Maciek Wielgus

Black Hole Initiative Postdoctoral Fellow, Harvard University
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EDUCATION

Warsaw University of Technology **Sep 2016**
Ph.D. in Machine Design and Maintanance: Photonic Engineering
Dissertation: Adaptive decomposition and analytic signal concept in the interferometric fringe pattern analysis

Warsaw University of Technology **Dec 2010**
M.S. in Robotics and Automatic Control: Photonic Engineering (interferometric patterns analysis)

Warsaw University **Sep 2010**
B.S. in Mathematics: Numerical Analysis (partial differential equations)

PROFESSIONAL EXPERIENCE

Black Hole Initiative Postdoctoral Fellow **2019 – present**
Harvard University, Cambridge, USA (mentor: Shep Doeleman)

Black Hole Initiative Postdoctoral Fellow **2017 – 2019**
Smithsonian Astrophysical Observatory, USA (mentor: Shep Doeleman)

Program participant: Confronting Theories of Accretion with Observations **Jan 2017 – Mar 2017**
UCSB, Santa Barbara, USA

Postdoctoral researcher at Nicolaus Copernicus Astronomical Center **2016 – 2017**
Polish Academy of Sciences, Warsaw, Poland (mentors: Wlodek Kluźniak, Marek Abramowicz)

Internship at Center for Astrophysics | Harvard & Smithsonian **Oct 2015 – Dec 2015**
Cambridge, USA (mentors: Ramesh Narayan, Olek Sadowski)

Designing industrial image processing algorithms at KSM Vision **2014 – 2015**
Warsaw, Poland

Internship at National Center of the Industrial Technology **Oct 2013 – Nov 2013**
Buenos Aires, Argentina (mentors: Guillermo Kaufmann, Alejandro Frederico)

Internship at Center for Astrophysics | Harvard & Smithsonian **Jun 2013 – Aug 2013**
Cambridge, USA (mentors: Ramesh Narayan, Olek Sadowski)

Internship at the College of Charleston **May 2013 – Jun 2013**
Charleston, USA (mentor: Chris Fragile)

Engineer at the Institute of Electron Technology **2011 – 2013**
Warsaw, Poland

RESEARCH INTERESTS

- astrophysics of compact objects
- general relativity
- very long baseline radio interferometry
- applied signal and image processing
- physics of accretion
- magnetohydrodynamics
- developing EHT data reduction and inspection pipeline

AWARDS

Albert Einstein medal (EHT collaboration) **2020**

Bruno Rossi Prize for a contribution to High Energy Astrophysics (EHT collaboration)	**2020**
Breakthrough Prize in Fundamental Physics (EHT collaboration)	**2020**
Smithsonian Institute American Ingenuity Award (EHT collaboration)	**2019**
Black Hole Initiative Prize for individual scientific contributions to the EHT project	**2019**
National Science Foundation Diamond Achievement Award (EHT collaboration)	**2019**
Polish Prime Minister Award for the best Ph.D. thesis in engineering	**2017**
Foundation for Polish Science START award (in 2015 with distinction as 1 of 5 young scientists nationwide)	**2015 – 2016**
Academic performance award from Polish Ministry of Science and Higher Education	**2013**
Scientific scholarship and travel award from Center for Advanced Studied Warsaw University of Technology	**2012 – 2013**
SPIE best student presentation award, International Converence on Advanced Topics in Optoelectronics, Microelectronics and Nanotechnology, Constanza, Romania	**2012**
Laureate (6th place nationwide) of the National Mathematics Competition for high school students	**2005**

Publications

40 reviewed scientific journal papers (11 as a first author). 61 papers listed on ADS. Full list available on the personal webpage. I was cited 1634 times, h-index=16 (ADS, May 2020). This is a shortlist of my favorite 20 journal papers to which I have contributed.

