

## Curriculum Vitae: Wei LIU

Stanford-Lockheed Institute for Space Research  
HEPL Solar Physics, Stanford University, 452 Lomita Mall  
Stanford, CA 94305-4085

Tel: (650) 424-3109; (408) 557-0118  
Email: weiliu@sun.stanford.edu  
Web: <http://sun.stanford.edu/~weiliu>

### Education

Ph.D. in Physics, Stanford University, Stanford, California 12/2006  
Dissertation: *Characteristics of Solar Flare Hard X-ray Emissions: Observations and Models*  
Reading Committee: Profs. Vahé Petrosian (adviser), Philip H. Scherrer, and Peter A. Sturrock

M.S. in Space Physics, University of Science and Technology of China, Hefei, Anhui, China 06/2000  
Thesis: *Solar Prominence Disturbances Associated with Photospheric Magnetic Flux Emergence and Cancellation: a Magnetohydrodynamic Simulation Study*; Adviser: Prof. Y. Q. Hu

B.S. in Space Physics, University of Science and Technology of China, Hefei, Anhui, China 07/1997

### Work Experience

*Research Associate* 02/2009 – present  
Stanford-Lockheed Institute for Space Research, Stanford University, Stanford, California

- Coronal EUV waves, jets, coronal condensation, prominences/coronal cavities, sun-grazing comets
- Tera-byte EUV/optical data from *Solar Dynamics Observatory (SDO)/AIA, Hinode/SOT*

*NASA Postdoctoral Program (NRC) Fellow* 01/2007 – 01/2009  
*RHESSI* group, Solar Physics Laboratory, NASA Goddard Space Flight Center, Greenbelt, Maryland

- New evidence of magnetic reconnection in flares, asymmetric X-ray footpoints and magnetic mirroring
- Soft and hard X-ray data from *Reuven Ramaty High Energy Solar Spectroscopic Imager (RHESSI)*

*Research Assistant* 06/2002 – 12/2006  
Prof. V. Petrosian Group, Department of Physics, Stanford University, Stanford, California

- Modeling solar flares with hybrid particle and fluid simulation, stochastic particle acceleration
- New type of hard X-rays at flare loop legs, direct imaging of chromospheric evaporation by *RHESSI*

*Resident Observer* 09/2002 – 01/2003  
Wilcox Solar Observatory (WSO), Stanford University, Stanford, California

- Daily operation of the telescope that observes solar magnetic fields

*Research Assistant* 06/2000 – 06/2002  
Prof. Scherrer Solar Physics Group, Hansen Experimental Physics Lab, Stanford University, California

- MHD simulation and phenomenological modeling of coronal mass ejections (CMEs)
- Wavelet analysis of *SOHO/MDI* magnetograms

### Principal/Co-Investigator Awards

*NASA Living with a Star, Targeted Research and Technology Program* 2012 – 2015  
Focused Science Topic: Flare Dynamics in the Lower Solar Atmosphere,  
“Coupling of Particle Acceleration and Atmospheric Response Processes in Solar Flares: Combined Kinetic-fluid Modeling and Comparison with Multiwavelength Observations”, Role: Co-I (PI: Prof. Vahé Petrosian)

*NASA Fermi Guest Investigator* 2012 – 2014  
“Testing Acceleration, Transport and Radiation in Fermi-LAT Detected Solar Flares”,  
Role: Co-I (PI: Prof. Vahé Petrosian)

*NASA Living with a Star, Targeted Research and Technology Program* 2011 – 2014  
Science Analysis for the Solar Dynamics Observatory (SDO), “Probing Coronal EUV Waves and Wave-like Phenomena: SDO/AIA Data Analysis and MHD Modeling”, Role: Science PI (PI: Prof. Philip H. Scherrer)

