Savvas Raptis

Space & Plasma Physics | Data Science | Machine Learning

PERSONAL DETAILS

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RESEARCH EXPERIENCE

Jun 2023 – Now
Postdoctoral Researcher
Johns Hopkins University Applied Physics Laboratory, Laurel, Maryland, USA

Jan 2023 – Apr 2023
Visiting Researcher
European Space Agency (ESA) - ESTEC, Leiden, Netherlands

Nov 2022 – May 2023
Postdoctoral Researcher
KTH Royal Institute of Technology, Stockholm, Sweden

Oct 2018 – Nov 2022
PhD. Researcher
KTH Royal Institute of Technology, Stockholm, Sweden

EDUCATION

2022
PhD. Space and Plasma Physics (240 ECTS/4-year)
KTH Royal Institute of Technology, Stockholm, Sweden
Thesis: "High-speed jets and related phenomena at Earth's bow shock and magnetosheath"
Download (English):

2018
MSc. Astronomy and Astrophysics (120 ECTS/2-year)
KU Leuven, Leuven, Belgium
Thesis: "Processing Solar Images to Forecast Coronal Mass Ejections using Artificial Intelligence"
Download (English):

2016
BSc. (Hons.) Physics (240 ECTS/4-year)
National and Kapodistrian University of Athens, Athens, Greece
Thesis: "Solar Energetic Particles: A study of their properties through measurements from ESA's SREM instrument."
Download (Greek):

TEACHING EXPERIENCE

Full Description & Examples:

2019 – 2023 **Teaching Assistant (TA) & Lecturer**
KTH, Royal Institute of Technology
2022: Guest Lecturer | Collisionless Shocks | PhD course
2022: Guest Lecturer | Space Physics I | Master course (EF2240)
2021 - 2022: Guest Lecturer & TA | Space Physics I | Master course (EF2240)
2020 - 2022: TA | Electrical Circuit Analysis | Bachelor course (EI1110)
2020 - 2021: TA | Space Physics I | Master course (EF2240)
2019 - 2022: TA | LaTeXworkshop | Bachelor course
2019: TA | Electrodynamics | Bachelor course (EI2405)

2013 – 2015 **Teacher - Mechanics/Oscillations/Waves (High School)**
City of Athens, Social Tuition Center of City of Athens
Assisting High school students with their studies in school and preparation for the Panhellenic national examinations to proceed to higher education.

SUPERVISION & ADMINISTRATION EXPERIENCE

2023 – Now **Convener**

- Co-convener, of the sessions "*Collisionless shocks and associated transient phenomena at Earth and beyond*" at European Geophysical Union (EGU) general assembly 2024
- Co-convener, of the session "*Dayside mesoscale transients and their impact on the magnetosphere and ionosphere*" at American Geophysical Union (AGU) general assembly 2023
- Main convener, and chair of the session "*Dayside transient phenomena and their effects on planetary magnetospheres*" at European Geophysical Union (EGU) general assembly 2023

2023 – Now **Mentor**

- Mentor for the European Geophysical Union (EGU) general assembly 2023
- Mentor of the summer internship program CIRCUIT of Johns Hopkins University

2022 – Now **Early Career Advisory Committee**
American Geophysical Union (AGU)
Member of the Early Career Leadership Advisory Committee (EC-LAC) of the Physics and Aeronomy (SPA) section

SCIENTIFIC REVIEWING, EDITING & SERVICE

2022 – Now **Grant Proposal Reviewer**

- NASA Heliophysics Heliophysics Supporting Research (HSR) ROSES-22 program - Mail-in Reviewer
- NASA Heliophysics Living with a Star Science (LWS) ROSES-23 program - Panel Reviewer

