

# Distinguished Lecture Series & Workshop on Geometric Analysis

The Chinese University of Hong Kong  
Department of Mathematics  
*June 21-23, 2016*

## Program schedule

### June 21, 2016 (Tue)

Time	Venue	Talks and Events
10:30-11:30	AB1 501a	<b>Title:</b> <i>Minimal surfaces of high codimension: isotropicity, holomorphicity and stability</i> <b>Speaker:</b> Mario Micalef (U Warwick)
		Lunch
14:30-15:30	LSB LT3	<b>Distinguished Lecture I:</b> <i>Eigenvalues and minimal surfaces I: closed surfaces</i> <b>Speaker:</b> Prof. Richard Schoen (Stanford/UC Irvine)
15:30-16:30	LSB 222	Refreshment and discussions
		Welcome dinner for distinguished scholar

### June 22, 2016 (Wed)

Time	Venue	Talks and Events
10:30-11:30	AB1 501a	<b>Title:</b> <i>Quasi-local mass integrals and the total mass</i> <b>Speaker:</b> Luen-Fai Tam (CUHK)
		Lunch
13:30-14:30	AB1 501a	<b>Title:</b> <i>Inverse mean curvature flow and infinite bottles</i> <b>Speaker:</b> Hojoo Lee (KIAS)
14:45-15:45	AB1 501a	<b>Title:</b> <i>Boltzmann's Entropy and Kahler-Ricci Solitons</i> <b>Speaker:</b> Frederick Fong (HKUST)
		Excursion and dinner

### June 23, 2016 (Thur)

Time	Venue	Talks and Events
10:30-11:30	AB1 501a	<b>Title:</b> <i>How to construct minimal hypersurfaces in <math>\mathbb{R}^n</math></i> <b>Speaker:</b> Jaigyoung Choe (KIAS)
		Lunch
14:30-15:30	LSB LT3	<b>Distinguished Lecture II:</b> <i>Eigenvalues and minimal surfaces II: surfaces with boundary</i> <b>Speaker:</b> Prof. Richard Schoen (Stanford/UC Irvine)
15:30-16:30	LSB 222	Refreshment and discussions
		Workshop banquet

\* All the talks will be held at Lady Shaw Building (LSB) and Academic Building No.1 (AB1) in The Chinese University of Hong Kong.

*The event is supported by the Department of Mathematics and the Institute for Mathematical Sciences at The Chinese University of Hong Kong. For any inquiries, please contact Martin Li at [martinli@math.cuhk.edu.hk](mailto:martinli@math.cuhk.edu.hk).*

## Distinguished Lecture Series

*Lecture 1: Eigenvalues and minimal surfaces I: closed surfaces*

*Lecture 2: Eigenvalues and minimal surfaces II: surfaces with boundary*

**Speaker:** Prof. Richard Schoen (Stanford/UC Irvine)

**Abstract:** We will discuss sharp eigenvalue bounds for surfaces which lead naturally into questions about minimal surfaces in spheres and euclidean balls. We will discuss existence issues and questions about the geometry of solutions of the extremal problems. The lectures will be aimed at a mathematical audience with basic knowledge of geometry and linear elliptic PDE.

### Workshop Talks

**Title:** *How to construct minimal hypersurfaces in  $\mathbb{R}^n$*

**Speaker:** Jaigyoung Choe (KIAS)

**Abstract:** We will show how to construct the higher dimensional generalizations of Enneper's surface, helicoid, Schwarz's  $P$ -surface and  $D$ -surface, Scherk's second surface.

**Title:** *Boltzmann's Entropy and Kahler-Ricci Solitons*

**Speaker:** Frederick Fong (HKUST)

**Abstract:** We discuss an entropy functional of Boltzmann's type defined on Kahler metrics in a fixed Kahler class. This functional is monotonically increasing along the Kahler-Ricci flow and has Kahler-Ricci solitons as its critical points. We derive a second variational formula and show that any Kahler-Ricci solitons (including Kahler-Einstein metrics) are linearly stable with respect to this functional. In this talk, the speaker will survey some related results about this functional and explain the significance of this second variation result.

**Title:** *Inverse mean curvature flow and infinite bottles*

**Speaker:** Hojoo Lee (KIAS)

**Abstract:** We investigate self-similar solutions to the inverse mean curvature flow in Euclidean space. Generalizing Andrews' theorem that circles are the only compact homothetic planar solitons, we apply the Hsiung-Minkowski integral formula to prove the rigidity of hyperspheres in the class of compact expanders of codimension one. We update the list of Huisken-Ilmanen's rotational expanders by constructing new examples of complete expanders, including topological hypercylinders, called infinite bottles. This is joint work with Gregory Drugan and Glen Wheeler.

**Title:** *Minimal surfaces of high codimension: isotropicity, holomorphicity and stability*

**Speaker:** Mario Micallef (U Warwick)

**Abstract:** The notions mentioned in the title are roughly related as follows. Isotropicity of a minimal surface is characterised by the vanishing of certain holomorphic differentials. Holomorphic curves in a complex torus with a flat metric are precisely the minimal surfaces which are maximally isotropic. And it is well known that a surface which is holomorphic in a Kähler manifold minimizes area in its homology class. I will present various results in this area and mention some open problems. In particular, I will discuss the deformation of a holomorphic curve in a complex torus with a flat metric to a minimal surface which is isotropic to a sufficiently high order (but less than maximal!). The holomorphicity of stable minimal surfaces which are isotropic to the same degree will also be described. This is joint work with Elisabeta Nedita and it is related to (some old) work with Claudio Arezzo and Jon Wolfson.

**Title:** *Quasi-local mass integrals and the total mass*

**Speaker:** Luen-Fai Tam (CUHK)

**Abstract:** In this talk, we will describe known results on how to evaluate the ADM mass of an asymptotically flat manifold and the mass integral of an asymptotically hyperbolic manifold. We then apply the results to relate Brown-York quasi-local mass of coordinate spheres and the ADM mass of an asymptotically flat manifold. We will also relate some quasi-local mass integrals of coordinate spheres and the total mass integral of an asymptotically hyperbolic manifold. We will also discuss some functionals on compact manifolds with boundary which are motivated by these considerations.