the proof of a sharp generalized Minkowski inequality that holds for any smooth, strictly $(k-1)$-convex, star-shaped domain Ω. Our proof relies on the solvability of the degenerate k-Hessian equation on the exterior domain $R^n \setminus \Omega$.

ZIHUI ZHAO, Johns Hopkins University
Unique continuation and the singular set of harmonic functions

Unique continuation property is a fundamental property for harmonic functions, as well as a large class of elliptic and parabolic PDEs. It says that if a harmonic function vanishes at a point to infinite order, it must vanish everywhere. In the same spirit, we are interested in quantitative unique continuation problems, where we use the local growth rate of a harmonic function to deduce some global estimates, such as estimating the size of its singular or critical set set. In this talk, I will talk about some recent results together with C. Kenig on boundary unique continuation.