Maria D. Kazachenko

Assistant Professor

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CURRICULUM VITAE

SUMMARY

My research focuses on storage and release of magnetic energy in solar active regions and the quiet Sun using observations (SDO, DKIST) and simulations (data-driven simulations, velocity & electric field inversion techniques). I graduated from Saint-Petersburg University, Russia with a degree in Mathematics (with honors). I obtained my PhD on "Predictions of reconnected flux, energy and helicity in eruptive solar flares" in Physics from Montana State University under the supervision of Dr. Richard Canfield, Prof. Dana Longcope and Prof. Jiong Qiu. I then joined the University of California at Berkeley first as an NSF SHINE Postdoctoral Fellow under Dr. George H. Fisher in 2011, then as an Assistant Research Physicist in 2013 and an Associate Research Physicist in 2017. In August 2018 I came to Boulder as an assistant professor where my position is split 50/50 between the APS department/CU Graduate School /LASP and the National Solar Observatory. I lead a large research group (8 members), have taught two full courses, co-taught two courses, and led public outreach in English and Spanish.

EDUCATION

Montana State University, Bozeman	Ph.D. & M.A., Physics, summa cum laude	2010
St. Petersburg State University, Russia	M.A., Mathematics, summa cum laude	2005

SELECTED AWARDS AND HONORS

Brinson Foundation Fellowship, **PI**	2022 – 2025
Spherical Cow Award, Best Talk, American Physical Society	2021
NSF CAREER Award, **PI**	2020 – 2025
CU Boulder Research Innovation Office Faculty Fellow	2020
NASA Heliophysics Early Career Investigator (ECIP) Award, **PI**	2019 – 2024
Robert Bartnik Visiting Fellowship, Monash University, Australia	2019
NSF Solar Heliospheric & Interplanetary Environment Postdoctoral Fellowship, **PI**	2011 – 2013
Solar Physics Division Student Award	2009
NASA ESSF Fellowship, **PI**	2007 – 2009

OTHER GRANTS AND FELLOWSHIPS

Brinson Travel Grant, **PI**	2022
NASA FINEST, **PI**	2021 – 2024
NASA Heliophysics Supporting Research, **Co-I**	2021 – 2024
NSF DKI Solar Telescope Lev-2 Data Products Development Award, **PI**	2019 – 2023
NASA Science Mission Directorate, **Co-I**	2018 – 2019
NASA Living With a Star, **Co-I**	2018 – 2022
NASA Living With a Star, **Co-I**	2018 – 2022

NASA Guest Investigator, **Co-I** 2018 – 2022
NASA Heliophysics Supporting Research, **Co-I** 2017 – 2021
NSF SHINE Research Grant, **PI** 2016 – 2019
NASA Heliophysics Supporting Research Grant, **Co-I** 2015 – 2017
NASA Guest Investigator Grant, **PI** 2015 – 2018
NASA Heliophysics Research Grant, **Co-I** 2013 – 2017
NASA/NSF Living With a Star Grant, **Co-I** 2013 – 2018

EMPLOYMENT HISTORY & RESEARCH EXPERIENCE

Assistant Professor, University of Colorado, Boulder, CO 2018 – Present
Research: Data-driven modeling of coronal magnetic fields; Preparing for Data from DKI Solar Telescope (DKIST); Statistical studies of solar flares;

Associate & Assistant Res. Scientist, University of California Berkeley, CA 2013 – 2019
Research: Observations and modeling of two-ribbon eruptive flares; Data-driven modeling of coronal magnetic fields

NSF SHINE Postdoctoral Fellow, University of California Berkeley, CA 2011 – 2012
Advisor: George H. Fisher
Research: Development and validation of electric-field-inversion methods;

NASA ESSF Research Assistant, Montana State University, Bozeman, MT 2005 – 2010
Advisors: Richard C. Canfield, Dana Longcope, Jiong Qiu
Research: 3D topological modeling of energy and helicity accumulation and release in solar flares

Summer Research Assistant, NSO, Sunspot, NM Summer 2004
Advisors: Alexei Pevtsov
Research: Role of magnetic reconnection in coronal heating

TEACHING

ASTR-3760 Solar and Space Physics course, CU Boulder Spring 2023
ASTR-5700 Stellar Astrophysics course, CU Boulder Spring 2020
PHYS 7810 Special Topics in Physics: Solar Physics with DKIST Spring 2020
ASTR-3760 Solar and Space Physics course, CU Boulder Spring 2019
REU Summer school, programming course, CU Boulder Summer 2019
REU Summer schools, programming course, UC Berkeley Summers: 2014 to 2017
REU Summer school, Montana State University, Bozeman Summers: 2007 & 2008

