

Prof. Teimuraz Zaqarashvili

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Career history

- 05.18 – **Professor of Astronomy and Astrophysics**, Ilia State University, Georgia
- 04.22 – **Head of Department**, Evgeny Kharadze Georgian National Astrophysical Observatory (GNAO), Georgia
- 03.23 – **Lecturer**, University of Graz, Austria
- 05.19 – 02.23 **Senior scientist**, University of Graz, Austria
- 01.17 – 04.19 **Senior scientist**, Space Research Institute, Graz, Austria
- 09.15 – 12.16 **Senior scientist**, University of Graz, Austria
- 04.10 – 05.18 **Associate Professor**, Ilia State University, Georgia
- 09.09 – 09.15 **Scientist**, Space Research Institute, Graz, Austria
- 10.08 – 04.10 **Assistant Professor**, Ilia State University, Georgia
- 07.06 – 09.09 **Senior scientist**, GNAO, Georgia
- 05.05 – 07.06 **Scientist**, University of Balearic Islands, Palma de Mallorca, Spain
- 06.02 – 05.05 **Senior scientist**, GNAO, Georgia
- 06.01 – 06.02 **NATO/Royal Soc. Fellow**, University of St. Andrews, St. Andrews, UK
- 01.95 – 06.01 **Scientist**, GNAO, Georgia

Education

- 1984 – 1991 **Master of Physics (with honour)**, Tbilisi State University (Georgia)
- 1991 – 1996 **PhD student**, Abastumani Astrophysical Observatory, Georgian Academy of Sciences

Qualifications

- 2005 **Doctor of Sciences (Habilitation)**, GNAO, Georgia
- 1997 **Candidate of Sciences (PhD)**, GNAO, Georgia

Projects

- 2016 – 2019 **Short-term cycles in stellar activity**, Shota Rustaveli National Science Foundation, Georgia, PI

2017 – 2022	Magnetised Jets in the solar atmosphere , Fonds zur Förderung der wissenschaftlichen Forschung (FWF), Austria, PI
2017 – 2018	Rosby waves in astrophysics , International Space Science Institute (ISSI), Switzerland, PI
2016 – 2017	Waves in fine-scale structures of the solar chromosphere , Scientific-technology collaboration (WTZ): Austria - Slovakia, Austria, PI
2016 – 2019	Rieger-type periodicity in solar activity and seismology of solar interior , Shota Rustaveli National Science Foundation, Georgia, PI
2013 – 2016	Magnetic Rossby Waves on the Sun , Fonds zur Förderung der wissenschaftlichen Forschung (FWF), Austria, PI
2013 – 2015	Formation and stability of solar spicules , Scientific-technology collaboration (WTZ): Austria - Poland, Austria, PI
2011 – 2016	SOLSPANET , European FP7 Project, Austria, Group leader
2010 – 2012	Magnetoseismology of the solar atmosphere , Shota Rustaveli National Science Foundation, Georgia, PI
2006 – 2009	Waves in the solar atmosphere: excitation, propagation and role in the chromosphere/coronal heating , Shota Rustaveli National Science Foundation, Georgia, PI
2004 – 2006	MHD waves in solar-terrestrial plasmas , NATO reintegration grant, Georgia, PI

Publications (ADS)

All	188
Referred/first author	126/41
Citations/Hirsch index	3273/35

Supervision

Completed	5 PhD theses, 5 Ms theses
Current	1 PhD student

Teaching experience

Bachelor: Hydrodynamics, Introduction to solar physics, Exoplanets (Ilia State University)

Master: Physics of stellar atmospheres, Astrophysical plasma dynamics, Solar physics, Planets and exoplanets (Ilia State University)

Master: Asteroseismology, Data analysis in astrophysics (University of Graz)

PhD: Astrophysical fluid dynamics (University of Graz)

Main areas of research

- Sun and solar wind
- Solar-terrestrial relations and space weather
- Stars and exoplanets
- Waves, instabilities and turbulence in astrophysical plasmas
- Observations on Earth based telescopes and space missions

Awards

- 1998 – 2000 **Research stipends** (President of Georgia) for outstanding young PhD (under 35)
- 2005 – 2006 **Research stipends** (President of Georgia) for outstanding Doctor of Science (under 40)
- 2017 **Best scientific group leader in Georgia 2017**, Shota Rustaveli National Science Foundation
- 2018 **Best scientific publication in 2018**, Ilia State University

Invited reviews/lectures:

- MHD waves in solar partially ionized plasmas, MHD waves and seismology of the solar atmosphere - BUKS2011, Palma de Mallorca, Spain, 27-29 June, 2011 (invited review)
- Solar coronal dynamics, European Week of Astronomy and Space Science, Tenerife, Spain, June 22-26, 2015 (invited review)
- Rosby waves, The fifth SOLARNET summer school, Belfast, UK, August 25- September 2, 2016 (invited lecture)
- MHD waves in the solar atmosphere: theory, Gyula (Hungary), SOLARNET Summer School “Solar atmospheric dynamics - From waves to instabilities and jets”, June 25-30, 2023 (invited lecture)
- Magnetised jets in the solar atmosphere: theory, Gyula (Hungary), SOLARNET Summer School “Solar atmospheric dynamics - From waves to instabilities and jets”, June 25-30, 2023 (invited lecture)

Short statement of most important research results:

Magnetic Rossby waves in the solar/stellar tachocline

Series of research papers (Zaqarashvili et al. 2007, 2010 a,b, 2011, 2015, Zaqarashvili 2018, Gachechiladze et al. 2019) showed that Rossby waves are significantly affected by horizontal dynamo magnetic field and differential rotation in the solar tachocline. The waves become unstable in certain parameters of field strength and differential rotation, and may lead to observed short (several months) and long term (hundreds of years) variations in solar activity.

Seismology of solar dynamo layer by Rieger periodicity in solar activity

Observed mid-ranged periodicity (150-180 days, known as Rieger periodicity) has been used for the first time to estimate the dynamo magnetic field strength in different solar cycles (Gurgenashvili et al, 2016, 2017; Zaqarashvili and Gurgenashvili 2018, Gurgenashvili et al. 2021). This is the only existed method to sound the field strength in the dynamo layer.

MHD Kelvin-Helmholtz instability in the solar atmosphere

Series of research papers (Zaqarashvili et al. 2010, 2014, 2015, Zhelyazkov et al. 2015, Kuridze et al. 2016, Zaqarashvili 2020, Zaqarashvili et al. 2021) showed that different types of plasma jets are often unstable to MHD Kelvin-Helmholtz instability, which may lead to plasma heating in different regions of the solar atmosphere (photosphere, chromosphere, corona, solar wind).

Damping of MHD waves in partially ionised plasmas

Damping of MHD waves has been studied in partially ionised plasma in two-and three-fluid approach for the first time (Zaqarashvili et al. 2011a,b, Zaqarashvili et al. 2013). It is suggested that

the damping of high-frequency MHD waves due to ion-neutral collisions may heat the chromospheric plasma.

Observations of MHD waves in the solar atmosphere

Series of research papers (Zaqarashvili 2003, Kukhianidze et al. 2006, Zaqarashvili et al. 2007, Srivastava et al. 2008, Zaqarashvili et al. 2013, Kuridze et al. 2015, Grant et al. 2018) studied the observational signature of MHD waves in the solar chromosphere and corona by ground and space-based instruments. Most important results are the first observation of kink waves in solar spicules (Kukhianidze et al. 2006, Zaqarashvili et al. 2007) and the first observation of Alfvén wave dissipation in the chromosphere (Grant et al. 2018).

Parametric resonance in MHD

Series of research papers studied the parametric amplification of MHD waves in periodic shear flows (Zaqarashvili, 2000, Zaqarashvili et al. 2002a) and parametric coupling of different MHD wave modes (Zaqarashvili 2001, Zaqarashvili and Roberts 2002, 2006, Zaqarashvili et al. 2005).

Albekioni, M., Zaqarashvili, T. V., Kukhianidze, V., Gurgenchashvili, E., Bourdin, Ph., Equatorially trapped Rossby waves in radiative stars, *Astronomische Nachrichten*, 344, e20230083, 2023

Editorials

2017 –

Associate editor, *Frontiers in Astronomy and Space Physics*

Knowledge

Languages: Georgian (native), English und Russian (fluent), Deutsch und Spanisch (basic)

Referred Publications

Albekioni, M., Zaqarashvili, T. V., Kukhianidze, V., Gurgenchashvili, E., Bourdin, Ph., Equatorially trapped Rossby waves in radiative stars, *Astronomische Nachrichten*, 344, e20230083, 2023

Albekioni, M., Zaqarashvili, T. V., Kukhianidze, V., Rossby waves on stellar equatorial β planes: Uniformly rotating radiative stars, *A&A*, 671, A91, 2023

Horstmann, G. M., Mamatsashvili, G., Giesecke, A., Zaqarashvili, T. V., Stefani, F., Tidally Forced Planetary Waves in the Tachocline of Solar-like Stars, *ApJ*, 944, 48, 2023

Dikpati, M., Gilman, P. A., Guerrero, G. A., Kosovichev, A. G., McIntosh, S. W., Sreenivasan, K. R., Warnecke, J., Zaqarashvili, T. V., Simulating Solar Near-surface Rossby Waves by Inverse Cascade from Supergranule Energy, *ApJ*, 931, 117, 2022