## Publications

### Refereed Journals

31. **Liu, W.**, Chen, Q. R., Petrosian, V. “Plasmoid Ejections and Loop Contractions in an Eruptive M7.7 Solar Flare: Evidence of Particle Acceleration and Heating in Magnetic Reconnection Outflows”, 2013, submitted to *ApJ*.
30. Berger, T. E., **Liu, W.**, Low, B. C. “SDO/AIA Detection of Solar Prominence Formation within a Coronal Cavity”, 2012, *ApJ Letters*, 758, L37.
29. Low, B. C., **Liu, W.**, Berger, T., Casini, R. “The Hydromagnetic Interior of a Solar Quiescent Prominence. II. Magnetic Discontinuities and Cross-field Mass Transport”, 2012, *ApJ*, 757, 21.
28. Low, B. C., Berger, T., Casini, R., **Liu, W.** “The Hydromagnetic Interior of a Solar Quiescent Prominence. I. Coupling between Force-balance and Steady Energy-transport”, 2012, *ApJ*, 755, 34.
27. **Liu, W.**, Ofman, L., Nitta, N. V., Aschwanden, M. J., Schrijver, C. J., Title, A. M., Tarbell, T. D. “Quasi-periodic Fast-mode Wave Trains Within a Global EUV Wave and Sequential Transverse Oscillations Detected by SDO/AIA”, 2012, *ApJ*, 753, 52.
26. Schrijver, C. J., Brown, J. C., Battams, K., Saint-Hilaire, P., **Liu, W.**, Hudson, H., Pesnell, W. D. “Destruction of Sun-Grazing Comet C/2011 N3 (SOHO) Within the Low Solar Corona”, 2012, *Science*, 335, 324-328.
25. Li, T., Zhang, J., Yang, S., **Liu, W.** “SDO/AIA Observations of Secondary Waves Generated by Interaction of the 2011 June 7 Global EUV Wave with Solar Coronal Structures”, 2012/02, *ApJ*, 746, 13.
24. Li, T., Zhang, J., Yang, S., **Liu, W.** “Kinematics and Amplitude Evolution of Global Coronal Extreme Ultraviolet Waves”, 2012, *Research in Astronomy and Astrophysics*, 12, 104-114.
23. **Liu, W.**, Berger, T. E., Low, B. C. “First SDO/AIA Observation of Solar Prominence Formation Following an Eruption: Magnetic Dips and Sustained Condensation and Drainage”, 2012, *ApJ Letters*, 745, L21.
22. Ofman, L., **Liu, W.**, Title, A., Aschwanden, M. “Modeling Super-fast Magnetosonic Waves Observed by SDO in Active Region Funnels”, 2011, *ApJ Letters*, 740, L33.
21. Holman, G. D., Aschwanden, M. J., Aurass, H., Battaglia, M., Grigis, P. C., Kontar, E. P., **Liu, W.** Saint-Hilaire, P., Zharkova, V. V. “Implications of X-ray Observations for Electron Acceleration and Propagation in Solar Flares”, 2011, *Space Sci. Rev.*, 159, 107-166.
20. Fletcher, L., Dennis, B. R., Hudson, H. S., Krucker, S., Phillips, K., Veronig, A., Battaglia, M., Bone, L., Caspi, A., Chen, Q., Gallagher, P., Grigis, P. T., Ji, H., **Liu, W.**, Milligan, R. O., Temmer, M. “An Observational Overview of Solar Flares”, 2011, *Space Sci. Rev.*, 159, 19-106.
19. **Liu, W.**, Title, A. M., Zhao, J., Ofman, L., Schrijver, C. J., Aschwanden, M. J., De Pontieu, B., & Tarbell, T. D. “Direct Imaging of Quasi-periodic Fast Propagating Waves of ~2000 km/s in the Low Solar Corona by the Solar Dynamics Observatory Atmospheric Imaging Assembly”, 2011, *ApJ Letters*, 736, L13. American Astronomical Society/Solar Physics Division (AAS/SPD) Press Release, Las Cruces, NM, 06/2011; Media coverage: [Phys.Org](#), [Astronomy Now](#), [Fox News](#), etc.
18. **Liu, W.**, Berger, T. E., Title, A. M., Tarbell, T. D., & Low, B. C. “Chromospheric Jet and Growing ‘Loop’ Observed by Hinode: New Evidence of Fan-Spine Magnetic Topology Resulting From Flux Emergence”, 2011, *ApJ*, 728, 103.
17. Nitta, N. V., Freeland, S. L., & **Liu, W.** “An Alternative View of the Masuda Flare”, 2010, *ApJ Letters*, 725, L28-L33.
16. **Liu, W.**, Nitta, N. V., Schrijver, C. J., Title, A. M., & Tarbell, T. D. “First SDO AIA Observations of a Global Coronal EUV Wave: Multiple Components and Ripples”, 2010, *ApJ Letters*, 723, L53-59.
15. **Liu, W.**, Berger, T. E., Title, A. M., & Tarbell, T. D. “An Intriguing Chromospheric Jet Observed by Hinode: Fine Structure Kinematics and Evidence of Unwinding Twists”, 2009, *ApJ Letters*, 707, L37-L41.
14. **Liu, W.**, Petrosian, V., & Mariska, J. T. “Combined Modeling of Acceleration, Transport, and Hydrodynamic Response in Solar Flares: I. The Numerical Model”, 2009, *ApJ*, 702, 1553-1566.