2021 – Now **Journal Reviewer**

- Journal of Geophysical Research (JGR): Space Physics - *AGU/Willey*
- Geophysical Research Letters (GRL) - *AGU/Willey*
- Annales Geophysicae - *EGU/Copernicus Publications*
- The Astrophysical Journal (ApJ) - *Institute of Physics (IOP)*
- Radio Science - *AGU/Willey*
- Frontiers in Astronomy and Space Sciences - *Frontiers*
- Journal of Plasma Physics - *Cambridge Press*

- Astrophysics and Space Science - *Springer*
- Advances in Space Research - *Elsevier*
- Remote Sensing - *MDPI*
- Journal of Experimental & Theoretical Artificial Intelligence - *Taylor & Francis*

More information: Web of Science Profile

2021 – Now **MMS Scientist In The Loop (SITL)**
SITL service work for the NASA MMS team for orbits: 1181 - 1183, 1204 - 1206, 1248 - 1250, 1284 - 1285 , 1314 - 1315, 1364 - 1365, 1404 - 1407

PUBLICATIONS

= Abstract | = PDF | = Powerpoint | = Video

2024 [20] Koller, F.,**Raptis, S.**, Temmer, M., & Karlsson, T. (2024). EThe Effect of Fast Solar Wind on Ion Distribution Downstream of Earth's Bow Shock. In The Astrophysical Journal Letters (Vol. 964, Issue 1, p. L5). American Astronomical Society. https://doi.org/10.3847/2041-8213/ad2ddf |

[19] Lindberg, M., Vaivads, A., Amano, T., **Raptis, S.**, & Joshi, S. (2023). Electron Acceleration at Earth's Bow Shock Due to Stochastic Shock Drift Acceleration. Geophysical Research Letters, 51, e2023GL106612. https://doi.org/10.1029/2023GL106612 |

[18] Zhou, Y., **Raptis, S.**, Wang, S., Shen, C., Ren, N., & Ma, L. (2024). Magnetosheath jets at Jupiter and across the solar system. Nature Communications, 15, 4, https://doi.org/10.1038/s41467-023-43942-4 |

- Press Coverage: phys.org, Astronomy Magazine

2023 [17] Collinson, G., Hietala, H., Plaschke, F., Karlsson, T., Wilson, B. L., Archer, M., Battarbee, M., Bianco-Cano, X., Bertucci, C., Long, D., Opher, M., Sergis, N., Gasque, C., Liu, T., **Raptis, S.**, Burne, S., Frahm, R., Zhang, T., & Futaana, Y. (2023). Shocklets and Short Large Amplitude Magnetic Structures (SLAMS) in the high Mach foreshock of Venus. Geophysical Research Letters, 50, e2023GL104610, https://doi.org/10.1029/2023GL104610 |

[16] Trollvik, H., Karlsson, T., & **Raptis, S.** (2023). Velocity of magnetic holes in the solar wind from Cluster multipoint measurements. Ann. Geophys., 41, 327–337, https://doi.org/10.5194/angeo-41-327-2023 |

[15] Lindberg, M., Vaivads, A., **Raptis, S.**, & Karlsson, T. (2023). MMS observation of two-step electron acceleration at Earth's bow shock.Geophysical Research Letters, 50, e2023GL104714. https://doi.org/10.1029/2023GL104714 |

2022 [14] Karlsson, T., Trollvik, H., **Raptis, S.**, Nilsson, H., & Hadi Madanian (2022). Solar wind magnetic holes can cross the bow shock and enter the magnetosheath. Ann. Geophys., 40, 687–699, doi:10.5194/angeo-40-687-2022 |

[13] Pollock, C., Chen, L-J., Schwartz, S., Wang, S., Avanov, L. A., Burch, J. L., Gershman, D. J., Giles, B. L., **Raptis, S.**, & Russell, C. T. (2022). Dynamics of Earth's bow shock under near-radial interplanetary magnetic field conditions. Physics of Plasmas 29, 112902 (2022) https://doi.org/10.1063/5.0089937 |

[12] **Raptis, S.**, Karlsson, T., Vaivads, A., Lindberg, M., Johlander, A., & Trollvik, H. (2022). On magnetosheath jet kinetic structure and plasma properties. Geophysical Research Letters, 49, e2022GL100678. https://doi.org/10.1029/2022GL100678 |

