

# Tilaye Tadesse Asfaw

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## CONTACT

**INFORMATION:** NASA/ Goddard Space Flight Centre (GSFC),  
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*E-mail 2:* tilaye.tadesse@gmail.com  
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## RESEARCH INTERESTS:

Data Analysis, Computational Physics, Machine Learning, Database, Space Weather, Solar Physics, Active Regions, Solar flares, Magnetic fields, Solar image processing , Magnetic Reconnection, Solar Wind, Coronal Mass Ejections (CMEs), Optimization Methods, Neutron stars, Cosmology and Science Education.

## PROFESSIONAL CONTRIBUTION:

- ◆ Developed Software tools (Spherical Nonlinear Force-Free Solar Coronal Magnetic Field Extrapolation tools) installed to NASA Community Coordinated Modeling Center(CCMC) for public use.  
<http://ccmc.gsfc.nasa.gov/models/modelinfo.php?model=NLFF>
- ◆ Reviwed several NASA and NSF proposals
- ◆ Reviwed journals for The Astronomical, Solar Physics, and Astrophysics and Space Science journals
- ◆ Astronomy 101 and Physics 101 exam standard setting, Polymetric Inc
- ◆ Graduate students seminar modulator (Year 2010 - 2011) at Max-Planck Institute for solar system research

## TECHNICAL SKILLS:

**Programming:** C, C++, FORTRAN, IDL, Python, R-programming and shell scripting.  
**Database Systems:** SQL and Oracle  
**Data Analysis:** Data Analysis with Python; Image processing ; machine learning using Python and R; parallel and distributed computing; Python data visualization including matplotlib, bokeh, plot.ly, seaborn; R data visualization  
**Operating Systems:** Microsoft Windows family, Apple OS X, Linux, Solaris, and other UNIX variants.

## POSITION:

- ◆ **Adjunct Faculty** at Department of Physics, Astronomy & Geosciences, USA, **August, 2015 - Present**
  - \* Teaching Astro/Physics several courses and labs.
- ◆ **Researcher Associate** at NASA- Goddard Space Flight Centre, USA, **April 1, 2015 - Present**
  - \* Analyze solar data using Python( pandas, cython, Numpy, SciPy, scikit-learn libraries), R, IDL programming languages and Solarsoft.
  - \* Integrating Nonlinear force-free code to NASA CCMC system.
- ◆ **NASA Post-Doctoral Program Researcher** at NASA- Goddard Space Flight Centre, USA, **April 1, 2013 - March 30, 2015**
  - \* Develop solar data analysis method to calculate 3D solar magnetic field, the codes are written by Python, C, IDL and R.

- ◆ **Post-Doctoral Researcher (NASA-grant)** at Department of Physics, Drexel University, USA, **April 1, 2012 - March 30, 2013**
  - \* Develop solar data analysis method
- ◆ **Post-Doctoral Researcher** at Max-Planck-Institute for Solar System Research, Germany, **March 1, 2011 - March 31 2012**
  - \* Develop solar magnetic field noise reduction method
  - \* Team member of SDO satellite data management, extensive experience in SQL
- ◆ **Full-Time Physics Lecturer** at Department of Physics, Addis Ababa University, Ethiopia, **Nov 14, 2005 - Feb 25, 2008 (Two years + 2 months )**
  - \* Taught several physics courses including computational physics
- ◆ **Full-Time Physics Lecturer** at Department of Physics, Jimma University, Ethiopia, **Aug, 2005 - Nov, 2005 (Three months )**
  - \* Taught several physics courses

#### EDUCATION:

**Max-Planck-Institute for Solar System Research**, Katlenburg-Lindau, Germany

**PhD**, Computational Solar Physics, Astronomy and Astrophysics, March 1, 2011

◆ **Dissertation Title:** *Nonlinear force-free reconstruction of the coronal magnetic field with advanced numerical methods.*

◆ Advisers:

\* Dr. Thomas Wiegmann

\* Dr. Bernd Inhester

\* Professor Dr. Sami solanki

**Addis Ababa University**, Addis Ababa, Ethiopia

**M.Sc.**, Astrophysics, August 2005

◆ **Thesis Topic:** *Braking index of isolated pulsars according to the relativistic plasma diffusion theory for pulsar fields.*