STUDENT AND POSTDOCTORAL SCHOLAR MENTORSHIP

Postdoctoral Fellow, Ryan French Jul 2022 -- Present
Postdoctoral Fellow, Rahul Yadav Jan 2022 -- Present
Graduate student, Cole Tamburri, CU Boulder Sep 2020 – Present
Graduate student, Marcel Corchado, CU Boulder Sep 2020 – Present
Graduate student, Dennis Tilipman, CU Boulder Jan 2020 – Present
DKIST Ambassador Postdoctoral Fellow Andrei Afanasev, CU Boulder Nov 2019 – Present
Graduate student, Kirk Long, CU Boulder Jan 2021 – May 2021
Hale Postdoctoral Fellow, Benoit Tremblay, CU Boulder Oct 2019 – Present
Undergraduate NSF REU student, Vincent Ledvina, CU Boulder 2019 – Present

Undergraduate student, Kent Lee Richie, CU Boulder	2019 – 2020
Graduate Student Erkka Lumme, University of Helsinki	2017 – 2020
Undergraduate NSF REU student Kristin Rosenau, MSU	Summer 2009
Undergraduate NSF REU student Nick Hill, Eric Wolf, MSU	Summer 2008
Undergraduate NSF REU student Nick Hill, Peter Wyper, MSU	Summer 2007
K-12 Teacher, Classical Singing, Pushkin Gymnasium Of Arts, Russia	2001 – 2003

APPOINTMENTS AND ELECTED POSITIONS

Chair: Solar Physics Division Metcalf Award Committee	Jan 2020 – Present
Chair: Solar Physics Division Nomination Committee	Jan 2020 – Present
Member: Solar Physics Division Steering Committee	Jan 2018 – Dec 2020
Fellow: Research & Innovation Office Faculty Fellow, CU Boulder	Nov 2019 – May 2021
Board Member: Research & Innovation Office Faculty Fellow, CU Boulder	Sep 2021 – Aug 2024
Member: DKI Solar Telescope science working group	Jun 2018 – Present
Review Editor: Loop, Frontiers	Apr 2018 – Present

PROFESSIONAL SERVICE

Journal Referee:	Nature Communications, Nature Astronomy, The Astrophysical J., The Astrophysical. J. Letters, Astronomy & Astrophysical J. Letters, Astrophysics & Space Science, Solar Physics J., Frontiers in Phys. & Astr.
Grant Referee:	Mail-in and Panel reviewer for NSF & NASA grant opportunities including NASA NPP, NSF CAREER, NASA HSR etc.; Reviewer for Leibniz Collaborative Excellence Funding Program; NCAR; Hale Fellowship.

RECENT CONFERENCES & SESSIONS ORGANIZATION

Session, COSPAR, Athens, Greece	Jul 2022
Two Sessions, TESS meeting, Seattle, WA	Aug 2022
SOC, Ground Based Observation Decadal Survey Meeting, online	Feb 2022
Session, American Geophysical Union Meeting, New Orleans	Dec 2021
Session, Solar Dynamics Observatory Meeting, online	Mar 2021
Session, COSPAR, Sydney, Australia	Jan 2021
SOC, Solar Physics Division Meeting, Minneapolis, MN	Aug 2020
Session, Solar Heliospheric & Interplanetary Environment Meeting, CO	Aug 2019
SOC, 1st Data-Driving Workshop, Boulder, CO	Aug 2018
Sessions, Solar Heliospheric & Interplanetary Environment Meeting, FL	Jul 2018

SELECTED INVITED TALKS

SHINE Meeting, *Plenary Speaker*, Hawaii, HI	Jun 2022
ISSI Meeting on Data-driven simulations, Bern, Switzerland	Apr 2022
NSF ECLIPSE Meeting, speaker, Alexandria, VA	Mar 2022
Colloquium for SolFER DRIVE center, online	Jan 2022
Solar Flare Energy Release Drive Science Center Meeting, *online*	Dec 2021
American Physical Society Meeting (APS), *online*	Oct 2021
International Association of Geomagnetism and Aeronomy (IAGA) Meeting, India	Aug 2021
Solar Flows Workshop, *online*	Dec 2021
NASA Living With a Star Team Meeting, *online*	Dec 2021
Solar Heliospheric & Interplanetary Environment (SHINE) Meeting, *Plenary Speaker*, *online*	Jul 2021
Solar Dynamics Observatory Meeting, *Plenary speaker*, *online*	Mar 2021
Committee on Space Research (COSPAR) Meeting, *online* / Sydney, Australia	Jan 2021