1. *Puffy accretion disks: sub-Eddington, optically thick, and stable*
   Lančová, D., Abarca, D., Kluźniak, W., **Wielgus, M.**, Sądowski, A., Narayan, R., Schee, J., Török, G., Abramowicz, M., ApJL, 884, L37 (2019), arXiv:1908.08396.
2. *Optically thin outbursts of rotating neutron stars can not be spherical*
   Wielgus, M., MNRAS, 488, p. 4937–4941 (2019), arXiv:1907.11268.
3. *Universal Interferometric Signatures of a Black Hole's Photon Ring*
   Johnson, M. D., Lupsasca, A., Strominger, A., Wong, G. N., Hadar, S., Kapec, D., Narayan, R., Chael, A., Gammie, C. F., Galison, P., Palumbo, D. C. M., Doeleman, S. S., Blackburn, L., **Wielgus, M.**, Pesce, D. W., Farah, J. R., & Moran, J. M., Science Advances Science Advances 6, 12 (2020), arXiv:1907.04329.
4. *EHT-HOPS pipeline for millimeter VLBI data reduction*
   Blackburn, L., Chan, C.-K., Crew, G. B., Fish, V. L., Issaoun, S., Johnson, M. D., **Wielgus, M.**, Akiyama, K., Barrett, J., Bouman, K. L., Cappallo, R., Chael, A. A., Janssen, M., Lonsdale, C. J., & Doeleman, S. S., accepted in ApJ (2019), arXiv:1903.08832.
5. *First M87 Event Horizon Telescope Results. III. Data Processing and Calibration*
   EHT Collaboration (217 authors), paper coordinated by Blackburn, L., Issaoun, S., **Wielgus, M.**, ApJL, 875, L3 (2019), arXiv:1906.11240.
6. *Atmospheric oscillations provide simultaneous measurement of neutron star mass and radius*
   Bollimpalli, D. A., **Wielgus, M.**, Abarca, D., & Kluźniak, W., MNRAS, 1529, (2019), arXiv:1812.01299.
7. *Multi-wavelength torus-jet model for Sagittarius A**
   Vincent, F. H., Abramowicz, M. A., Zdziarski, A. A., **Wielgus, M.**, Paumard, T., Perrin, G., & Straub, O., A&A, 624, A52 (2019), arXiv:1902.01175
8. *Collisions of Neutron Stars with Primordial Black Holes as Fast Radio Bursts Engines*
   Abramowicz, M. A., Bejger, M., & **Wielgus, M.**, ApJ, 868, 17 (2018), arXiv:1704.05931
9. *Radiative, two-temperature simulations of low-luminosity black hole accretion flows in general relativity*
   Sądowski, A., **Wielgus, M.**, Narayan, R., Abarca, D., McKinney, J. C., & Chael, A., MNRAS, 466, 705 (2017), arXiv:1605.03184
10. *Double Compton and Cyclo-Synchrotron in Super-Eddington Discs, Magnetized Coronae, and Jets*

McKinney, J. C., Chluba, J., **Wielgus, M.**, Narayan, R., & Sądowski, A., MNRAS, 467, 2241 (2017), arXiv:1608.08627.

11. *Levitating atmospheres of Eddington-luminosity neutron stars*
Wielgus, M., Sądowski, A., Kluźniak, W., Abramowicz, M., & Narayan, R., MNRAS, 458, 3420 (2016), arXiv:1512.00094.
12. *Limits on thickness and efficiency of Polish doughnuts in application to the ULX sources*
Wielgus, M., Yan, W., Lasota, J.-P., & Abramowicz, M. A., A&A, 587, A38 (2016), arXiv:1512.00749.
13. *Stable, levitating, optically thin atmospheres of Eddington-luminosity neutron stars*
Wielgus, M., Kluźniak, W., Sądowski, A., Narayan, R., & Abramowicz, M., MNRAS, 454, 3766 (2015), arXiv:1505.06099.
14. *Two-frame tilt-shift error estimation and phase demodulation algorithm*
Wielgus, M., Sunderland, Z., & Patorski, K., Optics Letters, 40, 3460 (2015).
15. *Local stability of strongly magnetized black hole tori*
Wielgus, M., Fragile, P. C., Wang, Z., & Wilson, J., MNRAS, 447, 3593 (2015), arXiv:1412.4561.
16. *Cosmic background radiation in the vicinity of a Schwarzschild black hole: no classic firewall*
M. Wielgus, G. F. R. Ellis, F. Vincent, M. Abramowicz, Physical Review D 90, 124024 (2014), arXiv:1406.6551.
17. *Continuous phase estimation from noisy fringe patterns based on the implicit smoothing splines*
M. Wielgus, K. Patorski, P. Etchepareborda, A. Federico, Optics Express 22 (9), 10775-10791 (2014)
18. *Denoising and extracting background from fringe patterns using midpoint-based bidimensional empirical mode decomposition*
M. Wielgus, K. Patorski, Applied Optics 53 (10), B215-B222 (2014)
19. *The perihelion of Mercury advance and the light bending calculated in (enhanced) Newton's theory*
M. Abramowicz, G. F. R. Ellis, J. Horák, **M. Wielgus**, General Relativity and Gravitation 46:1630 (2014), arXiv:1303.5453
20. *Oscillations of the Eddington capture sphere*
M. Wielgus, A. Stahl, M. Abramowicz, W. Kluźniak, Astronomy & Astrophysics 545, A123 (2012), arXiv:1208.2939v1

