## Plenary Speakers

**FRANCISCO GONZALEZ ACUÑA**, Instituto de Matemáticas, UNAM & CIMAT
*Minimal coverings of a 3-manifold with special open subsets*

What is the minimal number of "special" open subsets $U$ of a closed $3$-manifold $M^3$ that cover it?

We will discuss this question with the following nine meanings of the word "special":

absolute:
1. Homeomorphic to $\mathbb{R}^3$
2. Homeomorphic to $S^1 \times \mathbb{R}^2$
3. Homeomorphic to an open subset of $\mathbb{R}^3$
4. Contractible (in themselves)

relative:
5. Contractible in $M^3$
6. $\pi_1$-contractible in $M^3$
7. $H_1$-contractible in $M^3$
8. $H$-contractible in $M^3$
9. $S^1$-contractible in $M^3$.

**DAVID BRYDGES**, University of British Columbia, 1984 Mathematics Road, Vancouver, BC V6T 1Z2
*Self-Avoiding Walks and Trees*

A long chain molecule can be crudely modeled as a sequence of $N$ points in $\mathbb{R}^d$ where the first point is at the origin. The sequence is admissible if each point is the centre of a sphere such that the spheres are non-overlapping but touching each other in accordance with the topology of a chain. By putting a uniform distribution on the subset of $\mathbb{R}^{Nd}$ consisting of admissible sequences we can address basic questions such as what is the expected end-to-end distance when $N$ is large? Analogous questions can be posed for molecules with other topologies such as trees. An even more basic model for a long chain molecule is self-avoiding walk on the simple cubic lattice $\mathbb{Z}^d$. I will review and dicuss recent results related to this class of problems.

**GONZALO CONTRERAS**, CIMAT, P.O. Box 402, 36.000 Guanajuato, GTO, México
*$C^2$-densely the 2-sphere has an elliptic closed geodesic*

We prove that a Riemannian metric on the 2-sphere or the projective plane can be $C^2$-approximated by one whose geodesic flow has an elliptic closed geodesic. This result was conjectured by M. Herman and also partially recovers in the generic case a claim by H. Poincaré for convex surfaces. Consequences of this theorem are that there is a dense set of metrics in the 2-sphere whose geodesic flow is not ergodic and that there are no structurally stable geodesic flows on the 2-sphere. I find this a beautiful example of the use of modern dynamical systems in Riemannian geometry.

**PENGFEI GUAN**, McGill University
*Nonlinear Differential Equations in Geometry*

We will discuss some recent progress of nonlinear differential equations arising in geometry. Geometrically inspired problems provided the motivation for much of the development of the modern theory of nonlinear PDEs, in turn, the PDE theory plays key role in solving some outstanding problems in geometry. We will concentrate on nonlinear scalar equations to illustrate some of the main ideas and techniques. These equations are related to the Christoffel–Minkowski problem, high codimension mean curvature flow and the problem of prescribing the $\sigma_k$ curvature of a conformal metric.

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**JORGE URRUTIA**, Instituto de Matemáticas, UNAM
*On Quadrangulations of Point Sets*

Let $P = \{p_1, \dots, p_n\}$ be a point set in general position on the plane. A quadrangulation of $P$ is a set $Q = \{Q_1, \dots, Q_m\}$ of quadrilaterals (not necessarily convex) with disjoint interiors such that:

- the vertices of all $Q_i$ are elements of $P$;
- no element of $P$ lies in the interior of any $S_i$, $i = 1, \dots, m$;
- $S_1 \cup \cdots \cup S_m = \mathrm{Conv}(P)$ where $\mathrm{Conv}(P)$ denotes the convex hull of $P$.

$Q$ is called a *convex quadrangulation*of $P$ when all of its elements are convex. In this talk we study several problems on convex and non-convex quadrangulations of point sets,

We also study quadrangulations of bicolored point sets, that is sets of points on the plane such that its elements are colored with two colors, say red and blue. The set of blue points will be denoted by $B = \{b_1, \dots, b_r\}$, and the set of red points by $R = \{r_1, \dots, r_s\}$; $r + s = n$, $r \leq s$. We will assume that $P = R \cup B$ is in general position. A bichromatic quadrangulation $Q$ of $P$ is a quadrangulation in which all the edges of the elements of $Q$ join a blue and a red point. Some problems on quadrangulations of point sets colored with 3 colors will also be studied.

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**MACIEJ ZWORSKI**, University of California, Berkeley
*Quantum chaos in scattering theory*

Models of quantum chaotic scattering include scattering by several convex bodies, open quantum maps, analysis on convex co-compact hyperbolic surfaces, and semiclassical potential scattering. In the talk, I will describe common features of these different models. The general goal will be to explain how classical objects, such as the thermodynamical pressure or dimension of the trapped set, affect quantum properties such as the decay rates or the density of states. I will concentrate on (colourful) pictures and intuitions rather than on the technical aspects of this (rather technical) subject.