13. **Liu, W.**, Wang, T. J., Dennis, B. R., & Holman, G. D. “Episodic X-Ray Emission Accompanying the Activation of an Eruptive Prominence: Evidence of Episodic Magnetic Reconnection”, 2009, *ApJ*, 698, 632-640.
12. **Liu, W.**, Petrosian, V., Dennis, B. R., & Holman, G. D. “Conjugate Hard X-ray Footpoints in the 2003 October 29 X10 Flare: Unshearing Motions, Correlations, and Asymmetries”, 2009, *ApJ*, 693, 847-867.
11. **Liu, W.**, Petrosian, V., Jiang, Y. W., & Dennis, B. R. “Double Coronal Hard and Soft X-ray Source Observed by *RHESSI*: Evidence for Magnetic Reconnection and Particle Acceleration in Solar Flares”, 2008, *ApJ*, 676, 704-716.
10. **Liu, W.**, Liu, S., Jiang, Y. W., Petrosian, V. “*RHESSI* Observation of Chromospheric Evaporation”, 2006, *ApJ*, 649, 1124-1139.
9. Jiang, Y. W., Liu, S., **Liu, W.**, & Petrosian, V. “Evolution of the Loop-top Source of Solar Flares: Heating and Cooling Processes”, 2006, *ApJ*, 638, 1140-1153.
8. **Liu, W.**, Jiang, Y. W., Liu, S., & Petrosian, V. “*RHESSI* Observations of a Simple Large X-Ray Flare on 2003 November 3”, 2004, *ApJ Letters*, 611, L53-L56.
7. Boberg, F., Lundstedt, H., Hoeksema, J. T., Scherrer, P. H., & **Liu, W.** “Solar Mean Magnetic Field Variability: a Wavelet Approach to Wilcox Solar Observatory and *SOHO*/Michelson Doppler Imager Observations”, 2002, *JGR*, 107(A10), 1318-1324.
6. Zhao, X. P., Plunkett, S. M., & **Liu, W.** “Determination of Geometrical and Kinematical Properties of Halo Coronal Mass Ejection Using the Cone Model”, 2002, *JGR*, 107(A8), 1223-1231.
5. Hu, Y. Q., Jiang, Y. W., & **Liu, W.** “Coronal Magnetic Flux Rope Equilibria and Magnetic Helicity”, 2001, *Chinese Journal of Astronomy & Astrophysics*, 1, 77-84.
4. Hu, Y. Q., & **Liu, W.** “A 2.5-dimensional Ideal Magnetohydrodynamic Model for Coronal Magnetic Flux Ropes”, 2000, *ApJ*, 540, 1119-1125.
3. **Liu, W.**, Hu, Y. Q., Xia, L. D., & Yang, Y. L. “Prominence Disturbance Caused by Magnetic Cancellation”, 2000, *Chinese Astronomy and Astrophysics*, 24, 365-373.
2. Yang, Y. L., Liu, S. L., Hu, Y. Q., & **Liu, W.** “Numerical Study of Propagation Properties of Interplanetary Shocks”, 2000, *Chinese Journal of Geophysics*, 43 (4), 435-442.
1. Chen, Y., Li, Z.Y., **Liu, W.**, & Shi, Z. D. “Solitary Kinetic Alfvén Waves in The Inertial Limit Region”, 2000, *Physics of Plasmas*, 7, 371-374.