Gurgenchashvili, E., Zaqarashvili, T. V., Kukhianidze, V., Reiners, A., Reinhold, T., Lanza, A. F., Rieger-type cycles on the solar-like star KIC 2852336, *A&A*, 660, A33, 2022

Vashalomidze, Z., Zaqarashvili, T. V., Kukhianidze, V., Ramishvili, G., Hanslmeier, A., Gömöry, P., Prominence instability and CMEs triggered by massive coronal rain in the solar atmosphere, *A&A*, 658, A18, 2022

Erdélyi, R., Korsós, M. B., Huang, X., Yang, Y., Pizzey, D., Wrathmall, S. A., Hughes, I. G., Dyer, M. J., Dhillon, V. S., Belucz, B., Brajša, R., Chatterjee, P., Cheng, X., Deng, Y., Domínguez, S. V., Joya, R., Gömöry, P., Gyenge, N. G., Hanslmeier, A., Kucera, A., Kuridze, D., Li, F., Liu, Z., Xu, L., Mathioudakis, M., Matthews, S., McAteer, J. R. T., Pevtsov, A. A., Pötzi, W., Romano, P., Shen, J., Temesváry, J., Tlatov, A. G., Triana, Ch., Utz, D., Veronig, A.M., Wang, Y., Yan, Y., Zaqarashvili, T. V., Zuccarello, F., The Solar Activity Monitor Network - SAMNet, *Journal of Space Weather and Space Climate*, 12, 2, 21, 2022

- González-Avilés, J. J., Murawski, K., Zaqarashvili, T. V., Numerical simulations of a two-fluid jet at a magnetic null point in a solar arcade, *MNRAS*, 515, 5094, 2022
- Niedziela, R., Murawski, K., Kadowaki, L., Zaqarashvili, T., Poedts, S., Impulsively generated two-fluid magnetoacoustic-gravity waves: Solar chromosphere heating and plasma outflows, *A&A*, 668, A32, 2022
- Krasnoselskikh, V., Tsurutani, B. T., Dudok de Wit, Th., Walker, S., Balikhin, M., Balat-Pichelin, M., Velli, M., Bale, S. D., Maksimovic, M., Agapitov, O., Baumjohann, W., Berthomier, M., Bruno, R., Cranmer, Steven R., de Pontieu, B., Meneses, D., Eastwood, J., Erdelyi, R., Ergun, R., Fedun, V., Ganushkina, N., Greco, A., Harra, L., Henri, P., Horbury, T., Hudson, H., Kasper, J., Khotyaintsev, Y., Kretzschmar, M., Krucker, S., Kucharek, H., Langevin, Y., Lavraud, B., Lebreton, J-P, Lepri, S., Liemohn, M., Louarn, Ph., Moebius, E., Mozer, F., Nemecek, Z., Panasenco, O., Retino, A., Safrankova, J., Scudder, J., Servidio, S., Sorriso-Valvo, L., Souček, J., Szabo, A., Vaivads, A., Vekstein, G., Vörös, Z., Zaqarashvili, T., Zimbardo, G., Fedorov, A., ICARUS: in-situ studies of the solar corona beyond Parker Solar Probe and Solar Orbiter, *Experimental Astronomy*, 54, 277-315, 2022
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- Zaqarashvili, T. V., Lomineishvili, S., Leitner, P., Hanslmeier, A., Gömöry, P., Roth, M., Kink instability of triangular jets in the solar atmosphere, *A&A*, 649, A179, 2021
- Zaqarashvili, T. V., Albekioni, M., Ballester, J.L., Bekki, Y., Biancofiore, L., Birch, A.C., Dikpati, M., Gizon, L., Gurgenashvili, E., Heifetz, E., Lanza, A.F., McIntosh, S.W., Ofman, L., Oliver, R., Proxauf, B., Umurhan, O.M., Yellin-Bergovoy, R., Rossby waves in astrophysics, *Space Science Reviews*, 217, 15, 2021
- González-Avilés, J. J., Murawski, K., Srivastava, A. K., Zaqarashvili, T. V., González-Esparza, J. A., Numerical simulations of macrospicule jets under energy imbalance conditions in the solar atmosphere, *MNRAS*, 505, 50-64, 2021
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- Dikpati, M., Gilman, P. A., Chatterjee, S., McIntosh, S. W., Zaqarashvili, T. V., Physics of Magnetohydrodynamic Rossby Waves in the Sun, *ApJ*, 896, 141, 2020
- Zaqarashvili, T. V., Dynamic Kink Instability and Transverse Motions of Solar Spicules, *ApJ*, 874, 126, 2020
- Shergelashvili, B. M., Melnik, V. N., Dididze, G., Fichtner, H., Brenn, G., Poedts, S., Foysi, H., Khodachenko, M. L., Zaqarashvili, T. V., A new class of discontinuous solar wind solutions, *MNRAS*, 496, 1023-1034, 2020
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Dididze, G., Shergelashvili, B. M., Melnik, V. N., Dorovskyy, V. V., Brazhenko, A. I., Poedts, S., Zaqarashvili, T. V., Khodachenko, M., Comparative analysis of solar radio bursts before and during CME propagation, *A&A*, 625, A63, 2019

