IAU Symposium 388: Solar and Stellar Coronal Mass Ejections

May 5-10, 2024, Kraków, Poland

Executive Summary

Although coronal mass ejections (CMEs) were discovered in white light only in 1971, CME-like phenomena have been discussed from in situ observations in the solar wind and from solar radio bursts in the preceding two decades. The discovery of solar energetic particles (SEPs) dates back to the early 1940s. The earliest transient activities identified on the Sun have been solar flares and prominence eruptions. However, only in the 1990s were CMEs recognized as the key source of space weather impact on Earth in terms of particle radiation and geomagnetic storms. During the past three decades, CME observations exploded to the extent that more than 40,000 CMEs have been observed as of this IAU symposium. It has become possible to develop a complete picture of eruptions that incorporates flares, prominence eruptions, CMEs, shocks, and SEPs. There has also been enormous progress in modeling CMEs with magnetic flux rope structure, that helped complete the CME picture. The situation is quite different for stellar CMEs. Although stellar flares have been observed since the early 1920s, observations of stellar CMEs are very rare. There have been intense efforts to detect stellar CMEs after the discovery of exoplanets starting in the mid-1990s because of the anticipated exoplanetary space weather. While the detection of photospheric light Thomson-scattered by CMEs is routine for the solar case, we must contend with CME proxies for the stellar case guided by the extensive observations of solar CMEs over several decades.

The IAU symposium 388 on solar and stellar CMEs brought solar and stellar CME researchers under one roof and challenged the solar CME researchers to think like stellar researchers and vice versa. The symposium was fully in person attended by 140 participants from 23 countries. Obtaining visa to Poland was smooth for most participants except for two. One could not get her visa on time to attend the symposium. The other was not able to get a transit visa in Canada. One in five participants was a student and most of the students received financial support from IAU and other sources. The five days of the symposium covered all aspects of CMEs addressed by observations, theory, and numerical modeling. Almost all invited speakers agreed to travel to Krakow and talk. The contributed papers were of high quality, carefully selected by the SOC. Solar and stellar topics were purposely interspersed to encourage cross-fertilization of ideas. Each session started with a review talk followed by one or two invited talks and remaining contributed papers.

Day 1 started with a keynote speech by Dr. Marek Jamrozy (Astronomical Observatory of Jagiellonian University) on the history of astronomy and solar physics in Krakow including the contributions of Nicolaus Copernicus. The regular program was dedicated to the origin of CMEs – the nature of solar source regions and how CMEs are initiated. The last

symposium activity on Day 1 was the poster express session in which the presenters advertised their posters in a couple of minutes each. Day 2 presentations started with phenomena associated CMEs before diving into the detection and modeling of stellar CMEs. Day 3 sessions dealt with energetic particles accelerated by CMEs and flares and how they, along with cosmic rays, impact planetary atmospheres. The focus of Day 4 was on the complex propagation of CMEs in solar and stellar environments including their ability to drive shocks and generate various types of interplanetary radio bursts. On Day 5, the regular sessions dealt with the planetary/exoplanetary impact of regular CMEs and extreme events. The symposium activities culminated in a panel discussion aimed at exploration of future directions in making progress on knowledge gaps we currently have. The panelists were observers, modelers and data analysts from both solar and stellar communities. The discussion between the panel and the audience was lively and was limited only by the available time.

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Scientific Highlights

One of the main purposes of the IAU symposium 388 was to facilitate discussions and exchange between the solar and stellar communities involved in the study of transient phenomena and their impact on planets/exoplanets. The extensive discussions following the talks and during dedicated poster sessions made it clear that we succeeded in this objective. The extended coffee breaks and lunch arrangements at the venue facilitated further discussions that forged collaborations. Although the terminology and jargon are different between the solar and stellar communities, the symposium helped the participants identify and appreciate commonalities. The symposium brought out the synergy between solar and stellar research especially on the commonality in modeling and interpretation of energetic eruptions.