TALKS

Selection of 10 talks that I am particularly happy with.

Analyzing time variability of Sgr A* in the EHT data, New Horizons in Galactic Center Astronomy and Beyond, Yokohama	**Oct 2019**
Observing AGN sources with the Event Horizon Telescope, IAU 356, Addis Ababa	**Oct 2019**
Optically thick accretion: from theory to the most recent results, University of Waterloo, astronomy seminar	**Sep 2019**
First EHT results, KIPAC seminar, Stanford University	**May 2019**
Event Horizon Telescope, CTA 1st Science Symposium, Bologna	**May 2019**
Image of a black hole, Copernicus Science Center, Warsaw Popular lecture with live audience of over 400 people, available on YouTube (in Polish)	**Apr 2019**
First EHT results, Astronomy Department, Yale University	**Apr 2019**
Studying variability of Sgr A* with the EHT, CfA, Harvard & Smithsonian	**Feb 2018**
Levitating atmospheres of luminuous neutron stars, Black Hole Initiative, Harvard	**Apr 2017**
Eddington Capture Sphere around luminuous neutron stars, IAU 312, Beijing	**Aug 2014**

GRANTS AND FORMAL PROJECTS

PI: Thin disks GRRMHD simulations **2018 – 2019**
2×10^7 *CPU hours on PROMETHEUS supercomputer from PLGRID*

Named participant: Variable accretion flows **2013 – 2018**
Polish National Science Center Maestro grant, PI: Wlodek Kluzniak

CO-PI: Adaptive processing of fringe patterns in optical whole-field measurements **2013 – 2015**
Polish National Science Center Opus grant, PI: Krzysztof Patorski

PI: Automatic image analysis for nanomaterials research **2012 – 2014**
Foundation for Polish Science grant

Named participant: Turbulent viscosity in non-stationary black hole accretion disks **2012 – 2014**
Polish National Science Center Opus grant, PI: Marek Abramowicz

TEACHING EXPERIENCE

Lecturer of astrophysics at the Accretion summer school, University of Bremen **Sep 2016**
Transonic flows, ideal MHD, MRI

Teaching at Warsaw University of Technology **2011 – 2015**
Optomechatronics lab, Mechatronic systems lab and Instrumental optics lab

Teaching assistant and tutor at Warsaw University **2010 – 2011**
Calculus I & II, linear algebra for math students

OTHER ACTTIVITIES

- coordinator of the EHT Time Domain Working Group
- one of the key contributors to the EHT data set reduction and inspection pipeline
- served as a reviewer for MNRAS, A&A, Applied Optics, Optics Express, Optics Letters
- SOC member for the EHT polarization workshop in July 2019
- advised multiple students with scientific projects (W. Yan, D. Bollimpalli, S. Steel, D. Lancova)

LANGUAGES

- **Polish** [fluent]
- **English** [fluent]
- **Russian** [basic]
- **Spanish** [trying to learn]

NON-SCIENTIFIC INTERESTS

- travelling and tourism
- running (mostly long distances)
- playing the guitar