### Conference Proceedings

3. **Liu, W.**, Zhao, X. P., Wu, S. T., & Scherrer, P. H. “Effects of Magnetic Topology on CME Kinematic Properties”, 2003, in *ESA SP Series 535, the International Solar Cycle Studies (ISCS) Symposium: Solar Variability as an Input to the Earth's Environment*, Ed. A. Wilson (Noordwijk: ESA Publications Division), 459-464.
2. **Liu, W.**, Plunkett, S. P. & Zhao, X. P. “A Cone Model for Coronal Mass Ejections”, 2002, in *COSPAR Colloquia Series 14, Solar-Terrestrial Magnetic Activity and Space Environment*, Eds. H. Wang & R. Xu (Boston: Pergamon), 267-269.
1. Hu, Y. Q., and **Liu, W.**, “Eruption of Emerged Magnetic Flux Ropes from the Photosphere”, 1999, in *Proceedings of The First Franco-Chinese Meeting on Solar Physics*, Eds. C. Fang, J. C. Héroux, M. D. Ding (Beijing: International Academic Publishers), p. 1.

### Other Publications (book, dissertation, online)

3. **Liu, W.** “Solar Flares as Natural Particle Accelerators: A High-energy View from X-ray Observations and Theoretical Models” – a monograph (revised PhD Thesis) published by *Verlag Dr. Müller* (Saarbrücken, Germany), 2008, ISBN: 978-3-8364-7432-0, 252 pages ([ADS](#), [PDF](#), [Barnes & Noble](#), [Amazon](#)).
2. **Liu, W.** & Petrosian, V. “Double Coronal Hard X-ray Source”, [RHESSI Science Nuggets, No. 61](#), 10/2007.

1. **Liu, W.** “Characteristics of Solar Flare Hard X-ray Emissions: Observations and Models”, Dec. 2006, PhD Thesis, Stanford University (228 pages, [PDF](#)); published by *Proquest Dissertations And Theses 2007*, Section 0212, Part 0373, AAT 3242584.

## Presentations

### *Invited Seminars*

5. “The Dynamic Solar Corona in the Big Data Era”, Department of Physics, New Jersey Institute of Technology, Newark, NJ, 01/2013
4. “The Dynamic Solar Corona Seen by *SDO/AIA* at High Spatio-temporal Resolution”, Department of Physics and Astronomy, Rice University, Houston, TX, 11/2011
3. “Combined Particle-Hydrodynamic Simulations of Solar Flares and *Hinode* Observations of a Chromospheric Jet Resulting from Flux Emergence”, High Altitude Observatory, Boulder, CO, 03/2010
2. “High Energy Aspects of Solar Flares: *RHESSI* X-ray Observations and Combined Particle & Hydrodynamic Simulations”, Lockheed Martin Solar and Astrophysics Lab, Palo Alto, CA, 11/2008
1. “Investigation of Solar Flares with *RHESSI* X-ray Observations and Combined Particle-Hydrodynamic Simulations”, Solar Terrestrial Relationships Branch, Naval Research Lab, Washington, DC, 11/2007