We also organized two public lectures during the symposium week in the meeting venue. The lectures were attended by members of the public along with symposium participants. On the Tuesday evening, Dr. Tanja Amerstorfer (Austrian Space Weather Office, GeoSphere Austria, Graz, Austria) delivered a lecture on "What is Space Weather and how do we forecast it?". Dr. Vladimir Airapetian (NASA Goddard Space Flight Center and American University, USA) delivered the second lecture on "The Intimate Life of Giant Stellar Eruptions and Signatures of Habitable Worlds" on Thursday evening. The lectures were 40 minutes long followed by questions and discussion that lasted for about 20 minutes. The Thursday lecture was followed by a banquet including a cultural program in the countryside outside of Krakow.

During the day before the symposium, we organized a one-day school for students and young scientists. The school had 28 participants. The purpose of the school was to provide a refresher to the students so that they can better appreciate the papers on solar and stellar coronal mass ejections presented at the symposium. The school started with welcome remarks from Professor Grzegorz Michałek (LOC Chair) followed by seven lectures: 1. Solar interior and atmosphere (Dr. Alphonse Sterling, NASA Marshall Space Flight Center), 2. CMEs and associated phenomena (Dr. Nat Gopalswamy, NASA Goddard Space Flight Center), 3. CME-Flare relationship (Dr. Seiji Yashiro, The Catholic University of America), 4. The impact of stellar winds and CMEs on exoplanets (Aline Vidotto, University of Leiden), 5. Propagation of CMEs in solar and stellar environments (Ward Manchester IV, University of Michigan), 6. Solar Energetic Particle events (Dr. Pertti Mäkelä, The Catholic University of America), 7. Numerical studies of CMEs (Dr. Tibor Török, Predictive Sciences).

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Lists of speakers

One-day School Lecturers

1. Nat Gopalswamy (USA)
2. Pertti Makela (USA)
3. Ward Manchester (USA)
4. Alphonse Sterling (USA)
5. Tibor Torok (USA)
6. Aline Vidotto (The Netherlands)
7. Seiji Yashiro (USA)

Inaugural session

1. Marek Jamrozy (Poland)

List of invited review speakers

1. Mihir L. Desai (USA)
2. Meng Jin (USA)
3. Kosuke Namekata (Japan)
4. Emily Kilpua (Finland)
5. Paula Reyes (Chile)
6. Chenlong Shen (China)
7. Shin Toriumi (Japan)
8. Ilya Usoskin (Finland)
9. Jie Zhang (USA)

List of invited speakers

1. Julian Alvarado-Gomez (Germany)
2. Vladimir Airapetian (USA)
3. Konstantin Herbst (Germany)

4. Lucie Green (UK)
5. J, Magdalenic (Belgium)
6. Fusa Miyake (Japan)
7. Dibyendu Nandi (India)
8. P. Vemareddy (India)
9. Robert Wimmer-Schweingruber (Germany)
10. Donna Rodgers-Lee (Ireland)
11. Christine Verbeke (Belgium)
12. Astrid M. Veroning (Austria)
13. Brian T. Welsch (USA)

Panel Discussion

Moderator: Nat Gopalswamy (USA)

1. Joseph Callingham (The Netherlands)
2. Moira Jardine (UK)
3. Kanya Kusano (Japan)
4. Phillippe Lamy (France)
5. Christine Verbeke (Belgium)

List of chairs

1. Hebe Cremades (Argentina)
2. Nat Gopalswamy (USA)
3. Christiana Kay (USA)
4. Martin Leitzinger (Austria)
5. Hiroyuki Maehara (Japan)
6. Pertti Makela (USA)
7. Olga Malandraki (Greece)
8. Grzegorz Michalek (Poland)
9. Fang Shen (China)
10. Alphonse Sterling (USA)
11. Aline Vidotto (The Netherlands)
12. Seiji Yashiro (USA)

