



# Workshop on Fractals and Related Areas

*Organized by Department of Mathematics  
The Chinese University of Hong Kong*

**Sunday, 21 January 2018**

**Room 222, Lady Shaw Building, CUHK**

The workshop emphasizes on the recent  
development on fractals and related areas

## **Speakers:**

- ✧ *Ka-Sing Lau* (University of Pittsburgh & CUHK)
- ✧ *Jason Jun Luo* (Chongqing University)
- ✧ *Pablo Shmerkin* (Universidad Torcuato Di Tella)
- ✧ *Károly Simon* (Budapest University of Technology and Economics)
- ✧ *Alexia Yavicoli* (University of Buenos Aires)

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# Program

Venue: Rm. 222, Lady Shaw Building, CUHK

✚ 9:00am-9:50am : *Prof. Ka-Sing Lau (University of Pittsburgh & CUHK)*

## Another look at Sobolev spaces

Abstract: Let  $\Omega$  be a domain in  $\mathbb{R}^n$  with smooth boundary, it is well-known that the Sobolev spaces  $W^{1,2}(\Omega)$  and  $W^{s,2}(\Omega)$ ;  $0 < s < 1$  are function spaces that are associated with the Laplacian  $\Delta$  and the fractional Laplacian  $(-\Delta)^s$  respectively. There are extensions of these concepts to the Besov spaces on certain fractal sets  $K$ . In this talk, we will discuss some of the recent developments; in particular we will consider a theorem of Bourgain, Brezis and Mironescu on the limit behavior of  $W^{s,2}(\Omega)$ ,  $s \rightarrow 1^-$  to  $W^{1,2}$ , and the possible extension of the theorem to Besov spaces on  $K$ .

✚ 10:10am-11:00am : *Prof. Károly Simon (Budapest University of Technology & Economics)*

## Hausdorff dimension for triangular self-affine IFS

Abstract: We consider self-affine IFS on the plane,  $\{\mathcal{S}_i(x, y) = A_i x + t_i\}_{i=1}^m$ , where  $A_i$  are  $2 \times 2$  contracting lower diagonal matrices which differ only in their off-diagonal elements. We allow overlaps between the cylinders. We compute the Hausdorff dimension for the attractor under some conditions.

This talk is based on two papers: One of them is joint with B. Barany and M. Rams (to appear in ETDS) and the other one is in preparation and joint with my student I. Kolossvary.

✚ 11:20am-12:10 pm : *Prof. Pablo Shmerkin (Universidad Torcuato Di Tella)*

## New bounds on the dimensions of planar distance sets

Abstract: I will present some new lower bounds for the dimension of planar distance sets and pinned distances. These bounds improve the previously known one for sets of Hausdorff dimension greater than 1, and verify Falconer's distance set conjecture in some cases. Joint work with T. Keleti.

✚ 2:30pm-3:20pm : *Prof. Jason Jun Luo (Chongqing University)*

## The theory of Gromov hyperbolic graphs and its application to Lipschitz equivalence of self-similar sets

Abstract: Given an iterated function system (IFS) of contractive similitudes, the theory of Gromov hyperbolic graphs on the IFS has been established recently. In this talk, we introduce a notion of simple augmented tree on the IFS which is a Gromov hyperbolic graph. By using a combinatoric device called rearrangeable matrix and its generalization, we show that there exists a near-isometry between the simple augmented tree and the symbolic space of the IFS, so that their boundaries are Lipschitz equivalent. We then apply this result to consider the Lipschitz equivalence of self-similar sets with or without the open set condition, which is an interesting topic in fractal geometry and geometric measure theory.

✚ 3:40pm-4:30pm : *Ms. Alexia Yavicoli (University of Buenos Aires)*

## Fractals and Patterns

Abstract: I will talk about the relationship between the size of a set and the presence of geometric patterns, such as arithmetic progressions. In particular, I will discuss the existence of large sets that avoid countably many given linear patterns.