◆ Adviser: Dr. Legesse W. Kebede

**B.Sc.**, Physics, June 1995

◆ Major: Physics

◆ Minor: Mathematics

#### PROFESSIONAL MEMBERSHIP:

- ◆ American Geophysical Union (AGU)
- ◆ Ethiopian Physics Society-North America (EPSNA)

#### AWARDS AND GRANTS:

NASA-Goddard Space Flight Centre, USA

- ◆ **NASA-Research Opportunities in Space and Earth Sciences - 2014 (ROSES-2014) for the Living with a Star Science Program (LWS)** "An investigation of solar energetic particles from poorly connected solar events by propagation through 3-D interplanetary and coronal magnetic fields" (Co-Investigator), Jan 2015-Jan 2018

NASA-Goddard Space Flight Centre, USA

- ◆ **NASA-Post Doctoral Program Researcher**, "Nonlinear force-free modeling of the coronal magnetic field in spherical geometry (Estimation of free magnetic energy of solar eruptive events for prediction of space weather )" (P-Investigator), April 2013-March 2015

Department of Physics, Drexel University, USA

- ◆ NASA-grant Post doctoral Fellowship, April 2012-present  
Max-Planck-Institute for Solar System Research
- ◆ Post doctoral Fellowship, March 1 2011-March 31 2012  
Max-Planck-Institute for Solar System Research
- ◆ PhD Fellowship, Feb 2008-Feb 2011  
Max-Planck-Institute for Solar System Research
- ◆ Three months research visit Fellowship, June-October 2007  
Addis Ababa University
- ◆ Graduate Scholarship, Sep 2003-July 2005

ACADEMIC  
EXPERIENCE

**TOWSON UNIVERSITY**, Towson MD, USA

Adjunct Faculty

**August 2015 to Present**

- ◆ **Instructor for:** PHYS 100 ( Understanding Physics), PHYS 202 (General Physics for the health sciences), PHYS 131 ( Physics of light and color), PHYS 212 (General Physics II; Non-Calculus-Based), ASTRO 161 (General Astronomy I), and ASTRO 162 (General Astronomy II) .

**ADDID ABABA UNIVERSITY**, Addis Ababa, Ethiopia

Full time Lecturer

**November 2005 to Feb 2008**

- ◆ **Instructor for:** Phys 201 (Mechanics and Heat II with Calculus), Phys 211 (Physics lab. I), Phys 202 (Electricity and Magnetisim II with Calculus), Phys 212 (Physics lab.II), Phys 376 (Introduction to Electrdynamics), Phys 311 (Classical Mechanics), Phys 471 (Introduction to Astrophysics), Phys 475 (Computational Physics) .

**JIMMA UNIVERSITY**, Jimma, Ethiopia

Full time Lecturer

**August 2005 to November 2005**

- ◆ **Instructor for:** Phys 411 (Subject Methods), Phys 475 (Computational Physics)

**Bore Senior Secondary School**, Bore, Ethiopia

- ◆ **Full time physics teacher** **September 1997 to July 2003**

\* Instructor of Physics for grade 11 and 12

**Hageremariam Senior Secondary School**, Hageremariam , Ethiopia

- ◆ **Full time physics teacher** **September 1995 to July 1997**

\* Instructor of Physics for grade 11 and 12

PUBLICATIONS:

**Refereed Journals:**

15. *Magnetic field structure of huge erupting solar filament*,  
**Tilaye Tadesse**, Wiegelmann,T , Pevtsov, A. and P. J. MacNeice  
**Accepted, Astronomy & Astrophysics, 2016**
14. *Handedness and sense of rotation of an erupting prominence*,  
**Tilaye Tadesse**, Pevtsov, A. and P. J. MacNeice  
**Accepted, solar physics, 2016.**
13. *Magnetic field evolution of active region 11520 and its surroundings post-and-pre major X1.4 solar flare*,  
**Tilaye Tadesse**, Wiegelmann, T., and P. J. MacNeice  
**Accepted, solar physics, 2016.**