Public lecturers

1. Tanja Amerstorfer (Austria)
2. Vladimir Airapetian (USA)

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Sunday, May 5

Student Day – For Students Only, *Chairs: Pertti Mäkelä, Seiji Yashiro*

08:25 Welcome remarks, Grzegorz Michalek
08:30 Alphonse Sterling: Solar interior and atmosphere
09:30 Nat Gopalswamy: CMEs and associated phenomena
10:30 Coffee Break
11:00 Seiji Yashiro: CME-Flare relationship
12:00 Lunch
13:00 Aline Vidotto: The impact of stellar winds and CMEs on exoplanets
14:00 Ward Manchester: Propagation of CMEs in solar and stellar environments
15:00 Coffee Break
15:30 Pertti Mäkelä: Solar Energetic Particle events
16:30 Tibor Torok: Numerical studies of CMEs
17:30 Feedback from students and closing

Monday, May 6

08:30 Welcome and Opening Remarks: *N. Gopalswamy, G. Michałek* & University and Observatory Representative

Inaugural session, *Chair: Grzegorz Michalek*

08:50 History of Astronomy (Solar Physics) in Krakow, Poland (Keynote): *Marek Jamrozy*

1. Solar Sources of CMEs, *Chair: Alphonse Sterling*

09:15 Solar Sources of Flares and CMEs (Review): *Shin Toriumi*
09:40 Characterization of the Source Regions of High-Latitude CMEs: *Hebe Cremades, Francisco A. Iglesias, Luciano A. Merenda, Fernando M. López, Diego G. Lloveras*
09:55 Coffee Break
10:25 Magnetic Properties of Active Regions & Eruptive Structures (Invited): *Lucie Green*
10:45 Does the Presence of a Current Channel Impact the Eruptivity of Solar Flares?: *G. Barnes, K. Dissauer, P. W. Schuck*
11:00 Deciphering the Dynamics of Solar Eruptions: A Comparative Study of Decay Indices in Bipolar and Quadrupolar Active Regions and Their Impact on Coronal Mass Ejection Speeds: *Harshita Gandhi, Alex James, Lucie Green, Huw Morgan*
11:15 Decay Index Profile and Coronal Mass Ejection Speed: *Bernhard Kliem, Georgios Chintzoglou, Tibor Török, Jie Zhang*

2. CME initiation, *Chair: Ward Manchester*

11:30 Exploring the Dynamics of CME-Driven Shocks by Combining Numerical Modeling and Observations (Review): *Meng Jin, Gang Li, Nariaki Nitta, Wei Liu, Vahe Petrosian, Ward Manchester, Christina Cohen, Frederic Effenberger, Zheyi Ding, Melissa Pesce-Rollins, Nicola Omodei, Nat Gopalswamy*
11:55 Lunch
13:00 Unravelling Subtle Connections Between Coronal Mass Ejections and Stellar Magnetic Cycles (Invited): *Dibyendu Nandi*
13:20 The Relationship of Coronal Dimmings with CMEs and the Implication in Detecting Stellar CMEs: *Nariaki Nitta, Meng Jin, Karin Dissauer*
13:35 A Model for Confined Solar Eruptions Including External Reconnection: *Jun Chen*
13:50 Observations of a Failed Solar Filament Eruption Involving External Reconnection: *Yuehong Chen, Xin Cheng, Jun Chen, Yu Dai, Mingde Ding*
14:05 Stereoscopic Observations of Hard X-Ray Coronal Sources Produced in a Solar Failed Eruption: *Tomasz Mrozek, Zhentong Li, Marian Karlický, Sylwester Kołomański, Marek Stęślicki*
14:20 Favorable Initiation Condition of Magnetic Flux Ropes Near Hale Sector Boundary and Solar Sources of Magnetic Clouds at 1 au: *H. Xie, N. Gopalswamy, S. Akiyama, P. Mäkelä, S. Yashiro*