- NASA HQ highlight 1-page summary:

[11] Lindberg, M., Vaivads, A., **Raptis, S.**, Lindqvist, P.-A., Giles, B. L., & Gershman, D. J. (2022). Electron kinetic entropy across quasi-perpendicular shocks. Entropy 24, 745. https://doi.org/10.3390/e24060745 |

[10] **Raptis, S.**, Karlsson, T., Vaivads, A., Pollock, C., Plaschke, F., Johlander, A., Trollvik, H., & Lindqvist, P.-A. (2022). Downstream high-speed plasma jet generation as a direct consequence of shock reformation. Nature Communications. 13, 598 https://doi.org/10.1038/s41467-022-28110-4 |

- Springer 2022 Highlight: Breakthrough Research Highlights: Astronomy:
- Editor Highlighted: Focus - Astronomy and planetary science:
- Press Coverage: KTH, phys.org, spacedaily.com
- Behind The Paper: Nature Portfolio

2021 [9] Sigiava, A-G., **Raptis, S.**, Anastasiadis, A. A., Tsigkanos, A., Sandberg, I., Papaioannou, A., Papadimitrioy, C., Jiggens, P., Aran, A., & Daglis, I.A. (2021). Solar Energetic Particle Event occurrence prediction using Solar Flare Soft X-ray measurements with Machine Learning. Journal of Space Weather and Space Climate (JSWSC), 11, 59 https://doi.org/10.1051/swsc/2021043 |

[8] Karlsson, T., **Raptis, S.**, Trollvik, H., & Nilsson, H. (2021). Classifying the magnetosheath behind the quasi-parallel and quasi-perpendicular bow shock by local measurements. Journal of Geophysical Research: Space Physics, 126, e2021JA029269. doi: 10.1029/2021JA029269 |

[7] Katsavrias, C., **Raptis, S**., Daglis, I. A., Karlsson, T., Georgiou, M., & Balasis, G. (2021). On the generation of Pi2 pulsations due to plasma flow patterns around magnetosheath jets. Geophysical Research Letters, 48, e2021GL093611. doi:10.1029/2021GL093611 |

[6] Kajdič, P., **Raptis, S.**, Blanco-Cano, X., & Karlsson, T. (2021). Causes of jets in the quasi-perpendicular magnetosheath. Geophysical Research Letters, 48, e2021GL093173. doi:10.1029/2021GL093173 |

[5] Palmroth, M., **Raptis, S.**, Suni, J., Karlsson, T., Turc, L., et al., (2020). Magnetosheath jet evolution as a function of lifetime: global hybrid-Vlasov simulations compared to MMS observations. Ann. Geophys , doi: 10.5194/angeo-2020-49 |

2020 [4] Battarbee, M., Blanco-Cano, X., Turc, L., Kajdič, P., Johlander, A., Tarvus, V., Fuselier, S., Trattner, K., Alho, M., Brito, T., Ganse, U., Pfau-Kempf, Y., Akhavan-Tafti, M., Karlsson, T., **Raptis, S.**, Dubart, M., Grandin, M., Suni, J., and Palmroth, M. (2020), Helium in the Earth's foreshock: a global Vlasiator survey. Ann. Geophys., 38, 1081–1099, doi: 10.5194/angeo-38-1081-2020 |

[3] **Raptis, S.**, Karlsson, T., Plaschke, F., Kullen, A., & Lindqvist, P.-A. (2020). Classifying magnetosheath jets using MMS: Statistical properties. Journal of Geophysical

Research: Space Physics, 125, e2019JA027754. doi:10.1029/2019JA027754 |

[2] **Raptis, S.**, Aminalragia-Giamini, S., Karlsson, T., & Lindberg, M. (2020). Classification of Magnetosheath Jets using Neural Networks and High Resolution OMNI (HRO) data. *Machine Learning in Heliophysics* Front. Astron. Space Sci. - Space Physics, doi: 10.3389/fspas.2020.00024 |