Vashalomidze, Z. M., Zaqarashvili, T. V., Kukhianidze, V. D., Measurement of the Polytropic Index During Solar Coronal Rain Using a Diagram of the Electron Density Distribution as a Function of Electron Temperature, *Astrophysics*, 62, 69-78, 2019

Vashalomidze, Z. M., Zaqarashvili, T. V., Kukhianidze, V. D., Ramishvili, G., Eruption of Prominences Triggered by Coronal Rain in the Solar Atmosphere Observed by SDO/AIA and Stereo/EUVI, *Astrophysics*, 62, 529-539, 2019

Srivastava, A. K., Murawski, K., Kuźma, B., Wójcik, D. P., Zaqarashvili, T. V., Stangalini, M., Musielak, Z. E., Doyle, J. G., Kayshap, P., and Dwivedi, B. N., Confined pseudo-shocks as an energy source for the active solar corona, *Nature Astronomy*, 2, 951-956, 2018

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Grant, S. D. T., Jess, D. B., Zaqarashvili, T. V., Beck, C., Socas-Navarro, H., Aschwanden, M. J., Keys, P. H., Christian, D. J., Houston, S. J. and Hewitt, R. L., Alfvén wave dissipation in the solar chromosphere, *Nature Physics*, 14, 480-483, 2018

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Zaqarashvili, T. V. and Gurgenchashvili, E., Magneto-Rossby waves and seismology of solar interior, *Frontiers in Astronomy and Space Sciences*, 5, 7, 2018

Zhelyazkov, I., Zaqarashvili, T. V., Ofman, L., Chandra, R., Kelvin-Helmholtz instability in a twisting solar polar coronal hole jet observed by SDO/AIA, *Adv. Space Res.*, 61, 628-638, 2018

Bagashvili, S. R., Shergelashvili, B. M., Japaridze, D. R., Kukhianidze, V., Poedts, S., Zaqarashvili, T. V., Khodachenko, M. L. and De Causmaecker, P., Evidence for Precursors of the Coronal Hole Jets in Solar Bright Points, *ApJL*, 855, L21, 2018

Piantschitsch, I., Hanslmeier, A., Roth, M., Zaqarashvili, T. V., Numerical Simulations of Kelvin-Helmholtz Instabilities in a two-fluid regime, *Central European Astrophysical Bulletin*, 42, 10, 2018

Gurgenchashvili, E., Zaqarashvili, T. V., Kukhianidze, V., Oliver, R., Ballester, J. L., Dikpati, M., McIntosh, S. W., North-South Asymmetry in Rieger-type Periodicity during Solar Cycles 19-23, *ApJ*, 845, 137, 2017

Pylaev, O. S., Zaqarashvili, T. V., Brazhenko, A. I., Melnik, V. N., Hanslmeier, A., Panchenko, M., Oscillation of solar radio emission at coronal acoustic cut-off frequency, *A&A* 601, A42, 2017

Dumbadze, G., Shergelashvili, B. M., Kukhianidze, V., Ramishvili, G., Zaqarashvili, T. V., Khodachenko, M., Gurgenchashvili, E., Poedts, S., De Causmaecker, P., Long-period oscillations of active region patterns: least-squares mapping on second-order curves, *A&A*, 597, A93, 2017

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Philishvili, E., Shergelashvili, B. M., Zaqarashvili, T. V., Kukhianidze, V., Ramishvili, G., Khodachenko, M., Poedts, S., De Causmaecker, P., Quasi-oscillatory dynamics observed in ascending phase of the flare on March 6, 2012, *A&A*, 600, A67, 2017

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- Zhelyazkov, I., Zaqarashvili, T. V. and Chandra, R., Kelvin-Helmholtz instability in coronal mass ejecta in the lower corona, *A&A*, 574, A55, 2015
- Soler, R., Ballester, J. L. and Zaqarashvili, T. V., Overdamped Alfvén waves due to ion-neutral collisions in the solar chromosphere, *A&A*, 573, A79, 2015
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