National Solar Observatory, seminar	Jan 2021
SHINE Meeting, *Plenary Speaker*, *could not attend*, Hawaii, HI	Aug 2020
COSPAR Meeting, *could not attend / cancelled*, Sydney, Australia	Aug 2020
EarthCube Meeting, New Jersey Institute of Technology, NJ	Jan 2020
Colloquium, Applied Mathematics Department, CU Boulder, CO	Oct 2019
Plasma Seminar, Physics Department, CU Boulder, CO	Apr 2019
High Altitude Observatory (HAO), Boulder, CO	Jan 2019
Boulder Solar Week Meeting, HAO/NCAR, Boulder, CO	Mar 2019
NOAA Space Weather Prediction Center, Boulder, CO	Nov 2018
National Solar Observatory, Boulder, CO	Nov 2018
Solar Dynamics Observatory Science Meeting, *Plenary Speaker*, Belgium	Nov 2018
Colloquium, Astronomy & Planetary Science Department, CU Boulder, CO	Mar 2017
American Physical Society Meeting, New Jersey City, NJ	Nov 2017
IAGA Meeting, *could not attend*, Cape Town, South Africa	Aug 2017
NASA/NSF TIM meeting, NASA Ames Research Center, CA	May 2017
New Jersey Institute of Technology & Ioffe Institute, Moscow, Russia	May & Feb 2017
International Space Science Institute (ISSI), Bern, Switzerland	Jan 2017
Montana State University, MT	Oct 2016
NASA/NSF TIM meeting, NASA Ames Research Center, CA	May 2016
Boston University, MA	Feb 2016
Solar Heliospheric & Interplanetary Environment Meeting, VT	Jul 2015
"Magnetic Reconnection" Workshop, Lorentz Center, Holland	May 2015
American Geophysical Union Meeting, CA	Dec 2014
COSPAR Meeting, Moscow, Russia	Aug 2014

EQUITY AND INCLUSION

Member: Diversity & Inclusion Committee, National Solar Observatory	Jan 2019 – Present
Member: CU Science Technology and Astronomy Recruits (CU-STARS)	Oct 2019 – Present
Member: Diversity & Inclusion Committee, CU Boulder	Jan 2019 – Present

SELECTED OUTREACH ACTIVITIES

Member: CU Science Technology and Astronomy Recruits (CU-STARS)	2019 – 2021
Solar eclipse observations, virtual event (in Spanish)	2021
Guest Speaker, Scientific Sense Podcast	2021
Guest Speaker, Fiske Planetarium Podcast	2021
CU Boulder, Physics Department, Public Talk, CO	Jan 2020
Fiske Planetarium Outreach Talk for elementary school kids, CO	Nov 2019
Guest Speaker, Gorchakov Memorial School, Russia	Sep 2016
Guest Speaker, Google, CA	Jul 2015
Best Science Blog Prize, Science & Technology RF	Oct 2013
Guest Speaker, Chabot Space and Science Center, CA	May 2013
Guest Speaker, Mt. Diablo Astronomical Society, CA	July 2012
Guest Speaker, Chabot Space and Science Center, CA	Aug 2012

PH.D. THESIS

Predictions of reconnected flux, energy and helicity in eruptive solar flares, MSU-Bozeman, MT, 2011; PhD Advisors: Richard C. Canfield (principal), Dana W. Longcope & Jiong Qiu.

LANGUAGES AND HOBBIES

Languages	Russian (native), English (fluent), Spanish (fluent), German (intermediate)
Hobbies	Classical singing, piano, climbing

