MichałBejger

Scientific areas

Data analysis and detection of gravitational waves, machine learning, dense matter equation of state, numerical simulations of relativistic compact objects, high-performance computing

Contact

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Languages (CERF scale)

English (C2), German (B2), Italian (A2)

Bibliometry

(18 March 2024)
Citations: 75350
h: 89
SAO/NASA ADS

Education

2013	**Habilitation** *"Astrophysical parameters of neutron stars as tests of the dense matter properties"* (25.10.2013)	Nicolaus Copernicus Astronomical Center, PAS
2001–2005	**PhD** in physics (astrophysics) *"Neutron stars dynamics and the equation of state of dense matter"*. Supervisor: Paweł Haensel (16.06.2005; with distinction from the NCAC Scientific Council).	Nicolaus Copernicus Astronomical Center, PAS
1996–2001	**Master** of Science	Warsaw University, Faculty of Physics

Positions

2021–present	**Associate professor**	Istituto Nazionale di Fisica Nucleare, Ferrara, Italy
2014–present	**Associate professor**	Nicolaus Copernicus Astronomical Center, PAS, Warsaw, Poland
2018–2019	**Researcher**	AstroParticule et Cosmologie (APC), CNRS, Paris, France
2008–2014	**Assistant professor**	Nicolaus Copernicus Astronomical Center, PAS, Warsaw, Poland
2007–2008	**Post-doc**	Nicolaus Copernicus Astronomical Center, PAS, Warsaw, Poland
2006-2007	**Marie Currie Fellow post-doc**	Observatoire de Paris, LUTH, Paris-Meudon, France

Fellowships and awards

10.10.2016	W. Rubinowicz Science Prize from Polish Physical Society for the discovery of gravitational waves
04.05.2016	Gruber Cosmology Prize, Gruber Prize foundation, for the discovery of gravitational waves
02.05.2016	Special Breakthrough Prize in fundamental physics for the authors of the first direct detection of gravitational waves
15.03.2016	Nicolaus Copernicus Medal of the Polish Academy of Sciences (for members of the Virgo-POLGRAW team)
09–11.2015	DAAD Research Stay for University Academics and Scientists (Steinbuch Centre for Computing, Karlsruhe Institute of Technology, Germany)
04.2008–03.2011	Marie Curie Re-integration Fellowship (NCAC, Warsaw, Poland)
03.2006–08.2007	Marie Curie Intra-European Fellowship (LUTH, Paris, France)

Peer review service

AAS & APS journals (ApJ, ApJ, Phys. Rev. D, Phys. Rev. Lett.), MNRAS, A&A, EPJA, MLST, General Relativity and Gravitation, NWA

Institutional responsibilities

2014–2018: Proceedings of the Polish Astronomical Society editor

2009–2021: Member of the Scientific Council, NCAC

2008–2012: Institute Journal Club host, NCAC

Invited talks

24-10-2022	From holography to machine learning, Helsinki Finland, "Machine learning methods in gravitational wave astrophysics"
09.01.2023	TMEX Vietnam 2023, "Dense-matter equation of state from GW observations"
05-10-2022	rd Gravi-Gamma Workshop, Volterra Italy, "Continuous GWs from known and unknown sources: O3 observations and beyond"
23.11.2021	Cortona TNPI2021, "Unraveling the character of possible dense-matter state transition from neutron stars observations", Pisa Italy (online)
07.07.2021	Marcel Grossman MG16, "Search for gravitational waves from r-mode oscillations in PSR J0537–6910", on behalf of the LIGO-Virgo-KAGRA Collaboration and NICER Team, (online)
25.06.2020	IDPASC school, "Multi-messenger astronomy with gravitational waves", Spain (online)
25.04.2019	PHAROS 2019, "GW170817: lessons from the observations of a binary neutron star merger", Platja d'Aro, Spain
25.02.2019	GWEOS workshop, "Isolated NS: results and perspectives", Pisa, Italy
09.10.2018	Black Hole Initiative seminar, "Collisions of neutron stars with primordial black holes as fast radio bursts engines", Harvard Cambridge, USA
12.06.2018	Workshop "Neutron stars and their environments" (MODE-SNR-PWN), "Equation of state and the tidal deformability from gravitational wave measurements of LIGO and Virgo", Montpelier, France

Leader roles in research grants

2021–present	LIGO-Virgo-KAGRA Collaboration data analysis (Continuous Waves) working group co-chair
2021–present	Einstein Telescope Observation Science Board division 9 coordinator
2023-2025	Local PI (INFN Ferrara) in "Model discovery in the complex parameter space of unmodeled gravitational waveform reconstructions", funding MUR, PRIN 202275HT58
2022-2025	PI at NCAC in "Calm before the storm: rethinking the gravitational-wave analysis toolbox in the face of future challenges" OPUS project, funding NCN (2021/43/B/ST9/01714)
2018-2023	Management Committee Member and Work Group Leader in the COST Action "A network for Gravitational Waves, Geophysics and Machine Learning", funding: EU Horizon2020 (COST Action CA17137)
2018–2022	PI at NCAC in "Gravitational-wave astronomy: participation of the Polgraw group in Advanced Virgo and Advanced LIGO projects" HARMONIA project, funding: NCN (2017/26/M/ST9/00978)
2017–2022	PI in "Transient gravitational waves from neutron stars: models and data analysis" SONATA BIS project, funding: NCN (2016/22/E/ST9/00037)
2015–2018	PI at NCAC in "Participation of Poland in the Advanced Virgo project" HARMONIA project, funding: NCN (2014/14/M/ST9/00707)
2013–2017	PI at NCAC in "Networking and R&D for Einstein Telescope", funding: NCN/ASPERA Eranet (2013/01/ASPERA/ST9/00001)

