

# *Curriculum Vitae*

Xiaoxiang Chai

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## *Education*

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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*

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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*

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### **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

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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

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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

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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*

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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 inequalities via monotonicity formulas.* Workshop on Geometric Analysis, Algebraic geometry and Symplectic 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*

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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*

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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*

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