

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.

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.

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. (with Xueyuan Wan) The mass of an asymptotically hyperbolic end and distance estimates. arXiv: 2207.06141.
6. A curvature estimate for stable marginally outer trapped hypersurface with a free boundary. arXiv: 2205.05890.
7. Inverse mean curvature flow with a free boundary in hyperbolic space. arXiv: 2203.08467.
8. Asymptotically hyperbolic manifold with a horospherical boundary. arXiv: 2102.08889.
9. Minkowski formula of conformal Killing-Yano 2-forms. arXiv: 2101.08966.

10. Positive mass theorem and free boundary minimal surfaces. arXiv: 1811.06254.
11. Two quasi-local masses evaluated on surfaces with boundary. arXiv: 1811.06168.

Invited Talks

1. **22 Aug, 2022.** *Gromov dihedral rigidity in hyperbolic 3-space.* Department of mathematics, Peking University.
2. **10 June, 2022.** *Free boundary surface in scalar curvature geometry.* Department of Mathematics, Xiamen University.
3. **Apr 14, 2022.** *Inverse mean curvature flow with a free boundary in hyperbolic space.* Department of Mathematics, Pusan National University, Busan, South Korea.
4. **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.
5. **April 14, 2021.** *Harmonic maps on the cube to the circle and applications to the dihedral rigidity.* Duke University, USA.
6. **Aug 13, 2020.** *Free boundary MOTS: existence theory.* Nankai University.
7. **Sep 23-26, 2019.** *Positive mass theorem and free boundary minimal surfaces.* International Conference on Analysis and PDEs on Manifolds and Fractals, Nankai University.
8. **Jun 3, 2019.** *Constructing a minimal surface in a sphere with an arbitrary metric.* KIAS Three W Seminar.
9. **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.
10. **Aug 2018.** *Positive mass theorem and free boundary minimal surfaces.* Department of Mathematics, Peking University.
11. **June, 2018.** *Positive mass theorem and free boundary minimal surfaces.* Department of Mathematics, Sun Yat-Sen University (Zhuhai Campus).

Academic Visits

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

2. Oct 22-24, 2019. Jeonbuk National University, Korea. Host: Prof. Hojoo Lee.
3. Sep 2018, Department of Mathematics, Fudan University. Host Prof. Ling Yang.
4. 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.