Nan Li

Curriculum Vitae

Postdoc at The University of Chicago &
Argonne National Laboratory
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KICP Associate Fellow

Education

2009–2013 **Astrophysics, Ph.D., May 2013**, *National Astronomical Observatories*, Chinese Academy of Sciences, Beijing, China.
Thesis: "Gravitational Lensing and Cosmology"
Advisors: Prof. Liang Gao and Prof. Shude Mao

2006–2009 **Astrophysics, M.A., June 2009**, *National Astronomical Observatories*, Chinese Academy of Sciences, Beijing, China.
Thesis: "Cusp-core Problem and Strong Gravitational Lensing"
Advisor: Prof. Da-Ming Chen.

2001–2006 **Engineering Mechanics, B.S. June 2006**, *Beijing University of Aeronautics and Astronautics*, Beijing, China.
Thesis: "Structural Stability of the Connections between Stages of Step Objects"
Advisor: Yunfeng Xing

Research Experience

2013–present **The University of Chicago and Argonne National Lab**, Chicago IL, USA.
Working with Prof. Mike Gladders, Dr. Salman Habib, and Dr. Katrin Heitmann on simulations of gravitational lensing.

2009–2013 **National Astronomical Observatories, Chinese Academy of Sciences**, Beijing, China.
Worked with Prof. Liang Gao and Prof. Shude Mao on gravitational lensing and structures of galaxies and galaxy clusters.

2006–2009 **National Astronomical Observatories, Chinese Academy of Sciences**, Beijing, China.
Worked with Prof. Da-Ming Chen on strong gravitational lensing probability in the Universe.

2005–2006 **Beijing University of Aeronautics and Astronautics**, Beijing, China.
Worked with Prof. Yunfeng Xing on structural stability of the connections between stages of step objects.

Research Interests

- **Simulations of Gravitational Lensing**.
  Currently, my research is focused on simulations of gravitational lensing in galaxy clusters. This work covers both strong and weak lensing. Simulations of galaxy-scale strong lensing systems is one of my priority projects in the future, especially simulations of gravitational lens time delays.
- **Gravitational Lens Modeling**.
  Lens modeling is a technique to reconstruct the mass distribution of lenses. At present, there are several tools for lens modeling, with each possessing relative advantages and disadvantages compared to others in different cases. Using our simulations, I am working to identify criteria for choosing the proper tools for specific observations or lensing systems.
- **Automated Strong-lens Finding**.
  In next-generation imaging surveys, e.g., LSST and WFIRST, there will be millions or even billions of images, therefore an automated approach is necessary for finding strong lenses in these enormous datasets. I am very interested in applying machine learning to improve automated strong-lens finding algorithms.
- **Applications of Machine Learning in Cosmology**.
  With the capability of next-generation telescopes, astrophysics and cosmology is stepping into the *big data* era. The application of machine learning on strong-lens finding is an attempt to take on the challenge of *big data*. I am also interested in extending machine learning to other applications in astrophysics and cosmology.

Conferences and Workshops

2015 **LSST DESC Collaboration Meeting at ANL**, *Chicago*, IL, USA.
Talk: Lensing Simulations Using CatSim, GalSim, and PhoSim.

2015 **Santa Fe Cosmology Workshops for 2015**, *Santa Fe*, NM, USA.
Talk: Applications of Simulations of Gravitational lensing.

2015 **SPT Cluster Collaboration Meeting**, *Chicago*, IL, USA.
Talk: Simulations of Strong Lensing in the SPT Cluster Catalog.

2015 **LSST DESC Collaboration Meeting at SLAC**, *Menlo Park*, CA, USA.
Talk: Mocking Realistic Strongly-lensed Arcs.

2014 **KICP Postdoc Symposium for 2014 Spring**, *Chicago*, IL, USA.
Talk: Simulations of Strong Gravitational Lensing.

2012 **Santa Fe Cosmology Workshops for 2012**, *Santa Fe*, NM, USA.
Talk: Measuring Dark Matter Halo Density Slope with Flexion.

2011 **The 9th Sino-German Workshop on Galaxy Formation and Cosmology**, *HangZou*, China.
Talk: Effects of Supermassive Binary Blackholes on Gravitational Lenses.

