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Title: Astrophysical plasma modeling of the hot Universe : advances and challenges in high-resolution X-ray spectroscopy

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Curriculum Vitæ

I was born on the 5th of September 1988, in Ningbo, an ancient city with its history dating back to the Hemudu culture in 4800 BC. I completed my pre-university education in 2007 in Ningbo High School.

In the summer of 2007, I wanted to study astronomy in Beijing, the capital city of China. But there were merely four top level universities with the department of astronomy throughout the mainland of China, and the competition of the college entrance examination was indisputably fierce. I ended up in Hangzhou, the capital city of the province I was born, which was somehow a quite popular choice among my classmates in that summer. I enrolled to Zhejiang University of Technology with a physics major.

In my final year as a graduate student, I succeeded in the national post-graduate entrance examination and got the opportunity to pursue a Master of Astrophysics hosted by the National Astronomical Observatory, Chinese Academy of Science and University of Chinese Academy of Science, starting from September 2011.

All graduate students spend their first year doing coursework at the University of Chinese Academy of Science. At that time, I was intrigued by one course particularly – gaseous nebulae. The reasons are twofold: I enjoyed reading one of the textbooks *Astrophysics of Gaseous Nebulae and Active Galactic Nuclei* by Osterbrock; I learned a lot from one of the exercises where I reduced the SDSS spectrum of a star burst galaxy from scratch and inferred its physical properties (temperature, density and abundances) using plasma diagnostics.

In the following two years, under the supervision of Prof. Shuang-Nan Zhang (IHEP & NAOC) and Dr. Zhixing Ling (NAOC), I focused on studying small angle X-ray scattering with interstellar dust. I published my very first scientific paper in the *Astrophysical Journal* early 2014. I obtained my master's degree and got married in the summer of 2014.

My MSc study sparked my interest in high-resolution X-ray spectroscopy. Fortunately, I got a PhD position on this topic under the supervision of prof. dr. J. S. Kaastra (SRON & Leiden) and dr. Jelle de Plaa (SRON). During my PhD, I focused on improving the atomic data in the SPEX code and applying different types of plasma models to various astrophysical environments. I also enjoyed the opportunity to present my work at several international conferences and workshops in Tokyo (Japan), Boston (US), Rome (Italy), and Jekyll Island (US).

In the summer of 2018, I will work on a small project lead by Dr. Matteo Guainazzi (ESTEC) on the first catalogue of ionized emission lines measured by the RGS instrument on board *XMM-Newton*. Then I will move to Glasgow in September to take up a postdoc position with Prof. Nigel Badnell on theoretical and computational studies of atomic process of astrophysical plasmas.

List of publications

20. **Junjie Mao**, M. Mehdipour, J. S. Kaastra, et al. *A&A*, submitted in 2018
Photoionized emission and absorption features in the high-resolution X-ray spectra of NGC 3783
19. **Junjie Mao**, J. de Plaa, J. S. Kaastra, et al., *A&A*, submitted in 2017
Nitrogen abundance in the X-ray halos of clusters and groups of galaxies
18. **Junjie Mao**, J. S. Kaastra, M. Mehdipour et al. *A&A*, 2018, 612, A18
Anatomy of the AGN in NGC 5548 IX. Photoionized emission features in the soft X-ray band
17. **Junjie Mao**, J. S. Kaastra, M. Mehdipour et al., *A&A*, 2017, 607, A100
Density diagnostics of ionized outflows in active galactic nuclei X-ray and UV absorption lines from metastable levels in Be-like to C-like ions
16. **Junjie Mao**, Jelle Kaastra, N. R. Badnell, *A&A*, 2017, 599, A10
The energy loss rate of radiative recombination
15. **Junjie Mao**, Jelle Kaastra, 2016, *A&A*, 2016, 587A, 84M
The level-resolved radiative recombination data for SPEX3
14. **Junjie Mao**, Zhixing Ling, Shuang-Nan Zhang, *ApJ*, 2014, 785, 23
X-ray scattered halo around IGR J17544-2619
13. Liyi Gu, **Junjie Mao**, Jelle de Plaa et al. *A&A*, 2018, 611, A26
Charge exchange in galaxy clusters
12. Liyi Gu, **Junjie Mao**, Christopher P. O’Dea, et al., *A&A*, 2017, 601, A45
Charge exchange in the ultraviolet: implication for interacting clouds in the core of NGC 1275
11. Liyi Gu, **Junjie Mao**, Elisa Costantini, et al., *A&A*, 2016, 594, A78
Suzaku and XMM-Newton observations of the North Polar Spur: Charge exchange or ISM absorption?
10. F. Mernier, J. de Plaa, J. S. Kaastra et al., *MNRAS*, submitted in 2018
Mass-invariance of the iron enrichment in the hot haloes of massive ellipticals, groups, and clusters of galaxies
9. J. S. Kaastra, M. Mehdipour, E. Behar, et al. *A&A*, submitted in 2018
Recurring obscuration in NGC 3783
8. R. Middei, S. Bianchi, M. Cappi, et al., *A&A*, accepted in 2018
Multi-wavelength campaign on NCG 7469. IV. The broad-band X-ray spectrum

7. M. Mehdipour, J. S. Kaastra, G. A. Kriss, et al. *A&A*, accepted in 2018
Multi-wavelength campaign on NGC 7469 III. Spectral energy distribution and the AGN wind photoionisation modelling, plus detection of diffuse X-rays from the starburst with Chandra HETGS
6. M. Mehdipour, J. S. Kaastra, G. A. Kriss, et al. *A&A*, 2017, 607, A28
Chasing obscuration in type-I AGN: discovery of an eclipsing clumpy wind at the outer broad-line region of NGC 3783
5. J. S. Kaastra, L. Gu, J. Mao, et al. *JINST*, 2017, 12, 08
Science with hot astrophysical plasmas
4. F. Mernier, J. de Plaa, J. Kaastra et al., *A&A*, 2017, A80, 27
Radial metal abundance profiles in the intra-cluster medium of cool-core galaxy clusters, groups, and ellipticals
3. H. Akamatsu, L. Gu, T. W. Shimwell et al., *A&A*, 2016, 593, L7
Suzaku and XMM-Newton observations of the newly discovered early-stage cluster merger of 1E2216.0-0401 and 1E2215.7-0404
2. F. Mernier, J. de Plaa, C. Pinto et al., *A&A*, 2016, 592, A157
Origin of central abundances in the hot intra-cluster medium II. Chemical enrichment and supernova yield models
1. F. Mernier, J. de Plaa, C. Pinto et al., *A&A*, 2016, 592, A157
Origin of central abundances in the hot intra-cluster medium I. Individual and average abundance ratios from XMM-Newton EPIC

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I was lucky to work with amazing collaborators on different projects: Liyi, Ton and Nigel (I'm looking forward to starting my postdoc in your group!) on atomic related projects; Liyi, François, Hiroki, Ciro, Yu-Ying, and Hong-Liang on the CHEERS project; Missagh, Elisa, Jon, Graziella, Ehud, Stefano, Jerry, Gabriele, Pop, Laura, Barbara, Ciro, Jacobo, Uria, Riccardo, and Nahum on the AGN related projects.

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