[1] Yordanova, E., Vörös, Z., **Raptis, S.**, & Karlsson T. (2020). Current Sheet Statistics in the Magnetosheath. Front. Astron. Space Sci. - Space Physics, doi: 10.3389/fspas.2020.00002 |

SEMINARS

High-speed jets and related phenomena in Earth's bow shock and magnetosheath, Johns Hopkins University Applied Physics Laboratory (JHU/APL), Online, 19 August 2022.

Downstream high-speed plasma jet generation as a direct consequence of shock reformation, *IRF Uppsala Seminars* Uppsala University, Uppsala, Sweden, 16 March 2022.

Magnetosheath Jets: Simulations, Data Analysis & Machine Learning, *SpaceCoffee Meetings* National and Kapodistrian University of Athens, Athens, Greece, 29 January 2020.

Classifying Magnetosheath Jets Using MMS: Quasi parallel & Quasi perpendicular Jets, *Third International Vlasiator Science Hackathon* University of Helsinki, Helsinki, Finland, 21 August 2019.

Forecasting CMEs using Image Processing & Neural Networks, *SpaceCoffee Meetings* National and Kapodistrian University of Athens, Athens, Greece, 19 December 2018.

SCIENTIFIC PRESENTATIONS

2023

"Transient phenomena in foreshock, shock, and magnetosheath – Expectations from large separation campaign" *MMS SWT 23* Washington DC, US October 22 - 26, 2023. (*talk*) |

"Discovering patterns, imbalanced classification & boundary surfaces in Heliophysics with artificial neural networks" *DASH23* Johns Hopkins University Applied Physics Laboratory (JHU/APL), MD, US October 9 - 11, 2023. (*talk*) |

"Characterizing Earth's Magnetosheath and High-Speed Downstream Jets using Machine Learning" *LMAG23* Johns Hopkins University Applied Physics Laboratory (JHU/APL), MD, US August 21 - 24, 2023. (*talk*) |

"High-speed downstream jets: relevance to bow shock dynamics & evolution" *IAGA23* Messe Berlin – City Cube, Berlin, Germany, July 11 - 20, 2023. (**invited** *talk*) |

"Multi-mission observations of a high speed jet associated to a solar wind discontinuity" *EGU2023* Vienna, Austria, April 23 - 28, 2023. (*poster*) |

"High-speed jets at Earth's magnetosheath & more" *CGS weekly meetings* Laurel, US, January 18, 2023. (*talk*) |

2022

"Investigation of magnetosheath jet kinetic structure and plasma moment derivation" *AGU 2022 Fall meeting (AGU2022)* Chicago, US, December 11 - 15, 2022. (*poster*) |

"On the discrepancies of magnetosheath jet identification and statistical properties due to different temporal resolution and plasma moment derivation" *44th COSPAR Scientific Assembly (COSPAR2022)* Athens, Greece, July 16 - 24, 2022. (*talk*) |

"Magnetosheath Jets using MMS" *Swedish Space Plasma Meeting 2019* Umeå, Sweden, June 8 - 9, 2022. (*talk*) |

"High-speed plasma jets generated by the cyclic behavior of the Earth's bow shock" *Solar Orbiter School 2022* Sete, France, May 30 - June 3, 2022. (*poster*) |

"Shock Reformation Generating High-speed Magnetosheath Jets" *EGU2022* Vienna, Austria, May 23 - 27, 2022. (*talk*) |

"High-speed Downstream Plasma Jet Generated due to Shock Reformation" *8th MMS Community Workshop* Daytona Beach, FL, US, May 9-13, 2022. (*talk*) |

2021

"Super-magnetosonic Downstream Jet Formation as a Direct Consequence of Shock Reformation" *AGU 2020 Fall meeting (AGU2020)* New Orleans, US, December 13 - 17, 2021. (*poster*) |