BIBLIOGRAPHY

PEER REVIEWED ARTICLES

1. Yadav, R. & Kazachenko, M., "A Statistical Study of Magnetic Field Changes in the Photosphere During Solar Flares Using High-Cadence Vector Magnetograms and Their Association with Flare ribbons ", accepted to ApJ, 10/2022.
2. Ledvina, V., Kazachenko, M.,Tilipman D. et al., "Quantifying Properties of Photospheric Magnetic Cancellations in the Quiet Sun Internetwork", ApJ, 934, 38, 07/2022.
3. Kazachenko, M.D., Corchado, M. A., Tamburri, C., Welsch, B.T., "Invited Review: Short-term Variability with the Observations from the Helioseismic and Magnetic Imager (HMI) onboard the Solar Dynamics Observatory (SDO): Insights into Flare Magnetism", SolPhys, 297, 59, 05/2022.
4. Lumme E., Pomoell, J., Price, D.J., Kilpua, E.K.J., Kazachenko, M.D., Fisher, G.H., Welsch, B.T., "Data-driven, time-dependent modeling of pre-eruptive coronal magnetic field configuration at the periphery of NOAA AR 11726", A&A, 02/2022.
5. Kazachenko, M.D.; Lynch, B. J. ; Savcheva, A. ; Sun, X. ; Welsch, B. T., "Toward Improved Understanding of Magnetic Fields Participating in Solar Flares: Statistical Analysis of Magnetic Field within Flare Ribbons", ApJ 02/2022.
6. Lee, J., Sun, X., Kazachenko M.D., "Rapid Evolution of Bald Patches in a Major Solar Eruption", ApJ, 11/2021.
7. Lynch, B. J. ; Palmerio, E. ; DeVore, C. R. ; Kazachenko, M. D. ; Dahlin, J. T. ; Pomoell, J. ; Kilpua, E. K. J., "Modeling a Coronal Mass Ejection from an Extended Filament Channel. I. Eruption and Early Evolution", ApJ, 06/2021.
8. Afanasyev, A., Kazachenko, M. D., Fan, Y. , Fisher, G.H., Tremblay, B., "Validation of the PDFI_SS Method for Electric Field Inversions Using a Magnetic Flux Emergence Simulation", ApJ, 09/2021.
9. Rast M.P. et al., "Critical Science Plan for the Daniel K. Inouye Solar Telescope (DKIST)", Solar Physics, 04/2021.
10. Tremblay, B. ; Cossette, J.F. ; Kazachenko, M. D.; Charbonneau, P. ; Vincent, A., "Inferring depth-dependent plasma motions from surface observations using the DeepVel neural network", Journal of Space Weather and Space Climate, 01/2021.
11. Kazachenko M.D. & Hudson, H. "Active Region Irradiance During Quiescent Periods: New Insights from Sun-as-a-star Spectra", ApJ, 08/2020.

12. Hoeksema T. and the CGEM Team, The Coronal Global Evolutionary Model: Using HMI Vector Magnetogram and Doppler Data to Determine Coronal Magnetic Field Evolution, accepted by ApJ, 08/2020.
13. Fisher, G.H., Kazachenko M.D., Welsch, B.T., Sun, X., Lumme E., Bercik, D., DeRosa, M., Cheung, M.C.M, "The PDFI_SS Electric Field Inversion Software", ApJS, , arxiv: 1912.08301, 05/2020.
14. Lumme, E., Pomoell, J., Price, D.J., Kilpua, E.K.J., Kazachenko, M.D., Fisher, G.H., Welsch, B.T., "Data-driven time-dependent modeling of pre-eruptive coronal magnetic field configuration at the periphery of NOAA AR 11726", A&A, 10/2019.
15. Lynch, B. J.; Airapetian, V. S.; DeVore, C. Richard; Kazachenko, M. D.; Lüftinger, Teresa; Kochukhov, O.; Rosén, L.; Abbett, W. P., "Modeling a Carrington-scale Stellar Superflare and Coronal Mass Ejection from $kappa^{1}Cet$", ApJ, 880, 2, 97, 08/2019.
16. Lumme, E., Kazachenko, M.D., Fisher, G.H., Welsch, B.T., Pomoell, J., Kilpua, E.K.J., "Probing the Effect of Cadence on the Estimates of Photospheric Energy and Helicity Injections in Eruptive Active Region NOAA AR 11158", SolPhys, 294, 6, 84, 06/2019.
17. Cliver, E. W.; Kahler, S. W.; Kazachenko, M.; Shimojo, M., "The Disappearing Solar Filament of 2013 September 29 and Its Large Associated Proton Event: Implications for Particle Acceleration at the Sun", ApJ, 877, 11, 05/2019.
18. Chintzoglou, G., Zhang, J., Cheung, M.C.M., Kazachenko, M.D., The Origin of Major Solar Activity – Collisional Shearing Between Non-conjugated Polarities of Different Bipoles Nested Within Active Regions, ApJ, **871**, 01/2019.
19. Kahler, S.W., Cliver, E.W., Kazachenko, M.D., "Magnetic Flux Reconnection in Flaring Active Regions with Sustained Gamma-Ray Emission", ApJ, **868**, 12/2018.
20. Kazachenko, M.D., Lynch, B. J., Welsch, B.T., Sun, X., A Database of Flare Ribbon Properties From Solar Dynamics Observatory I: Reconnection Flux, ApJ, **845**, 1, 08/2017.
21. Kahler, S.W., Kazachenko, M.D., Lynch, B. J., Welsch, B.T., Flare Magnetic Reconnection Fluxes as Possible Signatures of Flare Contributions to Gradual SEP Events, Journal of Physics: Conference Series, **900**, 1, 2017.
22. Sun, X., Hoeksema, J. T., Liu, Y., Kazachenko, M.D., Chen, R., Investigating the Magnetic Imprints of Major Solar Eruptions with SDO/HMI High-Cadence Vector Magnetograms, ApJ, **839**, 1, 04/2017.
23. Lynch, B. J., Edmondson, J. K., Kazachenko, M. D., Guidoni, S. E., Reconnection Properties of Large-Scale Current Sheets During Coronal Mass Ejection Eruptions, ApJ, **826**, 1, 43, 2016.
24. Kazachenko, M. D., Fisher, G. H., Welsch B. T., Sun X., Liu, Y., Photospheric Electric Fields and Energy Fluxes in the Eruptive Active Region NOAA 11158, ApJ, **811**, 16, 2015.
25. Fisher, G. H., Abbett, W. P., Bercik, D. J., Kazachenko, M. D., Lynch, B. J., Welsch, B. T., Hoeksema, J. T., Hayashi, K., Liu, Y., Norton, A. A., Dalda, A. Sainz, Sun, X., DeRosa, M. L., Cheung, M. C. M., The Coronal Global Evolutionary Model (CGEM): Using HMI

