Maxwell Xu Cai

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EXPERIENCE

ADVISOR OF ARTIFICIAL INTELLIGENCE | SURF Cooperative

Sept 2019 -- Present | Amsterdam, The Netherlands

- Develop High-performance machine learning models for physical sciences
- Lecturer of deep learning courses
- Scientific Programmer

POSTDOC RESEARCHER | Leiden Observatory, Leiden University

Sept 2016 -- Aug 2019 | Leiden, The Netherlands

- Formation, Evolution and Habitability of Planetary System
- Dynamical coevolution of planetary systems and star clusters
- Deep Learning in Astrophysics
- Dwarf planets, minor objects, and the Oort cloud
- High-performance computing and high-availability distributed file systems

VISITING SCHOLAR / STUDENT FELLOW

- Astronomisches Rechen-Institut, Zentrum für Astronomie, Aug 2018, Heidelberg, Germany
- Institute for Advanced Study, May 2018 - June 2018, Princeton, NJ, USA
- Chalmers University of Technology, March 2018, Gothenburg, Sweden
- National Astronomical Observatory of Japan, Aug 2017, Tokyo, Japan
- Advanced Institute for Computational Sciences, RIKEN, July 2017 – Aug 2017, Kobe, Japan
- Astronomisches Rechen-Institut, Zentrum für Astronomie, Jun 2016 – Jul 2016, Heidelberg, Germany
- University of California, Santa Cruz, Jul 2015 – Sep 2015, Santa Cruz, CA, USA
- Canadian Institute for Theoretical Astrophysics, Jun 2014 – Aug 2014, Toronto, Canada
- Leiden Observatory, Leiden University, Feb & Jun 2013, Leiden, The Netherlands
- Astronomisches Rechen-Institut, Zentrum für Astronomie, Jan & Jul 2013, Heidelberg, Germany

EDUCATION

CHINESE ACADEMY OF SCIENCES | Ph.D. in Astrophysics

September 2011 -- July 2016 | Beijing, China

- Supervisors: Rainer Spurzem, M.B.N. Kouwenhoven, Douglas N.C. Lin
- Thesis: Dynamical Evolution of Planetary Systems in Star Clusters

SOUTH CHINA AGRICULTURAL UNIVERSITY | B.Sc. in Computer Science

September 2007 -- July 2011 | Guangzhou, China

COMPUTING SKILLS

- Data analysis: `NumPy`, `SciPy`, `Pandas`, `Matplotlib`, `h5py`
- Programming languages: `Python`, `C/C++`, `Java`, `R`, `JavaScript`, `PHP`, `bash`, LaTeX
- HPC frameworks: `CUDA`, `MPI`, `OpenMP`, `Thrust`, `Boost`
- Deep Learning frameworks: `TensorFlow`, `Keras`, `PyTorch`

- Operating systems: `UNIX` (including `macOS`), `Linux` (`Red Hat/Ubuntu`)
- Database systems: `MySQL`, `PostgreSQL`
- Infrastructure: Virtualization, Amazon Web Service, Google Cloud, `Docker`
- Software Engineering: Object-oriented Programming, `git`, `svn`, `CI/CD`
- Website Development: `Drupal`, `HTML5`, `CSS`

PROFESSIONAL SERVICE

STUDENT SUPERVISION

At Leiden University, I have supervised 6 master students for their master research projects (planetary system dynamics, machine learning) and 10 undergraduate students (planetary system dynamics, computational astrophysics), as of November 2018.

REFEREE IN PEER-REVIEW JOURNALS

- Monthly Notices of the Royal Astronomical Society (MNRAS)
- Astronomy & Astrophysics (A&A)
- Computational Astronomy and Cosmology (CACM)

SCIENTIFIC ORGANIZING COMMITTEE

- The origins of black hole mergers and gravitational waves, Jan – present, Lorentz Center, Leiden
- Leiden-BNU Summer school for computational astrophysics, July 2018, Leiden
- AMUSE multi-scale physics modeling workshop, April 2018, Leiden
- Third Dutch Star Cluster Meeting, Feb – Oct 2017, Leiden
- Leiden/ESA Astrophysics Program for Summer Students (LEAPS), Nov 2016 – Aug 2017, Leiden
- Formation of the Solar System and the Origin of Life, Sep 2016 – Feb 2017, Lorentz Center, Leiden
- IAU Symposium #312: "Star clusters and black holes in galaxies across cosmos time", July – Aug 2014, Chinese Academy of Sciences, Beijing

PART-TIME IT SPECIALIST

- Kavli Institute for Astronomy and Astrophysics, Peking University, Sep 2011 – Jun 2016, Beijing
- National Astronomical Observatory of China, Sep 2012 – Aug 2016, Beijing

GRANTS, AWARDS & PROFESSIONAL MEMBERSHIPS

GRANTS

- Leids Kerkhoven-Bosscha Fonds (LKBF) grant for international conference attendance (2017, 2018)
- 1.5 Million CPU-hours on the Dutch Supercomputer "Cartesius" (2017)