14:35 Coffee Break

2. CME initiation continued, *Chair: Christina Kay*

15:00 The Importance of Reconnection in Understanding CME Flux Ropes (Invited): *Brian T. Welsch*
15:20 The Role of Magnetic Flux Emergence in Coronal Mass Ejection Onset and Internal Structure: *Mark G. Linton*
15:35 The Effect of Poloidal Magnetic Field and Helicity Injection in a Breakout CME: *Nitin Vashishtha, Vaibhav Pant, Dana Camelia Talpeanu, Dipankar Banerjee*
15:50 Eruption of Coronal Flux Rope Under Streamers from Full 3D MHD Simulation: *Piyali Chatterjee, Samriddhi Sankar Maity*
16:05 Impact of Input Magnetic Maps on CMEs Propagation: *B. Perri, G. A. Aulanier, S. Poedts, B. Schmieder*
16:20 Poster Express, *Chairs: Christina Kay, Fang Shen*
18:30–21:00 Reception

Tuesday, May 7

3. CME, flare, eruptive prominence relationship, *Chair: Nat Gopalswamy*

08:30 The Coupling Relations Between Solar Flares and Coronal Mass Ejections (Review): *Jie Zhang*
08:55 The Solar Flare – Coronal Mass Ejection Connection: *S. Yashiro, N. Gopalswamy, S. Akiyama, G. Michałek, P. Mäkelä*
09:10 Statistical Study of Prominence Eruptions in the Wide Field of View of Solar Orbiter/EUI/FSI: *D.-C. Talpeanu, E. D'Huys, L. Rodriguez, M. Mierla, D. Shukhobodskaia, B.D. Dorsch, M. West, D. Berghmans, A. Zhukov, C. Verbeeck*
09:25 Giant Prominence Eruption on 15 February 2022: Coronal and Heliospheric Consequences Observed by Solar Orbiter and Parker Solar Probe: *A. N. Zhukov, M. Mierla, E. Palmerio, D. Berghmans, S. Parenti, F. Auchère, P. Heinzel, L. Y. Khoo, B. Sánchez-Cano, B. J. Lynch, Y. J. Rivera, S. Shestov, L. Rodriguez, C. Verbeeck*
09:40 Eruptive Prominences Detected with Metis on Solar Orbiter: *Petr Heinzel*
09:55 TEMIRA – an Advanced X-Ray Package for the Determination of Flaring Plasma Iron Abundance and Thermodynamic Characteristics from STIX and GOES Data: *Janusz Sylwester, Barbara Sylwester, Arun Kumar Awasthi, Karol Kułaga*
10:10 Coffee Break
10:35 Magnetic Evolution of Active Regions: Formation and Eruption of Magnetic Flux Ropes (Invited): *P. Vemareddy*
10:55 Extreme-Ultraviolet Wave and Coronal Seismology: *Pooja Devi, Ramesh Chandra, Arun Kumar Awasthi, Brigitte Schmieder, Reetika Joshi*
11:10 ~~Parker Solar Probe Flies Through an Eruption Associated Magnetic Reconnection Current Sheet in the Solar Corona: *Ritesh Patel, Tatiana Niembro, Xiaoyan Xie, Daniel B. Seaton, Samuel T. Badman, Soumya Roy, Yeimy J. Rivera, Katharine K. Reeves, Guillermo Stenborg, Phillip Hess, Matthew J. West, Alex Feller, Johann Hirzberger, David Orozco Suarez, Sami K. Solanki, Hanna Strecker, Gherardo Valori*~~