12. *Effect of Size of the Computational Domain on Spherical Nonlinear Force-Free Modeling of Coronal Magnetic Field Using SDO/HMI Data*,  
**Tilaye Tadesse**, Wiegelmann, T., Inhester, B., Pevtsov, A. and P. J. MacNeice  
**Solar Physics**, Volume 290, Issue 4, pp.1159-1171, 2015
11. *Global Solar Free Magnetic Energy and Electric Current Density Distribution of Carrington Rotation 2124* ,,  
 Bemporad, A., **Tilaye Tadesse**, Kliem, B., Mierla, M., and Tripathi, D.  
**Solar Physics**, Volume **289**, pp.4031-4045, 2014.
10. *A Comparison Between Nonlinear Force-Free Field and Potential Field Models Using Full-Disk SDO/HMI Magnetogram*,  
**Tilaye Tadesse**, Wiegelmann, T., Inhester, B., Olson K., MacNeice P. J., and Pevtsov, A.  
**Solar Physics**, Volume **289**, pp.831-8450, 2014.
9. *First use of synoptic vector magnetograms for global nonlinear, force-free coronal magnetic field models*,  
**Tilaye Tadesse**, Wiegelmann, T., Gosain, S., Pevtsov, A. and P. J. MacNeice  
**Astronomy & Astrophysics**, Volume **562**, A(105), 2014.
8. *Modeling coronal magnetic field using spherical geometry: cases with several active regions*,  
**Tilaye Tadesse**, Wiegelmann, T., Olson K., and P. J. MacNeice  
**Astrophysics & Space Science Journal**, Volume **347**, pp 21-27, 2013.
7. *Solar full-disk nonlinear force-free field extrapolation of SDO/HMI and SOLIS/VSM magnetograms*,  
**Tilaye Tadesse**, Wiegelmann, T., Inhester, B., Pevtsov, A. and P. J. MacNeice  
**Astronomy & Astrophysics**, Volume **550**, A(14), 2013.
6. *How to optimize nonlinear force-free coronal magnetic field extrapolations from SDO/HMI vector magnetograms?*,  
 Wiegelmann, T., Thalmann, J., Inhester, B., **Tilaye Tadesse**, Sun,X., Hoeksema, J.T., and Liu Yang  
**Solar Physics**, Volume **281**, pp.37-51, 2012.
5. *Magnetic Field Structure and Evolution for Flaring AR 11117 and its Surrounding*,  
**Tilaye Tadesse**, Wiegelmann, T., Inhester, B., and Pevtsov, A.  
**Solar Physics**, Volume **281**, pp.54-65, 2012.
4. *Magnetic Connectivity between Active Regions 10987, 10988, and 10989 by Means of Nonlinear Force-Free Field Extrapolation*,  
**Tilaye Tadesse**, Wiegelmann, T., Inhester, B., and Pevtsov, A.  
**Solar Physics**, Volume **277**, pp.119-130, 2012.
3. *Nonlinear force-free field extrapolation in spherical geometry: improved boundary data treatment applied to a SOLIS/VSM vector magnetogram*,  
**Tilaye Tadesse**, Wiegelmann, T., Inhester, B., and Pevtsov, A.  
**Astronomy & Astrophysics**, Volume **527**, A(30), 2011.
2. *Nonlinear force-free coronal magnetic field modeling and preprocessing of vector magnetograms in spherical geometry* ,  
**Tilaye Tadesse**, Wiegelmann, T. and Inhester, B.,  
**Astronomy & Astrophysics**, Volume **508**, pp.421-432, 2009.

1. *A Critical Assessment of Nonlinear Force-Free Field Modeling of the Solar Corona for Active Region 10953*,  
 Derosa, M. L., Schrijver, C. J., Barnes, G., Leka, K. D., Lites, B. W., Aschwanden, M. J., Amari, T., Canou, A., McTiernan, J. M., Regnier, S., Thalmann, J., Valori, G., Wheatland, M. S., Wiegelmann, T., Cheung, M., Conlon, P. A., Fuhrmann, M., Inhester, B., and **Tilaye Tadesse**,  
**The Astrophysical Journal**, Volume **696**, Issue 2, pp. 1780-1791, 2009