AWARDS

- Postdoc fellowship, Leiden Observatory (2016-2019)
- KIAA-CAS postdoc fellowship (2016, declined)
- PhD fellowship, National Astronomical Observatory of China (2011-2016)
- Outstanding PhD candidate at the University of Chinese Academy of Sciences (2012/13/14/15)
- NAOC-AMD joint scholarship (2015)

PROFESSIONAL MEMBERSHIPS

- Junior member of the International Astronomical Union (since 2018)
- Member of the European Astronomical Society (since 2017)

LANGUAGES

- Native: Chinese, Cantonese
- Advanced: English
- Basic: Dutch, French, German

PUBLICATIONS

BOOKS

1. Javier Roa, Adrian Hamers, **Maxwell Xu Cai**, Nathan Leigh, *Moving Planets Around: An introduction to N-body simulations*, MIT Press (in press)

REFEREED, CORRESPONDING AUTHOR

1. **Cai M. X.**, Portegies Zwart S., Kouwenhoven M. B. N., Spurzem R., 2019, *On the survivability of planets in young massive clusters and its implication of planet orbital architectures in globular clusters*, MNRAS, 489, 4311

2. **Cai, M. X.**, Portegies Zwart, S., & van Elteren, A. 2018, *The signatures of the parental cluster on field planetary systems*, MNRAS, 474, 5114

3. **Cai, M. X.**, Kouwenhoven, M. B. N., Portegies Zwart, S. F., & Spurzem, R., 2017, *Stability of Planetary Systems in Star Clusters*, MNRAS, 470, 4337

4. **Cai, M. X.**, Gieles, M., Heggie, D. C., & Varri, A. L. 2016, *Evolution of Star Clusters on Eccentric Orbits*, MNRAS, 455, 596

5. **Cai, M. X.**, Meiron, Y., Kouwenhoven, M. B. N., Assmann, P., & Spurzem, R. 2015, *Block Time Step Storage Scheme for Astrophysical N-body Simulations*, ApJS, 219, 31

REFEREED, COAUTHOR

1. Flammini Dotti, Francesco; Kouwenhoven, M. B. N.; **Cai, Maxwell Xu**; Spurzem, Rainer, 2019, *Planetary systems in a star cluster I: the Solar system scenario*, MNRAS, 489, 2280.

2. Torres, S.; **Cai, M. X.**; Brown, A. G. A.; Zwart, S. P. 2019, *Galactic tide and local stellar perturbations on the Oort cloud: creation of interstellar comets* , A&A, 629, 139.

3. A. van Elteren, S. Portegies Zwart, I. Pelupessy, **M. X. Cai** and S.L.W. McMillan, 2019, *The survivability of planetary systems in young and dense star clusters*, A&A, 624, 120.

4. Van Eylen, Vincent; Albrecht, Simon; Huang, Xu; MacDonald, Mariah G.; Dawson, Rebekah I.; **Cai, Maxwell X.**; Foreman-Mackey, Dan; Lundkvist, Mia S.; Silva Aguirre, Victor; Snellen, Ignas; Winn, Joshua N., 2019, *The orbital eccentricity of small planet systems*, AJ, 157, 61

5. Varri, A. L., **Cai, M. X.**, Concha-Ramírez, F., et al. 2018, *A MODEST review*, accepted for publication in 'Computational Astrophysics and Cosmology', Computational Astrophysics and Cosmology, Volume 5, Issue 1, article id. 2, 26 pp.

6. Hamers, Adrian S.; **Cai, Maxwell X.**; Roa, Javier; Leigh, Nathan, 2018, *Stability of exomoons around the Kepler transiting circumbinary planets*, MNRAS, 480, 3800

7. Portegies Zwart, S., Torres, S., Pelupessy, I., Bedorf, J., & **Cai, M. X.**, 2018, *The origin of interstellar asteroidal objects like 1I/2017 U1 'Oumuamua*, MNRAS, 419L, 17P

8. Qian, P. X., **Cai, M. X.**, Portegies Zwart, S. F., & Zhu, M. 2017, *SiMon: Simulation Monitor for Computational Astrophysics*, PASP, 129, 094503

9. Kouwenhoven, M. B. N., Shu, Q ,**Cai, M. X.** & Spurzem, R., 2016, *Planetary systems in star clusters*, MmSAI, v.87, p.630 (2016)

10. Qian, X, **Cai, X.**‡, Zhu, M., 2015, *A Study of 3D Visualization of Astronomical Data Based on the Blender*, Astronomy Research and Technology, 12, 2 (in Chinese)

11. Cui, C., Li, J., & **Cai, X.**‡ et al. 2013, *Robotic Autonomous Observatory Network Review*, Progress in Astronomy, 31, 2 (in Chinese)

PROCEEDINGS

1. **Cai, M. X.**, Spurzem, R., & Kouwenhoven, M. B. N. 2015, *Planetary Systems in Star Clusters*, Proceedings of the International Astronomical Union, IAU Symposium, Volume 312, pp. 235-236

2. Berczik, P., Spurzem, R., Wang, L., Zhong, S., & Huang, S., **Tsai, M.**‡, Kennedy, G., Naso, L., Li, C., 2013, *Up to 700k GPU cores, Kepler, and the Exascale future for simulations of star clusters around black holes*, HPC-UA 2013, Third International Conference "High Performance Computing", HPC-UA 2013, p. 52-59

‡ Before 2014, papers were published with names "Tsai, Maxwell" or "Cai, Xu".