4. Detection and modeling of stellar CMEs, *Chair: Aline Vidotto*

11:25 Observational Signatures of Stellar CMEs Associated with Superflares (Review): *Kosuke Namekata*
11:50 Lunch
13:00 High-velocity Blueshifts of Hα and Fe XXV Heα Lines during Superflares of the RS CVn-type Stars: *Shun Inoue, Teruaki Enoto, Yuta Notsu, Hiroyuki Uchida, Kosuke Namekata, Hiroyuki Maehara, Satoshi Honda, Wataru Buz Iwakiri, Miki Kurihara, Masahiro Tsujimoto, Keiichi Namizaki, Takeshi Go Tsuru, Daisaku Nogami, Kazunari Shibata*
13:15 Time-Resolved Spectroscopy of a Superflare on the Active K Dwarf LQ Hydrae: *Hiroyuki Maehara, Kosuke Namekata, Yuta Notsu, Shun Inoue, Kai Ikuta, Satochi Honda, Daisaku Nogami, Kazunari Shibata*
13:30 Blue Wing Asymmetries in Balmer Lines During Mid M Dwarf Flares and Possible Stellar Mass Ejections: *Yuta Notsu, Adam F. Kowalski, Hiroyuki Maehara, Kosuke Namekata, Kenji Hamaguchi, Teruaki Enoto, Isaiah I. Tristan, Suzanne L. Hawley, James R. A. Davenport, Satoshi Honda, Kai Ikuta, Shun Inoue, Keiichi Namizaki, Daisaku Nogami, Kazunari Shibata*
13:45 Modeling of Radiative Properties of Stellar CMEs: *J. Wollmann, P. Heinzel, K. Namekata, V. Airapetian*
14:00 Stellar CME Simulations and Their Spectral Responses: *Yu Xu, Hui Tian, Julián David Alvarado-Goméz*
14:15 Resolving the CME Confinement Paradox in the Highly Magnetic Environment of AB Doradus: *D. Evensberget, K. M. Strickert, A. A. Vidotto*
14:30 Coffee Break
14:55 EUV and X-Ray Signatures of Stellar CMEs (Invited): *Astrid M. Veronig*
15:15 X-ray Spectroscopy of Stellar Flares on an M Dwarf Star EV Lacertae: Detection of Chromospheric Evaporation and a Possible Stellar Filament Eruption: *Hechao Chen, Hui Tian, Hao Li , Yu Xu, Hongpeng Lu, Zhenyong Hou, Yuchuan Wu*
15:30 Possible Detection of Coronal Mass Ejections on Late-Type Main-Sequence Stars in LAMOST Medium-Resolution Spectra: *Hong-peng Lu, Hui Tian*
15:45 Interplanetary Shock Waves Driven by Coronal Mass Ejections (Review): *E. Kilpua*
16:10 Poster viewing
18:00 Public Lecture, *Chair: Nat Gopalswamy*
What is Space Weather and how do we forecast it? *Tanja Amerstorfer*, Austria