Publications

- **Cusp-Core Problem and Strong Gravitational Lensing**.
  Li, Nan; Da-Ming Chen, 2009, RAA, Vol. 9, No. 11, 1173–1184
- **Effects of Supermassive Binary Blackholes on Gravitational Lenses**.
  Li, Nan; Mao, Shude; Gao, Liang; Loeb, Abraham and di Stefano, R., 2012, MNRAS, Vol. 419, 2424–2432
- **Measuring the Mass-to-light Ratio of Galaxies with Weak Lensing**.
  Li, Nan; Li, Ran; Er, Xinzhong, 2013, RAA, Vol. 13, No. 9, 1041–1051
- **Simulations of Strong Gravitational Lensing in Galaxy Clusters**.
  Li, Nan et al, will be submitted to APJ by 11/10/2015
- **The Gini Coefficient as a Morphological Measurement of Strongly Lensed Galaxies in the Image Plane**.
  Florian, Michael K.; **Li, Nan**; Gladders, Michael D., will be submitted to APJ by 11/10/2015
- **The Gini Coefficient as a Tool for Image Family Identification in Strong Lensing Systems with Multiple Images**.
  Florian, Michael K.; Gladders, Michael D.; **Li, Nan**; Sharon, Keren, will be submitted to APJ by 11/10/2015.
- **Parallel DTFE Surface Density Field Reconstruction**.
  Rangel, Esteban; **Li, Nan**; Habib, Salman; Peterka, Tom; Agrawal, Ankit; Liao, Wei-keng; Choudhary, Alok, submitted to 30th IEEE International Parallel & Distributed Processing Symposium
- **Self-adaptive Density Estimation of Particle Data**.
  Peterak, Tom; Croubois, Hadrien; **Li, Nan**; Rangel, Esteban; Cappello Franck, accepted for publication in SIAM Journal on Scientific Computing
- **Galaxy-galaxy Weak Lensing Measurement from SDSS: (I) Image Processing**.
  Luo, Wentao; Yang, Xiaohu; Zhang, Jun; Tweed, Dylan; Fu, Liping; Mo, H.J.; van den Bosch, Frank C.; Shu, Chenggang; Li, Ran; **Li, Nan**; Liu, Xiangkun; Pan, Chuzhong; Wang, Yiran; Radovich, Mario, in preparation
- **Large-Scale Simulations of Sky Surveys**.
  Heitmann, K.; Habib, S.; Finkel, H.; Frontiere, N.; Pope, A.; Morozov, V.; Rangel, S.; Kovacs, E.; Kwan, J.; **Li, N.**; Rizzi, S.; Insley, J.; Vishwanath, V.; Peterka, T.; Daniel, D.; Fasel, P.; Zagaris, G., Computing in Science & Eng., vol. 16, no. 5, pp.14–23 2014

Computer Skills

Advanced	Python, Cython, C/C++, OpenMP, OpenCL
Intermediate	MPI, MPI4py, Bash shell, IDL, Fortran, Matlab
Basic	Swift, Cuda, Html
Skillful	Gnuplot, Latex, Latex-beamer, Linux, Mac OSX, Git

Languages

Mothertongue	**Chinese**	
Intermediate	**English**	*Conversationally fluent*
Basic	**Korean**	*Basic words and phrases only*

Public Education

10/2015 **DES outreach: Adler After Dark at Chicago.**.
The Adler Planetarium is a public museum dedicated to the study of astronomy and astrophysics. It hosts various events about once a month to introduce exciting new scientific discoveries to Adler visitors. "DES outreach: Adler After Dark at Chicago" is one of these events in 10/2015. We volunteers (from Fermilab, Argonne, and the University of Chicago) intend to apply entertaining games to show people interesting topics in cosmology: for example, Tug-of-War: the battle between gravity and dark energy, Lens-yourself: involving gravitational lensing effects in your photos.

06/2015 **Translation of "The Science of Interstellar" to Chinese**.
My Chinese colleagues and I translated the book The Science of Interstellar, which is written by Prof. Kip Thorne (the science adviser and executive producer of the movie Interstellar), to Chinese. Our goal is to allow Chinese speakers to enjoy the journey through the otherworldly science behind Christopher Nolan's film Interstellar, and show the reasons why this movie is called "one of the most scientifically accurate science fiction movie ever made". The translated book was published by Zhejiang People's Publishing House June 2015, in China.

03/2015 **An Application to Demonstrate Gravitational Lensing**.
Bending Light is an application to demonstrate what gravitational lensing is. It is designed as an advanced tool, suitable for use in a classroom setting, or even in a research setting to allow the rapid exploration of basic models for visualization purposes. By using the mouse and keystrokes, one can build and explore a wide range of strong lensing scenarios. Extensive control of both the background sources and foreground lenses is offered. The software visualizes both the background sources and their strongly lensed images. Moreover, the caustics and critical curves of the lensing system are shown. Please go to `http://linan7788626.github.io/bending_light_cython` for more details.