### *Selected Conference Talks*

15. “Particle Acceleration and Plasma Heating in Bi-directional Reconnection Outflows Revealed by *SDO/AIA* and *RHESSI* Observations”, Solar in Sonoma Workshop: Tracing the Connections in Solar Eruptive Events, Petaluma, CA, 11/2012
14. “*SDO/AIA* Detection of Quasi-periodic Wave Trains Within Global EUV (‘EIT’) Waves and Their Coronal Seismology Implications”, American Astronomical Society (AAS) Meeting 220, Anchorage, AK, 06/2012 (Abstract 515.01)
13. “*SDO/AIA* Observations of Coronal EUV Waves and Their Seismological Implications”, invited review, Workshop on Coronal Magnetism, Boulder, CO, 05/2012
12. “Sun-grazing Comets (C/2011 N3 and Lovejoy) Seen by *SDO/AIA* and Their MHD Implications”, Comet Lovejoy Workshop, Boulder, CO, 03/2012
11. “*SDO/AIA* Observations of Sustained Coronal Condensation and Mass Drainage in Prominences as Return Flows of the Chromosphere-Corona Mass Cycle”, *SDO-4/IRIS/Hinode* Workshop, Monterey, CA, 03/2012
10. “*SDO/AIA* Observations of a Global EUV Disturbance Traveling into a Coronal Cavity and Its Subsequent Oscillations: New Evidence of Fast Mode MHD Waves”, AAS/Solar Physics Division (SPD) Meeting 42, Las Cruces, NM, 06/2011 (Abstract 9.06)
9. (1) “Direct Imaging by *SDO/AIA* of Quasi-periodic Propagating Fast Mode Magnetosonic Waves of ~2000 km/s in the Solar Corona”, (2) “*SDO/AIA* Observations of Coronal Condensation Leading to Prominence Formation”, LWS/*SDO* Workshop, Squaw Valley, CA, 05/2011
8. “First *SDO/AIA* Observations of Global Coronal EUV Waves: Multiple Components and Ripples”, American Geophysical Union (AGU) Fall Meeting, San Francisco, 12/2010 (Abstract SH13A-07)
7. “Direct Imaging of an Emerging Flux Rope and a Resulting Chromospheric Jet Observed by *Hinode*”, AAS Meeting 216, Miami, FL, 05/2010, (Abstract 403.07)
6. “Combined Fokker-Planck Modeling of Particle Acceleration/Transport and Hydrodynamic Simulation of Atmospheric Response in Solar Flares”, AGU Fall Meeting, San Francisco, 12/2009 (Abstract SH21C-04)
5. “Testing the Neupert Effect with Combined Fokker-Planck and Hydrodynamic Simulations”, 37th COSPAR Scientific Assembly, Montreal, Canada, 07/2008 (Abstract E22-0033-08)
4. “Characteristics of Solar Flare Hard X-ray Emissions: Observations and Models”, AAS Meeting 210, Honolulu, HI, 05/2007 (Abstract 068.01D)

3. “X-ray Emission from Flaring Loops: Comparison Between *RHESSI* Observations and Hydrodynamic Simulations”, AAS/SPD Meeting 37, Durham, NH, 06/2006 (Abstract 27.05)
2. “Impulsive Phase Hard X-Ray Source Motions Observed by *RHESSI*”, AGU Spring Meeting, New Orleans, LA, 05/2005 (Abstract SP41C-06)
1. “Source Motions and Foot-point Asymmetries in the 2003 October-November X-class Flares Observed by *RHESSI*”, AAS Meeting 204, Denver, CO, 05/2004 (Abstract 47.14)

## Teaching Experience

*Summer Intern Adviser* 05/2008 – 08/2008

Solar Physics Laboratory, NASA Goddard Space Flight Center

- Advised college student Shea H. Webber (now pursuing PhD at George Mason University) analyzing *RHESSI* data of solar flares.