Wednesday, May 8

7. CMEs and Energetic Particles, *Chair: Olga Malandraki*

08:30 Solar Energetic Particle Events (Review): *Mihir I. Desai*
08:55 SEP Environment near the Sun from Solar Orbiter and Parker Solar Probe (Invited): *Robert F. Wimmer-Schweingruber, Javier Rodriguez-Pacheco, George C. Ho, Christina M. Cohen* and the Solar Orbiter EPD and Parker Solar Probe ISOIS teams
09:15 Charge-State Dependent Heating of Fe at a CME-Driven Shock Observed by Solar Orbiter: *B. L. Alterman, Stefano Livi, Ryan Dewey, Susan Lepri, Jim Raines, Sarah Spitzer, Domenico Trotta, Colby Haggerty, Christopher Bert, Frederic Allegrini, George Ho, Keiichi Ogasawara, Mark Philips, Georgios Nicolaou, Christopher Owen, Daniel Verscharen, A. Fedorov, Philippe Louarn, Roberto Bruno, Raffaella D'Amicis, Irena Gershkovich, Janelle Holmes, Keeling Ploof, Antoinette Galvin, Lynn Kistler, Peter Wurz, Yeimy Rivera, Virginia Angelini, David Burgess, Ed Fauchon-Jones, Tim Horbury, Helen O'Brien, Heli Hietala, Milan Maksimovic, Timothy Stubbs*
09:30 Energetic Characterization of Electrons Emitted During Three Flares as Observed by STIX and EPD During 26-28 September 2021: *Arun Kumar Awasthi, Alexander Warmuth, Tomasz Mrozek, Janusz Sylwester, Barbara Sylwester, Frederic Shueller*
09:45 Unexpected Energetic Particle Observations Near the Sun by Parker Solar Probe and Solar Orbiter: *Olga E. Malandraki, Christina M. S. Cohen, Joe Giacalone, John G. Mitchell, Rohit Chhiber, David J. McComas, Nathan A. Schwadron, Javier Rodríguez-Pacheco, Robert Wimmer-Schweingruber, George Ho, Nils Janitzek, Mihir Desai*
10:00 Coffee Break
10:25 Origin of 3 He Abundance Enhancement in Gradual Solar Energetic Particle Events: *R. Bucik, S. T. Hart, M. A. Dayeh, M. I. Desai, G. M. Mason, M. E. Wiedenbeck*
10:40 Energetic Particle Transport During Long-Duration Solar Gamma Ray Flares: *Frederic Effenberger, Julien Dörner, Horst Fichtner*
10:55 Near Relativistic Proton Spectra Measured by SOHO/EPHIN: *B. Heber, M. Hörlöck, S. Jensen, P. Kühl, H. Sierks*
11:10 Co-occurrence of SGRE and SEP events: *P. Mäkelä, N. Gopalswamy, S. Akiyama, S. Yashiro, H. Xie*
11:25 SEPs and Cosmic Ray Effects in Exoplanetary Atmospheres (Invited): *Donna Rodgers-Lee*
11:45 The Influence of SEPs and Cosmic Rays on the Early Earth Atmosphere: *Shauna Rose Raeside, Donna Rodgers-Lee, Paul Rimmer, Tom Ray*
12:00 Lunch
13:00 Free Afternoon

Thursday, May 9

5. Propagation of CMEs in solar and stellar environments, *Chair: Martin Leitzinger*

08:30 The Space Weather Effect Influenced by the CME Propagation (Review): *Chenglong Shen, Yuming Wang, Yutian Chi*
08:55 Understanding Coronal Mass Ejections from Magnetically-Active Stars (Invited): *Julian Alvarado-Gomez, Jeremy Drake, Ofer Cohen, Cecilia Garraffo, Federico Fraschetti, Katja Poppenhäger*
09:15 Deflection of CMEs in Unipolar Ambient Magnetic Fields: *T. Torok, M. Ben-Nun, E. Palmerio, C. Downs, V. S. Titov, M. G. Linton, R. M. Caplan, R. Lionello*
09:30 Two Distinct Eruptive Events Observed by Metis on October 28, 2021: *Y. De Leo, H. Cremades, F. A. Iglesias, L. Teriaca, R. Aznar Cuadrado, F. M. López, L. Di Lorenzo, M. Romoli* and the Metis Team
09:45 Coffee Break
10:25 Understanding Our Capabilities in Observing and Modeling Coronal Mass Ejections (Invited): *Christine Verbeke, M. Mierla, M.L. Mays, C. Kay, M. Dumbovi*
10:45 Numerical Research on the Effect of the Initial Parameters of CME Flux-rope Model on Simulation Results: *Fang Shen, Yousheng Liu, Yi Yang, Mengxuan Ma*
11:00 Implications of The Abundance of Halo CMEs for the Strength of Solar Cycle 25: *N. Gopalswamy, G. Michalek, S. Yashiro, P. Makela, S. Akiyama, H. Xie*
11:15 Effects of HSSs on the Interplanetary Evolution of CMEs and Their Sheath Regions: *C. Kay, T. Nieves-Chinchilla, S. Hofmeister, E. Palmerio, V. Ledvina*
11:30 Modeling of Non-Radially Propagating Halo CMEs and Forecasting Their Arrival Time at Earth: *Angelos Valentino, Jasmina Magdalenic*
11:45 Integrating Kinematics and Thermodynamics of Coronal Mass Ejections Through Observations and Analytical Modeling: *Soumyaranjan Khuntia, Wageesh Mishra, Sudheer K. Mishra, Yuming Wang, Jie Zhang, Shaoyu Lyu*
12:00 Lunch

