# JUSTYNA M. SOKÓŁ, PhD

NAWA Bekker Program Visiting Fellow at Princeton University
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## EDUCATION

**2016 Ph.D.** **Physical Science**, with major in Geophysics
Space Research Centre Polish Academy of Sciences (CBK PAN), Warsaw, Poland

**2010 M.Sc.** **Physics**, with major in Experimental Physics
Opole University, Opole, Poland

## EMPLOYMENT

| | |
|---|---|
| *associate researcher* (CBK PAN, Warsaw, Poland) | 12/2016 – present |
| *research assistant* (CBK PAN, Warsaw, Poland) | 3/2013 – 11/2016 |
| *specialist in Physics* (CBK PAN, Warsaw, Poland) | 1/2012 – 3/2013 |
| p*hysicist* (CBK PAN, Warsaw, Poland) | 8/2010 – 12/2011 |

## RESEARCH EXPERIENCE

- **57** articles (**7** as first author)
- **1** chapter in book, **2** conference publications, **1** arXiv e-print, **2** popular science papers in Polish
- **h-index: 22** (based on ADS)
- total citations: **1367** (based on ADS)
- first author of **35** talks (including **4** invited) at international conferences and workshops (e.g., AGU, EGU, COSPAR, AIAC, IBEX and IPS meetings; co-author of 139 talks)
- *full list of publications and conference contributions:* *http://users.cbk.waw.pl/~jsokol/Publications_articles.html*

## MEMBERSHIP IN INTERNATIONAL SCIENCE GROUPS

- **Interstellar Mapping and Acceleration Probe (IMAP) Proposal Team** 2016 – present
  *as Co-Investigator, GLOWS and IMAP-Lo instrument scientists, science and modeling*
- **Interstellar Boundary Explorer (IBEX) Science Team** 2010 – present
  as *supporting scientist of the Polish group*

## PRIZES AND AWARDS

- Scholarship of the Polish National Agency for Academic Exchange (NAWA) in the Bekker program, visiting fellow in the Space Physics Group at Princeton University (June 2019 – May 2020)
- **Heliophysics Future Leaders** (2018 – present)
- Visiting scientist at the Nagoya University (P-STEP programme, February-March 2019)
- Award for Young Scientists 2018, CBK PAN, Poland (research visit at University of New Hampshire, October 2018)
- Award for Young Scientists 2016, CBK PAN, Poland
- Prizes of the Director of the CBK PAN in 2013, 2014, 2015 *(group)*, 2016, 2017 *(group)*
- Award of the Director of the CBK PAN *(group)* in 2012
- Annual scientific scholarship for the academic grades from the Faculty of Mathematics Physics and Computer Science, Opole University, Opole, Poland in 2006, 2007, 2008, 2009

## INTERNATIONAL CONFERENCES & WORKSHOPS PARTICIPATION

- IBEX Science Working Team Meeting (2011, 2012, 2013, 2014, 2016, 2017, 2018)
- IMAP Science Team Meeting (2018)
- Toyama Interational Symposium on "Physics at the Cosmic Frontier" (2019)
- International Symposium "Recent progress in heliospheric physics by direct measurements of unexplored space plasmas" at Nagoya University (2019)
- Remote Sensing of the Heliosphere Workshop (IPS workshop; 2011, 2016, 2017)
- American Geophysical Union Fall Meeting (AGU; 2013, 2015, 2016, 2017, 2018)
- European Geosciences Union General Assembly (EGU; 2012, 2014, 2017)
- Annual International Astrophysics Conference (AIAC; 2017, 2018)
- 39$^{th}$ COSPAR Scientific Assembly (2012)
- “New Paradigms for the Heliosphere” workshop (2015)

## INVITED TALKS

- *From the Earth to the Local Interstellar Medium: space physics by IBEX*, at Toyama International Symposium on "Physics at the Cosmic Frontier", University of Toyama, Toyama, Japan, March 7-9, 2019
- *From IBEX to IMAP: imaging the distant heliosphere by energetic neutral atoms and interstellar neutral gas*, at International Symposium "Recent progress in heliospheric physics by direct measurements of unexplored space plasmas", Nagoya University, Nagoya, Japan, February 25-28, 2019
- *Modeling of solar ionization factors*, at UCSD IPS Workshop, San Diego, CA, USA, 2016
- *Time variations of solar wind structure derived from interplanetary scintillation observations*, at "New Paradigms for the Heliosphere" workshop, Phyzikzentrum Bad Honnef, Germany, 2015

