# *Curriculum Vitae*


## Xiaoxiang Chai

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## *Education*

2015 - July 2018, PhD in Mathematics, Department of Mathematics

The Chinese University of Hong Kong, Hong Kong

Advisor: Prof. Martin Man-chun Li; Co-advisor: Prof. Luen-fai Tam

Thesis title: *Some aspects of the minimal surface theory*

2012 - 2015, Master of Science (advisor: Prof. Jiaxin Hu)

Tsinghua University, Beijing, China

Master Thesis title: *First Eigenvalue Problem of Dirichlet forms*

2008 - 2012, Bachelor of Science, Sun Yat-sen University, Guangzhou, China

## *Work Experience*

Mar 2019 - Feb 2020, Research fellow at Korea Institute for Advanced Study

Host Prof. Choe Jaigyoung

Feb 2020 - Now, Research fellow at Korea Institute for Advanced Study

Host Prof. Inkang Kim

## *Research Interests*

**Minimal surfaces**

- Min-max methods, free boundary minimal surface;
- Geometric measure theory, mean curvature flow etc.

**Relativity and related geometry**

- Positive mass theorem, geometry of scalar curvature.

## *References*

1. Prof. Jaigyoung Choe (choe@kias.re.kr).

   Professor and Director of Korea Institute for Advanced Study, Seoul.

2. Prof. Martin Man-chun Li (martinli@math.cuhk.edu.hk).

   Associate Professor at the Chinese University of Hong Kong, Hong Kong.

3. Prof. Pengzi Miao (pengzim@math.miami.edu).

   Professor at University of Miami, Florida.

4. Prof. Xueyuan Wan (xwan@cqut.edu.cn).

   Professor at Chongqing University of Technology, Chongqing.

## *Publications*

1. Willmore type inequality using monotonicity formulas. Pacific Journal of Mathematics, **307** (1), 53-62, (2020). arXiv: 1811.05617v2.

2. Evaluation of the mass of an asymptotically hyperbolic manifold. The Journal of Geometric Analysis, **32**, (7), 1-18, (2022). arXiv: 1811.09778.

3. (with Inkang Kim) Scalar curvature, mean curvature and harmonic maps to the circle. Annals of Global Analysis and Geometry, **62**, 201–219 (2022). arXiv: 2103.09737.

4. (with *Xueyuan Wan*) The mass of an asymptotically hyperbolic end and distance estimates. *Accepted in Journal of Mathematical Physics*. arXiv: 2207.06141.

## *Submitted Papers and Preprints*

1. (with Martin Li) A mixed boundary value problem for Jang's equation and the existence of free boundary marginally outer trapped surfaces. 2019-2022. Available at https://chxiaoxn.github.io/fb-mots.pdf

2. A tilted spacetime positive mass theorem. 2022. Available at https://chxiaoxn.github.io/tilt-spacetime-positive-mass-theorem.pdf

3. (with *Gaoming Wang*) Dihedral rigidity in hyperbolic 3-space. arXiv:2208.03859. (This paper contains a previous result *Mass and polyhedra in asymptotically hyperbolic manifolds* arXiv:2102.10715)

4. (with *Xueyuan Wan*) Band width estimates of CMC initial data sets arXiv: 2206.02624. (This supersedes previous papers 2107.12782, 2107.12784)

5. A curvature estimate for stable marginally outer trapped hypersurface with a free boundary. arXiv: 2205.05890.

6. Inverse mean curvature flow with a free boundary in hyperbolic space. arXiv: 2203.08467.

7. Asymptotically hyperbolic manifold with a horospherical boundary. arXiv: 2102.08889.

8. Minkowski formula of conformal Killing-Yano 2-forms. arXiv: 2101.08966.

9. Positive mass theorem and free boundary minimal surfaces. arXiv: 1811.06254.

10. Two quasi-local masses evaluated on surfaces with boundary. arXiv: 1811.06168.

## *Invited Talks*

1. **Dec 1-9, 2022.** *Scalar curvature rigidity of polyhedron in hyperbolic 3-space and generalizations.* Pusan National University, Busan.