"Characterization of the Earth's Magnetosheath and its Fast Plasma Flows Using Upstream Measurements and Machine Learning" *Asia Oceania Geosciences Society (AOGS) 18th Anual Meeting* Online, August 1-8, 2021. (*virtual talk*) |

"Magnetosheath Jets Close to the Bow Shock: Generation Mechanisms Using MMS" *The 15th Hellenic Astronomical Conference* Patras, Greece, July 5 - 8 , 2021. (talk) |

"Fast Plasma Flows Downstream of the Bow Shock Using MMS: Correlations and Generation Mechanisms" *EGU2021* Vienna, Austria, April 19 - 30, 2021. (*Virtual* PICO) |

"Differentiating Between Convective and Nested Structures With a Single Spacecraft" *Swedish Space Plasma Meeting 2021* Kiruna, Sweden, February 1 - 2, 2021. (talk) |

"Magnetosheath jets using MMS: classification and generation mechanisms" *43rd COSPAR Scientific Assembly (COSPAR2021)* Sydney, Australia, January 28 - February 04, 2021. (talk) |

"Magnetosheath Jets Close to the Bow Shock | Generation Scenarios using MMS" *mini-GEM - Collisionless Shock Group* Online January 19, 2021. (**invited***virtual* talk) |

2020

"Investigation of Different Types of Magnetosheath Jets and their Origin using MMS" *AGU 2020 Fall meeting (AGU2020)* San Francisco, US, December 01-12, 2020. (*Virtual* talk) |

"Jets Downstream of Quasi-parallel and Quasi-perpendicular Bow Shock" *MMS FALL SWT 2020* Online October 08, 2020. (*Virtual* talk) |

2019

"Classification of Magnetosheath Jets using Neural Networks, Solar Wind Observations and High-resolution IMF Measurements" *Sixteenth European Space Weather Week (ESWW16)* Liege, Belgium, November 18-22, 2019. (poster) |

"Creation & Classification of Magnetosheath Jet Database using Magnetospheric Multiscale (MMS) mission" *Sixteenth European Space Weather Week (ESWW16)* Liege, Belgium, November 18-22, 2019. (poster) |

"Classification of Magnetosheath Jets using Neural Networks and High Resolution OMNI (HRO) data" *Machine Learning in Heliophysics* Amsterdam, Netherlands, September 16-20, 2019. (talk) |

"Deep Learning Applications in Space & Solar Physics" *Solar Physics Summer School at Raman Science Center* Leh, India, June 10-16, 2019. (poster) |

"Investigation of Quasi-parallel & Quasi-perpendicular Magnetosheath Jets Using Magnetospheric Multiscale (MMS)" *EGU General Assembly 2019* Vienna, Austria, April 7-12, 2019. (talk) |

"Difference between Quasi-parallel & Quasi-perpendicular Magnetosheath Jets Using MMS" *SRS (Svenska Rymdforskares Samarbetsgrupp) 2019* Gothenburg, Sweden, March 14-15, 2019. (poster) |

"Quasi-parallel & Quasi-perpendicular Magnetosheath Jets Using MMS" *Swedish Space Plasma Meeting 2019* Uppsala, Sweden, February 7-8, 2019. (talk) |

2018

"Processing Solar Images to forecast Coronal Mass Ejections using Artificial Intelligence" *Fifteenth European Space Weather Week (ESWW15)* Leuven, Belgium, November 5-9, 2018. (poster) |

SUMMER SCHOOLS & WORKSHOPS

2022 **Solar Orbiter School**
CCSD, Sète, France
Course - Summer School | 30 May – 03 June 2022.
Presentation topic: *High-speed plasma jets generated by the cyclic behavior of the Earth's bow shock*

2021 **Polar Magnetospheric Substorms**
UNIS, Svalbarad, Norway
Course - Winter School | 26 November – 07 December 2021.
Presentation topic: *Magnetosheath Jets Formation & Basic Properties using MMS*

14s Iberian Space Science Summer School

University of Coimbra, Coimbra, Portugal
Summer school | 26 – 30 July 2021.