Vector Magnetogram and Doppler Data to Model the Buildup of Free Magnetic Energy in the Solar Corona, Space Weather, **13**, 6, 369-373, 2015.

26. Sorriso-Valvo, L., De Vita, G., Kazachenko, M. D., Krucker, S., Primavera, L., Servidio, S., Vecchio, A., Welsch, B. T., Fisher, G. H., Lepreti, F., Carbone, V., Sign Singularity and Flares in Solar Active Region NOAA 11158, ApJ , **801**, 36 2015.
27. Kazachenko, M. D., Fisher, G. H., Welsch B. T., A Comprehensive Method of Estimating Electric Fields from Vector Magnetic Field and Doppler Measurements, ApJ, **795**, 17, 2014.
28. Labrosse, N., Hudson, H., Kazachenko, M. D., Prominences in SDO/EVE spectra: contributions from large solar structures, IAU Symposium, 300, 439, 2014.
29. Kazachenko, M. D., Canfield, R.C, Longcope, D.W., Qiu, J., Predictions of Energy and Helicity in Four Major Eruptive Solar Flares, Solar Physics, **288**, 166, 2012.
30. Qiu, J.; Liu, W., Hill, N.; Kazachenko, M. D., Reconnection and Energetics in Two-ribbon Flares: a Revisit of the Bastille-Day Flare, ApJ, **725**, Issue 1, 319, 2012.
31. Kazachenko, M. D., Canfield, R.C., Longcope, D.W.; Qiu, J., Sunspot Rotation, Flare Energetics and Flux Rope Helicity: The Halloween Flare on 2003 October 28, ApJ, **722**, Issue 2, 1539, 2010.
32. Kazachenko, M. D., Canfield, R.C., Longcope, D.W., Qiu, J., DesJardins, A., Nightingale, R., Sunspot Rotation, Flare Energetics and Flux Rope Helicity: The Eruptive Flare on 2005 May 13, 2009, ApJ, **704**, Issue 2, 1146, 2009.
33. Canfield, R.C, Kazachenko, M. D., Acton, L. W., Mackay, D. H., Son, Ji, Freeman, T. L., Yohkoh SXT Full-Resolution Observations of Sigmoids: Structure, Formation, and Eruption, ApJ, **671**, Issue 1, L81, 2007.
34. Pevtsov A. A., Kazachenko, M. D., On the Role of the Large-Scale Magnetic Reconnection in the Coronal Heating, SOHO 15, 2004.