SUBMITTED

1. F.Flammini, **Maxwell Xu Cai**, Rainer Spurzem, M.B.N. Kouwenhoven, *RainerPlanetary Systems in Star Clusters: the dynamical evolution and survival*, submitted to IAU proceedings

CONFERENCES & PRESENTATIONS

INVITED TALKS

†Presentations in group meetings, lunch talks, and AstroCoffee are not included on this list.

- Challenges and Innovation in Computational Astrophysics, Saint Petersburg, Russia (Sept 2019)
- Deep learning for Science, International Supercomputing Conference, Frankfurt, Germany (June 2019)
- From stars to planets, Gothenburg, Sweden (June 2019)
- SSO Open Seminar, European Space Agency, Noordwijk, The Netherlands (Feb 2019)
- The 2nd Workshop on Star and Planet Formation Simulation in the Post-K Era, Kobe, Japan (Oct 2018)
- IBM THINK conference, IBM, Amsterdam, The Netherlands (Oct 2018)
- Leiden Observatory Science Day, Leiden University, The Netherlands (Sept 2018)
- SFB881 (Sonderforschungsbereich) Workshop, Heidelberg University (Aug 2018)
- IAS informal astrophysical seminar, Institute for Advanced Study, Princeton, NJ, USA (June 2018)
- Netherlands Astronomy Conference, Groningen, The Netherlands (May 2018)
- Nanjing University Science Forum of Youth Talents, Nanjing, China (May 2018)
- NOVA Network II meeting, University of Groningen, The Netherlands (Oct 2017)
- Third Dutch Cluster Meeting, Leiden, The Netherlands (Oct 2017)
- MODEST-17, Charles University, Prague, Czech Republic (Sep 2017)
- "Moving Planets Around" writing workshop, RIKEN/AICS, Kobe, Japan (Aug 2017)
- Second Dutch Star Cluster Meeting, API/University of Amsterdam (Feb 2017)
- SFB881 (Sonderforschungsbereich) Workshop, Heidelberg University (June 2016)
- Beijing-Nanjing Bilateral Astrophysics Workshop, Peking University, Beijing (May 2016)
- 6th China-Korea Workshop on Stellar Dynamics and Gravitational Waves, National Astronomical Observatory of China (Dec 2015)
- Annual meeting of the Chinese Astronomical Society, Peking University, Beijing (Oct 2015)
- 5th China-Korea Workshop on Stellar Dynamics and Gravitational Waves, Seoul National University (Dec 2014)
- The International Summer-Institute for Modeling in Astrophysics Conference, Canadian Institute for Theoretical Astrophysics, University of Toronto (Aug 2014)
- 4th China-Korea Workshop on Stellar Dynamics and Gravitational Waves, National Astronomical Observatory of China (Dec 2013)
- European Week of Astronomy and Space Science, University of Turku, Finland (Jul 2013)
- Hands-on Workshop on Computational Astrophysics, Lorentz Center, Leiden (Feb 2013)
- 3rd China-Korea Workshop on Stellar Dynamics and Gravitational Waves, Seoul National University (Dec 2012)

POSTERS

- Exoplanet and Planet Formation Conference, Shanghai Jiaotong University, Shanghai, China (Dec 2017)
- 72th Dutch Astronomy Conference, Radboud University, Nijmegen, The Netherlands (May 2017)
- ISC High Performance, Frankfurt, Germany (Jun 2016)
- Sagan Exoplanet Summer Workshop, Caltech, California, USA (Jul 2015)
- MODEST-15, University of Concepcion, Chile (Mar 2015)
- IAU Symposium #312: Star Clusters and Black Holes in Galaxies Across Cosmos Time, Chinese Academy of Science, Beijing, China (Aug 2014)

ATTENDANCES

- AI in Practice, Amsterdam Science Park (Oct 2018)
- Formation of the Solar System and the Origin of Life, Lorentz Center, Leiden (Feb 2017)
- NOVA Network II meeting, University of Amsterdam (Feb 2017)
- Contemporary physical challenges in Heliospheric and Astrophysical Models, Ghent (Oct 2016)
- GPU Technology Conference, NVIDIA, Amsterdam (Sep 2016)
- Astro-GR: Gravitational Wave Astronomy 2012, Beijing (Sep 2012)
- IAU XXVIII General Assembly, Beijing (Aug 2012)

REFERENCES

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