2020 **Solar-Stellar Connection STFC Summer School**
University of Warwick, Warwick, UK
Summer school | 14 – 18 September 2020.
Presentation topic: *Magnetosheath Jets*

STFC Introductory Solar System Plasmas Summer School
University of Birmingham, Birmingham, UK
Summer school | 24 – 27 August 2020.

NASA Heliophysics Summer School
UCAR, Boulder, CO, USA
Summer school | 6 - 17 July 2020.
Presentation topic: *Magnetosheath Jets using Magnetospheric Multiscale (MMS) Mission*

2019 **Solar Physics Summer School**
Raman Science Center, Indian Institute of Astrophysics, Leh, India
Summer school | 10 - 16 June 2019.
Presentation topic: *Deep Learning Applications in Space & Solar Physics*

2018 **CESRA Summer School**
Royal Observatory of Belgium, Brussels, Belgium
Summer school | 10 - 14 September 2018.
Presentation topic: *Forecasting Coronal Mass Ejections using Artificial Intelligence*

2017 **Intensive Week on Numerical Modeling in Astrophysics**
University of Cologne, Cologne, Germany
Summer school | 11 - 16 September 2017.

2016 **BCGS Summer School in Physics and Astronomy**
BCGS, Bad Honnef, Germany
Summer school | 22 - 26 Aughust 2016.
Presentation topic: *Is there a quantum computer? The D-Wave controversy*

2015 **Petnica Summer Institute: Astrophysics and Astroparticles**
Petnica Science Center, Valjevo, Serbia
Summer school | 24 July - 2 August 2015.
Presentation topic: *Limb Darkening*

DISTINCTIONS, AWARDS & MERITS

2023 **Sprigner Nature 2022 Astronomy Highlight**
Springer Nature, Berlin, Germany
Our work "Downstream high-speed plasma jet generation as a direct consequence of shock reformation" has been featured as one of the nine articles of 2022's highlighted research in Astronomy.

2022 – 2024 **ISSI International Team 555**
International Space Science Institute, Bern, Switzerland
Early-career researcher of ISSI team "Impact of Upstream Mesoscale Transients on the Near-Earth Environment".

2023 **Outstanding contribution - ESA Cluster mission**
Euroean Space Agenecy (ESA) - ESTEC, Leiden, Netherlands

Recognition of outsanding contribution to the Cluster mission

2019 – 2022 **ISSI International Team 465**
International Space Science Institute, Bern, Switzerland
Early-career researcher of ISSI team "Foreshocks Across the Heliosphere: System Specific or Universal Physical Processes?".

2016 – 2018 **Student Representative – Committee of Msc. Astronomy and Astrophysics**
KU Leuven, Leuven, Belgium
Student representative in the facility committee of the Master of Astronomy and Astrophysics - Permanente Onderwijscommissie (POC).

SKILLS

Languages	Greek (Native), English (Excellent), French (Good)
Programming	Python, MATLAB, R, C++, IDL, JavaScript, SQL
Software	LaTeX, git, Inkcape, ParaView, VisIt
ML tools	Tensorflow, Keras, Scikit-learn, Pytorch, SciANN
Hobbies	Classical guitar, fitness, video games

GRANTS, FUNDINGS & SCHOLARSHIPS

- GEM - NSF: Explorative Global-To Kinetic-Scale Modeling of Collisionless Shocks Using Physics-Informed Data Mining and Machine Learning (**Contributor/Collaborator**)
- ROSES - HARD: A Machine-Learning Ready Dataset of Multi-mission Plasma Region Identifications (**Co-I**)

REFERENCES

PhD supervisor | Tomas Karlsson | Royal Institute of Technology, : tomask@kth.se
PhD co-supervisor | Andris Vaivads | Royal Institute of Technology, : vaivads@kth.se

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