### PhD Thesis:

- \* *Nonlinear force-free reconstruction of the coronal magnetic field with advanced numerical methods*, ISBN 978-3-942171-45-8, Uni-edition GmbH, Germany, 2011

### ORAL PRESENTATIONS AND POSTERS:

- \* **December 4, 2015 (Oral)**, Towson University, Department of Physics, Astronomy and Geosciences, Towson, MD,  
*Modeling solar coronal magnetic field to understand space weather onsets*, by **Tilaye Tadesse**, Wiegelmann, T., Inhester, B. and Pevtsov A.
- \* **March 10, 2015 (Oral)**, NASA - Marshall Space Flight Center, Huntsville, AL,  
*Nonlinear force-free reconstruction of the coronal magnetic field in large scale using SDO/HMI data*, by **Tilaye Tadesse**, Wiegelmann, T., Inhester, B. and Pevtsov A.
- \* **December 14-19, 2014 (Poster)**, AGU-American Geophysical Union 2014 meeting, San Francisco, CA,  
*Effect of the computational domain size on nonlinear force-free models of coronal magnetic field using SDO/HMI data*, by **Tilaye Tadesse**, Wiegelmann, T., Inhester, B. and Pevtsov A.
- \* **November 3-6, 2014 (Oral)**, NASA 2014 Living With Star (LWS) meeting, Portland, OR,  
*First use of synoptic vector magnetograms for global NLFF coronal magnetic field models*, by **Tilaye Tadesse**, Wiegelmann, T., Inhester, B. and Pevtsov A.
- \* **October 21, 2014 (Oral)**, Department of Physics and Astronomy, Kansas University, Lawrence, KS,  
*Modeling magnetic field in solar atmosphere for forecasting space weather*, by **Tilaye Tadesse**, Wiegelmann, T., Inhester, B. and Pevtsov A.
- \* **October 3, 2014 (Oral)**, Department of Physics and Space Sciences, Florida Institute of Technology, Melbourne, FL,  
*How to model magnetic field in solar atmosphere for forecasting space weather*, by **Tilaye Tadesse**, Wiegelmann, T., Inhester, B. and Pevtsov A.
- \* **September 19, 2014 (Oral)**, NASA-Goddard Space Flight Center (GSFC), Space Weather Laboratory, Greenbelt, MD,  
*Estimation of free magnetic energy of solar eruptions for forecasting space weather*, by **Tilaye Tadesse**, Wiegelmann, T., Inhester, B. and Pevtsov A.
- \* **June 1-5, 2014 (Poster)**, 224th American Astronomical Society Meeting Workshops, Boston, MA,  
*First use of synoptic vector magnetograms for global nonlinear force free coronal magnetic field models*, by **Tilaye Tadesse**, Wiegelmann, T., Inhester, B. and Pevtsov A.