## MENTORING (directly supervised)

- summer student: University of Warsaw, September 2017
  project: *“Visualization of distribution of the interstellar neutral gas observed from the Earth’s orbit”*

## SOCIETY MEMBERSHIPS

| | |
|---|---|
| American Geophysical Union | 2013 – present |
| European Geosciences Union | 2012, 2014, 2017 |

## COMMUNITY SERVICE

- convener or chairman at 4 sessions at international conferences (e.g., AGU, AIAC)
- reviewer of *The Astrophysical Journal*
- reviewer for the NASA ROSES programme
- student judge at AGU meetings

## POPULAR SCIENCE AND OUTREACH

- evaluator of the Odysseus II European Youth Space Contest
- institute seminars
- articles in Polish popular science journals
- participation in the popular science events

## MOST IMPORTANT ACHIEVEMENTS

- Development of an empirical model of the evolution of the solar wind speed and density as a function of time and heliographic latitude based on in-situ measurement and the solar wind speed derived from the observations of interplanetary scintillations (Sokół et al. 2013, Solar Physics 285; Sokół et al. 2015, Solar Physics 290).
- Construction of an empirical and homogeneous model of photoionization rates for ISN gas species inside the heliosphere based on available solar EUV flux measurements and the solar EUV proxy data (Bzowski et al. 2013, ISSI SRS 13; Bzowski et al. 2013, A&A 557; Sokół & Bzowski 2014; Sokół et al. 2016, MNRAS 458).
- Development of a system to calculate the ionization losses for ISN H, He, Ne, and O inside the heliosphere with the use of the above mentioned models. The ionization losses assessments were next implement to the study of the primary and secondary populations of ISN gas observed by IBEX (e.g., Bzowski et al. 2012, 2014, 2015; Kubiak et al. 2014, 2016; Sokół et al. 2015, ApJS 220:29; Sokół et al. 2015, ApJS 220:27; Sokół et al. 2016, MNRAS 458).
- Construction of the system to assess the ionization rates for the H ENAs observed by IBEX, which were next used in the study of the H ENA survival probabilities (McComas et al.. 2012, 2014, 2017).
- My research showed that the modulation of ionization factors inside the heliosphere as a function of time, heliographic latitude, and distance to the Sun should be taken into account to correctly interpret the ISN gas measurements, because they can significantly affect the distribution of the gas observed in the Earth's orbit (e.g., Bzowski et al. 2013a, A&A 557; Sokół et al. 2015, ApJS 220:29; Sokół et al. 2015, ApJS 220:27; Sokół et al. 2016, MNRAS 458).
- I have demonstrated that the variation of the ionization factors results in an apparent shift in the location of the PUI cone and crescent peak observed from the Earth's orbit and can bias the derivation of the ISN gas flow direction from the analysis of PUI measurements (Sokół et al. 2016, MNRAS 458).

# SELECTED PUBLICATIONS

*number of citations based on ADS*

1. **Sokół, J.M.**, Kubiak, M.A., Bzowski, M. – 2019, *Interstellar Neutral Gas Species And Their Pickup Ions Inside The Heliospheric Termination Shock. The Large-scale Structures*, submitted to The Astrophysical Journal

2. **Sokół, J.M.**, Bzowski, M., Tokumaru, M. – 2019, *Interstellar Neutral Gas Species And Their Pickup Ions Inside The Heliospheric Termination Shock. Ionization Rates For H, O, Ne, And He.*, The Astrophysical Journal, 872:57 (9pp), doi:10.3847/1538-4357/aafdaf **(times cited: 4)**

3. **Sokół, J.M.**, Bzowski, M., Kubiak, M.A., Möbius, E. – 2016, *Solar cycle variation of interstellar neutral He, Ne, O density and pick-up ions along the Earth's orbit*, Monthly Notices of the Royal Astronomical Society, vol. 458, Issue 4, pp 3691-3704, doi:10.1093/mnras/stw515 **(times cited: 15)**

4. **Sokół, J.M.**, Swaczyna, P., Bzowski, M., Tokumaru, M. – 2015, *Reconstruction of helio-latitudinal structure of the solar wind proton speed and density*, Solar Physics, 290:2589–2615, doi:10.1007/s11207-015-0800-2 **(times cited: 24)**

5. **Sokół, J.M.**, Bzowski, M., Kubiak, M.A., Swaczyna, P., Galli, A., Wurz, P., Möbius, E., Kucharek, H., Fuselier, S.A., McComas, D.J. – 2015, *The interstellar neutral He haze in the heliosphere: what can we learn?*, Astrophysical Journal Supplement Series, 220:29 (12pp), doi:10.1088/0067-0049/220/2/29 **(times cited: 15)**