2. **11 Nov, 2022.** *Band width estimates of CMC initial data sets and applications.* Department of mathematics, University of Miami.

3. **22 Aug, 2022**. *Gromov dihedral rigidity in hyperbolic 3-space*. Department of mathematics, Peking University, Beijing.

4. **10 June, 2022**. *Free boundary surface in scalar curvature geometry*. Department of Mathematics, Xiamen University, Xiamen.

5. **Apr 14, 2022**. *Inverse mean curvature flow with a free boundary in hyperbolic space*. Department of Mathematics, Pusan National University, Busan.

6. **March 1-3, 2022**. *Mixed boundary value problems in Gromov dihedral rigidity*. Conference of *Geometric analysis on manifolds, fractals and metric spaces*. Yamagata University, Japan.

7. **April 14, 2021**. *Harmonic maps on the cube to the circle and applications to the dihedral rigidity*. Duke University, USA.

8. **Aug 13, 2020**. *Free boundary MOTS: existence theory*. Nankai University, Tianjin.

9. **Sep 23-26, 2019**. *Positive mass theorem and free boundary minimal surfaces*. International Conference on Analysis and PDEs on Manifolds and Fractals, Nankai University, Tianjin.

10. **Jun 3, 2019**. *Constructing a minimal surface in a sphere with an arbitrary metric*. KIAS Three W Seminar.

11. **Feb 21-Mar 1, 2019**. *Willmore inequatilies via monotonicity formulas*. Workshop on Geometric Analysis, Algebraic geometry and Sympletic geometry. The Chinese University of Hong Kong.

12. **Aug 2018**. *Positive mass theorem and free boundary minimal surfaces*. Department of Mathematics, Peking University.

13. **June, 2018**. *Positive mass theorem and free boundary minimal surfaces*. Department of Mathematics, Sun Yat-Sen University (Zhuhai Campus).

## *Academic Visits*

1. Nov 7-Nov 12. University of Miami, Florida. Host: Prof. Pengzi Miao.

2. Nov 5-6, 2022. University of Connecticut, Northeastern Workshop in Geometric Analysis (NEWGA).

3. Oct 27-Nov 4, 2022. Cornell University. Host: Prof. Xin Zhou, Gaoming Wang.

4. Nov 8-11, 2019. *Geometric Analysis Seminar for Young Scholars*. Sun Yat-sen University.

5. Oct 22-24, 2019. Jeonbuk National University, Korea. Host: Prof. Hojoo Lee.

6. Sep 2018, Department of Mathematics, Fudan University. Host Prof. Ling Yang.

7. Sep 2018, Department of Mathematics, Nankai University. Host Prof. Yuhua Sun.

## *Teaching Assistant Duties*

1. 2017 - 2018 Term 2, MATH1010I University Mathematics, CUHK.

2. 2017 - 2018 Term 1, MATH1010 University Mathematics, CUHK.

3. 2016 - 2017 Term 1, MATH1010 University Mathematics, CUHK.
4. 2015 - 2016 Term 1, MATH1510 Calculus for Engineers, CUHK.
5. 2015 - 2016 Term 1, MATH1020 General Mathematics, CUHK.
6. 2014 - 2015 Term 2, Complex function theory (10420252),Tsinghua University.
7. 2014 - 2015 Term 1, Methods of Mathematical Physics (10420262), Tsinghua University.
8. 2013 - 2014 Term 2, Linear Algebra (10421102), Tsinghua University.
9. 2013 - 2014 Term 1, Linear Algebra (10421113), Tsinghua University.
10. 2012 - 2013, Calculus A (10421065), Tsinghua University.

## *Awards*

2014, Awards of Excellence, Department of Mathematics, Tsinghua University.