- \* **February 18, 2014 (Oral)**, Seminar Series of the Physics Department at Morgan State University, Baltimore, MD,  
*Estimation of free magnetic energy of solar eruptive events for prediction of space weather*, by **Tilaye Tadesse**, Wiegelmann, T., Inhester, B. and Pevtsov A.
- \* **October 28, 2013 (Oral)**, NASA-Goddard Space Flight Center (GSFC), Space Weather Laboratory,  
*Estimation of free magnetic energy of global Sun from Synoptic vector maps using NLFFF models*, by **Tilaye Tadesse**, Wiegelmann, T., Inhester, B. and Pevtsov A.
- \* **September 21, 2012 (Oral)**, NASA-Goddard Space Flight Center (GSFC), Space Weather Laboratory,  
*Nonlinear force-free reconstruction of the coronal magnetic field using SDO/HMI data with advanced numerical methods*, by **Tilaye Tadesse**, Wiegelmann, T., Inhester, B. and Pevtsov A.
- \* **July 25-29, 2011 (Poster)**, Stereo-4/SDO-2/SOHO-25 Workshop at Kiel, Kiel, Germany,  
*Magnetic Connectivity between Active Regions 10987, 10988, and 10989 using NLFFF modelling*, by **Tilaye Tadesse**, Wiegelmann, T., Inhester, B. and Pevtsov A.
- \* **May 9-13, 2011 (Poster)**, Fourth Solaire Network Meeting at Teistungen, Teistungen, Germany,  
*Magnetic Connectivity between Active Regions 10987, 10988, and 10989*, by **Tilaye Tadesse**, Wiegelmann, T., Inhester, B. and Pevtsov A.
- \* **December 14, 2010 (Oral)**, Institute for Geophysical and Extraterrestrial physics, T. University of Braunschweig, Braunschweig, Germany, *Nonlinear force-free reconstruction of the coronal magnetic field with advanced numerical methods*, by **Tilaye Tadesse**
- \* **July 18-25, 2010 (Oral)**, 38<sup>th</sup> COSPAR Scientific Assembly, Bremen, Germany, *Nonlinear force-free field extrapolation in spherical geometry: improved boundary data treatment applied to a SOLIS/VSM vector magnetogram*, by **Tilaye Tadesse**, Wiegelmann, T., and Inhester, B.
- \* **July 7, 2010 (Oral)**, Solar System Seminar, Katlenburg-Lindau, Germany, *Nonlinear force-free field extrapolation of a SOLIS/VSM vector magnetogram in spherical geometry*, by **Tilaye Tadesse**, Wiegelmann, T., and Inhester, B.
- \* **July 15, 2009 (Oral)**, Solar System Seminar, Katlenburg-Lindau, Germany, *Nonlinear force-free coronal magnetic field modeling and preprocessing of vector magnetograms in spherical geometry*, by **Tilaye Tadesse**, Wiegelmann, T., and Inhester, B.
- \* **Jun. 23-25, 2009 (Oral)**, NLFFF Consortium Meeting 6, St. Andrews University, Scotland, UK,  
*NLFF coronal magnetic field modeling and preprocessing of vector magnetograms in spherical geometry: a test on synthetic data*, by **Tilaye Tadesse**, Wiegelmann, T., and Inhester, B.
- \* **Jan. 14, 2009 (Oral)**, Solar System Seminar, Katlenburg-Lindau, Germany, *Nonlinear force-free reconstruction of solar corona magnetic fields in spherical geometry using an optimization method* by **Tilaye Tadesse**, Wiegelmann, T., and Inhester, B.

- \* **Oct. 22 - 23, 2008 (Oral)**, A Next Generation Coronal Active Region Model Workshop, Drexel University, Philadelphia, USA,  
*Nonlinear force-free extrapolation of solar corona magnetic fields in spherical geometry using an optimization method: a case for synthetic magnetogram*, by **Tilaye Tadesse**, Wiegelmann, T., and Inhester, B.
- \* **Jun. 30 - Jul. 2, 2008 (Oral)**, NLFFF Consortium Meeting 5, Katlenburg-Lindau, Germany,  
*NLFF coronal magnetic field extrapolation in spherical coordinates for part of a sphere*, by **Tilaye Tadesse**, Wiegelmann, T., and Inhester, B.
- \* **Sep. 27, 2007 (Oral)**, Max-Planck Institute for solar system research, Katlenburg-Lindau, Germany,  
*Comparison of different numerical algorithms for the determination of potential fields in the solar corona*, by **Tilaye Tadesse**, and Wiegelmann, T.

#### REFERENCES:

- ◆ **Dr. Thomas Wiegelmann**,
  - \* Max-Planck Institute for solar syetem research, Germany
  - \* e-mail: [wiegelmann@mps.mpg.de](mailto:wiegelmann@mps.mpg.de)
  - \* Phone number: +49-5556-979-155
- ◆ **Dr. Peter MacNeice**,
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- ◆ **Dr. Bernd Inhester**,
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- ◆ **Dr. Alexei Pevtsov**,
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  - \* Phone number: (575) 434-7011
- ◆ **Professor Dr. Sami solanki**,
  - \* Max-Planck Institute for solar syetem research, Germany
  - \* e-mail: [solanki@mps.mpg.de](mailto:solanki@mps.mpg.de)
  - \* Phone number: +49-5556-979-552
- ◆ **Dr. Mesfin Tsige**,
  - \* The University of Akron, Department of Polymer Science, USA
  - \* e-mail: [mtsige@uakron.edu](mailto:mtsige@uakron.edu)
  - \* Phone number: (330) 972-5631