6. **Sokół, J.M.**, Kubiak, M.A., Bzowski, M., Swaczyna, P. – 2015, *Interstellar neutral helium in the heliosphere from Interstellar Boundary Explorer observations. II. The Warsaw Test Particle Model (WTPM)*, Astrophysical Journal Supplement Series, 220:27 (24pp), doi:10.1088/0067-0049/220/2/27 **(times cited: 26)**

7. **Sokół, J.M.**, Bzowski, M. – 2014, *Photoionization rates for helium: update*, arXiv:1411.4826 **(times cited: 16)**

8. **Sokół, J.M.,** Bzowski, M., Tokumaru, M., Fujiki, K., McComas, D.J. – 2013, *Heliolatitude and time variations of solar wind structure from in-situ measurements and interplanetary scintillation observations*, Solar Physics Vol 285, pp 167-200, doi:10.1007/s11207-012-9993-9 **(times cited: 67)**

9. Bzowski, M., **Sokół, J.M.**, Kubiak, M.A., Kucharek, H. – 2013, *Modulation of neutral interstellar He, Ne, O in the heliosphere: survival probabilities and abundances at IBEX*, Astronomy & Astrophysics Vol 557, A50, doi:10.1051/0004-6361/201321700 **(times cited: 49)**

10. Bzowski, M., **Sokół, J.M.**, Tokumaru, M., Fujiki, K., Quémerais, E., Lallement, R., Ferron, S., Bochsler, P., McComas, D.J. – 2013, *Solar parameters for modeling the interplanetary background*, Chapter 3 in "Cross-Calibration of Far UV Spectra of Solar System Objects and the Heliosphere", ISSI Scientific Report Series 13, ed. E. Quémerais, M. Snow, R.-M. Bonnet, Springer Science + Business Media, New York, pp 67-138, doi:10.1007/978-1-4614-6384-9_3 **(times cited: 41)**

11. Kubiak, M.A., Bzowski, M., **Sokół, J.M.**, Swaczyna, P., Grzędzielski, S., Alexashov, D.B., Izmodenov, V.I., Möbius, E., Leonard, T., Fuselier, S.A., Wurz, P., McComas, D.J. – 2014, *Warm breeze from the starboard bow: a new population of neutral helium in the heliosphere*, Astrophysical Journal Supplement Series, 213:29 (21pp), doi:10.1088/0067-

0049/213/2/29 **(times cited: 44)**

12. McComas, D.J., Christian, E., Schwadron, N.A., Fox, N., Westlake, J., Allegrini, F., Baker, D., Biesecker, D., Bzowski, M., Clark, G., Cohen, C., Cohen, I., Dayeh, M., Decker, R., de Nolfo, G., Desai, M., Ebert, R., Elliott, H., Fahr, H., Fichtner, H., Frisch, P., Funsten, H.O., Fuselier, S., Galli, A., Galvin, T., Giacalone, J., Gkioulidou, M., Guo, F., Horanyi, M., Isenberg, P., Janzen, P., Kistler, L., Korreck, K., Kubiak, M.A., Kucharek, H., Larsen, B., Lee, M., Leske, R., Lugaz, N., Luhmann, J., Matthaeus, W., Mazur, J., Mitchell, D., Möbius, E., Ogasawara, K., Reisenfeld, D.B., Richardson, D., Russell, C.T., Scherer, K., **Sokół, J.M.**, Spence, H., Skoug, R., Sternozsky, Z., Swaczyna, P., Szalay, J.R., Tokumaru, M., Wiedenbeck, M., Wurz, P., Zank, G., Zirnstein, E.J. – 2018, *Interstellar Mapping and Acceleration Probe (IMAP): a new NASA mission*, Space Science Reviews, 214:116, doi:10.1007/s11214-018-0550-1 **(times cited: 3)**

13. McComas, D. J., Zirnstein, E.J., Bzowski, M., Dayeh, D.A., Funsten, H.O., Fuselier, S.A., Janzen, P.H., Kubiak, M.A., Kucharek, H., Möbius, E., Reisenfeld, D.B., Schwadron, N.A., Szalay, J.R., **Sokół, J.M.**, Tokumaru, M. – 2017, *Seven years of imaging the global heliosphere with IBEX*, Astrophysical Journal Supplement Series, 229:41 (32pp), doi:10.3847/1538-4365/aa66d8 **(times cited: 22)**