10 recent selected publications

"Search for postmerger gravitational waves from binary neutron star mergers using a matched-filtering statistic", Królak, Andrzej, Piotr Jaranowski, Michał Bejger, Paweł Cieciel g, Orest Dorosh, and Andrzej Pisarski

Classical and Quantum Gravity *40.21, 215008 (Nov. 2023) p. 215008. 2023 (arXiv: 2304.08171 (gr-qc))*

"Astrophysics with continuous gravitational waves", Haskell, B. and M. Bejger

Nature Astronomy *7 (Oct. 2023) pp. 1160–1170. 2023 ()*

"Denoising gravitational-wave signals from binary black holes with a dilated convolutional autoencoder", Bacon, Philippe, Agata Trovato, and Michał Bejger

Machine Learning: Science and Technology *4.3, 035024 (Sept. 2023) p. 035024. 2023 (arXiv: 2205.13513 (gr-qc))*

"Neural network time-series classifiers for gravitational-wave searches in single-detector periods", Trovato, A., É. Chassande-Mottin, M. Bejger, R. Flamary, and N. Courty

arXiv e-prints, *arXiv:2307.09268 (July 2023) arXiv:2307.09268. 2023 (arXiv: 2307.09268 (gr-qc))*

"Crustal Failure as a Tool to Probe Hybrid Stars", Pereira, Jonas P., Michał Bejger, Paweł Haensel, and Julian Leszek Zdunik

ApJ *950.2, 185 (June 2023) p. 185. 2023 (arXiv: 2210.14048 (astro-ph.HE))*

"Detecting dense-matter phase transition signatures in neutron star mass-radius measurements as data anomalies using normalizing flows", Morawski, Filip and Michał Bejger

Phys. Rev. C *106.6, 065802 (Dec. 2022) p. 065802. 2022 (arXiv: 2212.05480 (astro-ph.HE))*

"A Robust Test of the Existence of Primordial Black Holes in Galactic Dark Matter Halos", Abramowicz, Marek, Michał Bejger, Andrzej Udalski, and Maciek Wielgus

ApJ *935.2, L28 (Aug. 2022) p. L28. 2022 (arXiv: 2206.13335 (astro-ph.HE))*

"Probing Elastic Quark Phases in Hybrid Stars with Radius Measurements", Pereira, Jonas P., Michał Bejger, Lucas Tonetto, Germán Lugones, Paweł Haensel, Julian Leszek Zdunik, and Magdalena Sieniawska

ApJ *910.2, 145 (Apr. 2021) p. 145. 2021 (arXiv: 2011.06361 (astro-ph.HE))*

"Anomaly Detection in Gravitational Waves data using Convolutional AutoEncoders", Morawski, Filip, Michał Bejger, Elena Cuoco, and Luigia Petre

arXiv e-prints, *arXiv:2103.07688 (Mar. 2021) arXiv:2103.07688. 2021 (arXiv: 2103.07688 (astro-ph.IM))*

"Neural network reconstruction of the dense matter equation of state derived from the parameters of neutron stars", Morawski, F. and M. Bejger

A&A *642, A78 (Oct. 2020) A78. 2020 (arXiv: 2006.07194 (astro-ph.HE))*

Software projects

`PolgrawAllSky`
Data-analysis pipeline, implementing the network-of-detectors time-domain $\mathcal{F}$-statistic method search for almost monochromatic gravitational wave signals (`github.com/mbejger/polgraw-allsky`)

`SageManifolds`
Contribution to the free and open source computer algebra system *SageMath* (`www.sagemath.org`) with the implementation of the differential geometry and symbolic tensor calculus package *SageManifolds* (`sagemanifolds.obspm.fr`)

Teaching

27.10.20–09.02.21	Gravitational waves, monograph lecture at Nicolaus Copernicus Center, winter semester 2020/21, Warsaw, Poland
8–22.07.17	4th Cosmology School: Introduction to cosmology lecturer, "Cosmology with Gravitational Waves", Kraków, Poland
17.07.17	Helmholtz International Summer School "Nuclear theory and astrophysical applications" lecturer, "Gravitational waves from neutron stars in the era of Advanced LIGO and Advanced Virgo detectors", Dubna, Russia
24–28.10.16	Fifth GraWIToN School (GW Initial Training Network) lecturer, "Computational aspects of continuous wave data analysis and its optimization", Rome, Italy
Spring 14	Monographic lecture for graduate students *"Relativistic Astrophysics and Related Computational Methods"* (`https://users.camk.edu.pl/bejger/lectures`)
2015–	Supervision of theses: PhD - 3, bachelor - 2

Popularization of science

2011–2023	Astronomy editor at the "Delta" monthly magazine, aimed at the high-school and pre-graduate students interested in mathematics, computer science, physics and astronomy (in Polish: journal author's website)
see also	Scientific outreach site for the list of texts and recordings
2015–2021	Polgraw-Virgo Collaboration outreach representative

Organization of scientific meetings

2–5.09.2019	LIGO-Virgo Collaboration meeting, Warsaw, Poland (LOC, 250 participants)
26–28.03.2018	POLNS18, Warsaw, Poland (SOC & LOC, 57 participants)
27–31.03.2017	Annual NewCompStar Conference 2017, Warsaw, Poland (SOC & LOC, 150 participants)
22–25.09.2010	Joint LIGO-Virgo Meeting, Kraków, Poland (LOC, remote participation system manager, 150 participants)

Collaborations and memberships

2021–present	Member of the Einstein Telescope Observational Science Board
2011–present	Member of the Virgo gravitational-wave detector project and the LIGO-Virgo collaboration
2013–2017	Polish Einstein Telescope design & study team
2015–present	International Astronomical Union
2016–present	Polish Astronomical Society