*Teaching Assistant & Lab Instructor*, “Electricity & Magnetism Laboratory” 03/2005 – 06/2005

Department of Physics, Stanford University (Prof. Douglas Osheroff, 12 hours/week)

- Oversaw laboratory, set up and tested lab instruments
- Lectured lab classes, assisted students with lab work, evaluated lab reports

*Teaching Assistant & Section Leader* 09/2001 – 08/2006

Department of Physics, Stanford University, Stanford, CA

- Led discussion sections, lectured review sessions (100+ students)
- Held regular office hours, graded homework and exams

Courses taught (10 – 12 hours/week):

- Statistical Mechanics (graduate level, Prof. Alexander Fetter), Spring 2006
- Light & Heat (Prof. Peter F. Michelson), Fall 2005
- Nature of the Universe (Prof. Masao Sako, now at Univ. Penn.), Summer 2005; Winter & Summer 2006
- Electricity & Optics (Prof. H. Alan Schwettman), Winter 2003
- Mechanics & Heat (Prof. Andrei Linde), Fall 2001

Nominee for the Kirkpatrick Award for the Best Teaching Assistant of the year, 2006

*Adviser*, Mathematical Contest in Modeling Team 09/1999 – 02/2000

University of Science and Technology of China, Hefei, Anhui, China

- Guided students to construct mathematical models to solve highly competitive, real-world problems
- Promoted critical-thinking skills, fostered teamwork, and advised scientific writing

*Teaching Assistant*, “Numerical Methods for Scientific Computation” 09/1999 – 01/2000

Department of Mathematics, University of Science and Technology of China, Hefei, Anhui, China

- Graded homework and led office hours

## Technical and Computing Skills

Analysis and interpretation of large volume, multi-wavelength (EUV, soft and hard X-rays, white light, magnetic field) data sets from space- and ground-based solar observatories: *SDO/AIA*, *Hinode/SOT*, *RHESSI*, *SOHO/MDI*, *LASCO*, *EIT*, *TRACE*, and Wilcox Solar Observatory (WSO)

Numerical modeling of plasma: (1) kinetic approach: Fokker-Planck calculation of particle acceleration and transport (2) fluid approach: Magnetohydrodynamics (MHD) and Hydrodynamics (HD) simulations

Fourier/Wavelet analysis of time series data

Languages: IDL, Fortran, C/C++, Unix shell script, HTML

Software Packages: Solar SoftWare (SSW), Numerical Recipes, Latex, Microsoft Office

Platforms: Unix/Linux, Macintosh, Windows

## Honors and Awards

Marquis Who's Who in America, 2012

NASA Postdoctoral Program (NPP) Fellowship, previously known as the National Research Council (NRC) Postdoctoral Fellowship, 2007 – 2009

Studentship Award by the American Astronomical Society (AAS) Solar Physics Division (SPD), 2003

Meritorious Award in the US Mathematical Contest in Modeling (MCM), 1997

First-class Award in the MCM, Chinese Society for Industrial and Applied Mathematics, 1995 & 1996

## Professional Affiliations

Sigma Xi, the Scientific Research Society

2008 – 2012

American Astronomical Society (AAS) / Solar Physics Division (SPD)

2002 – present

American Geophysical Union (AGU)

2001 – present

## Community Services

*Reviewer for Astrophysical Journal (Letters), Solar Physics, Astronomy & Astrophysics, and NASA proposals*

2008 – present

*LOC, "Solar in Sonoma: Tracing the Connections in Solar Eruptive Events", California Wine Country Conference Series No. 3, Petaluma, CA*

11/2012

*Seminar Organizer, Lockheed Martin Solar and Astrophysics Laboratory*

2010 – 2011

*E/PO volunteer, NASA at the Smithsonian Folklife Festival, Washington DC*

07/2008