14. McComas, D.J., Allegrini, F., Bzowski, M., Dayeh, M.A., DeMajistre, R., Funsten, H.O., Fuselier, S.A., Gruntman, M., Janzen, P.H., Kubiak, M.A., Kucharek, H., Möbius, E., Reisenfeld, D.B., Schwadron, N.A., **Sokół, J.M.**, Tokumaru, M. – 2014, *IBEX: The First Five Years (2009-2013)*, Astrophysical Journal Supplement Series, 213:20 (28pp), doi:10.1088/0067-0049/213/2/20 **(times cited: 49)**

15. McComas, D.J., Dayeh, M.A., Allegrini, F., Bzowski, M., DeMajistre, R., Fujiki, K., Funsten, H.O., Fuselier, S.A., Gruntman, M., Janzen, P.H., Kubiak, M.A., Kucharek, H., Livadiotis, G., Möbius, E., Reisenfeld, D.B., Reno, M., Schwadron, N.A., **Sokół, J.M.**, Tokumaru, M. – 2012, *The first three years of IBEX observations and our evolving heliosphere*, Astrophysical Journal Supplement Series Vol 203 No 1, doi:10.1088/0067-0049/203/1/1 **(times cited: 85)**

# PROJECT PARTICIPATION

**NAWA Polish National Agency for Academic Exchange, Poland** **June 2019 – May 2020**

**Role: Principal Investigator**; data analysis, theory and software development, modeling

**Title:** *Solar cycle modulation of pickup ions and energetic neutral atoms throughout the heliosphere (Princeton University, Princeton, NJ)*

**No:** PPN/BEK/2018/1/00049 (Bekker Program)

**National Science Center, Poland** **June 2016 – May 2019**

**Role: co-investigator**; data analysis, theory development, modeling

**Title:** *Interstellar medium in the vicinity of the Sun: inferences from analysis of the flux of neutral atoms*

**No:** 2015-19-B-ST9-01328 (OPUS)

**National Science Center, Poland** **April 2016 – May 2019**

**Role: co-investigator;** data analysis, software development, modeling, theory

**Title:** *Polish participation in the NASA space mission Interstellar Boundary Explorer (IBEX): what is the source for the Warm Breeze and how is it related to the asymmetry of the heliosphere?*

**No:** 2015-18-M-ST9-00036 (HARMONIA)

**Space Research Centre Polish Academy of Sciences (CBK PAN), Poland** **October 2018**

**Role: Principal Investigator;** theory, methods, and software development

**Title:** *Optimization of observation strategy for IMAP-Lo*
*(research visit at University of New Hampshire, Durham, NH, 3 weeks)*

**No:** KIWZ.407.01.02.2016 (Award for Young Scientists)

**Space Research Centre Polish Academy of Sciences (CBK PAN), Poland**
**September 2016 – May 2017**

**Role: Principal Investigator;** theory, methods, and software development

**Title:** *Preliminary assessment of the possibility of determining the temperature and density structure of electrons in the solar wind as a function of the heliolatitude based on interstellar neutral helium glow observed from the orbit of the Earth*

**No:** KIWZ.407.01.02.2016 (Award for Young Scientists)

**National Science Center, Poland** **May 2013 – March 2016**

**Role: co-investigator;** data analysis, software development, modeling, theory

**Title:** *Polish participation in the NASA space mission Interstellar Boundary Explorer (IBEX): astronomy of neutral atoms*

**No:** 2012/06/M/ST9/00455 (HARMONIA)

**Polish Ministry for Science and Higher Education** **August 2010 – March 2013**

**Role: co-investigator;** data analysis, software development

**Title:** *Scientific and engineering participation of Poland in the NASA IBEX mission*

**No:** NS-1260-11-09

**Polish Ministry for Science and Higher Education** **August 2010 – March 2013**

**Role: co-investigator;** data analysis, software development

**Title:** *What does IBEX see - attempt to interpret first observations from Interstellar Boundary Explorer*

**No:** NN-203-513-038

**International Space Science Institute, Bern, Switzerland** **2012 – 2014**

**Role: *young scientist*;** data analysis, theory and modeling

**Title:** *Spatial and temporal studies of the heliospheric interaction with the local interstellar medium from SOHO/SWAN UV, IBEX neutral atom, and ACE and STEREO pickup ion observations*

**No:** ISSI International Team 223

**International Space Science Institute, Bern, Switzerland** **2011**

**Role: *young scientist*;** data analysis and modeling

**Title:** *Cross-calibration of past FUV experiments* FONDUE (Fully ON-line Datacenter for Ultraviolet Emissions)

**No:** ISSI Working Group