5. Propagation of CMEs in solar and stellar environments continue, *Chair: Fang Shen*

13:00 Three-Dimensional Simulation of Geo-Effective, Small- to Meso-Scale Solar Wind Structures Observable by SWIFT Constellation: *Ward Manchester, Nishtha Sachdeva, Shirsh Lata Soni, Matti Ala-Lahti, Mojtaba Akhavan-Tafti, Emilia Kilpua, Zhenguang Huang, Aniket Jivani, Hongfan Chen, Gabor Toth*
13:15 Influence of Solar Wind Medium on the Propagation of Earth Impacting CMEs: *Nandita Srivastava, Sandeep Kumar, Nat Gopalswamy*
13:30 Properties of High-Latitude Coronal Mass Ejections as Seen in the Corona in 1996-2023: *Noam Tishler, Olga Khabarova, Hadar Erez, Nuran Samara, Colin Price*
13:45 Space Weather Detection with Interplanetary Scintillation Using the Murchison Widefield Array: *A. Waszewski, J. Morgan*

6. CMEs, shocks, and radio bursts, *Chair: Pertti Makela*

14:00 Extreme Solar Events: Do We Know Them? (Review): *Ilya Usoskin*
14:25 Coffee Break
14:50 Radio Observations of Stellar CMEs (Invited): *R. A. Osten*
15:10 First Detection of an Extra Solar Type II Burst: *D.C. Konijn, J.R. Callingham, H. K. Vedantham, C. Tasse, R. Keers, P. Zarka*
15:25 Coronal Mass Ejections and radio Bursts (Invited): *J. Magdalenic*
15:45 Radio Imaging of High Frequency Type-II Solar Radio Burst: *V. Vasanth, Y. Chen, G. Michalek*
16:00 Can a Type II Radio Burst Occur Without a Coronal Mass Ejection?: *Anshu Kumari, Nat Gopalswamy*
16:15 Coronal Mass Ejections Associated with Decameter-Hectometer (DH) Type II Radio Bursts: *Bhuwan Joshi, Binal D. Patel*
16:30 Enhancing Triangulation of Interplanetary Type II Bursts through Wavevector Correction: *Vratislav Krupar, Oksana Kruparova, Adam Szabo*
16:45 Poster viewing
18:00 Public Lecture, *Chair: Aline Vidotto*
The Intimate Life of Giant Stellar Eruptions and Signatures of Habitable Worlds, *Vladimir Airapetian*, USA
20:00–24:00 Conference Dinner *(outside city, transport by bus - 19:00)*

Friday, May 10

8. CME impact on planets/exoplanets, *Chair: Hebe Cremades*

08:30 CMEs, ICMEs, and Geomagnetic Storms (Review): *Paula I. Reyes, Víctor A. Pinto, Pablo S. Moya*
08:55 Predicting Geo-Effectiveness Two Days Prior to CME Impact with EUHFORIA: *S. Poedts, S. Doumen, A. Maharana, P. Wintoft, T. Baratashvili*
09:10 Impact of Eruptive Events from Young Suns on Atmospheric Chemistry and Climates of Rocky Exoplanets (Invited): *Vladimir S. Airapetian, Meng Jin, Junxiang Hu, Kosuke Namekata, Kensei Kobayashi*
09:30 Close-In Exoplanets: Nature's Own Parker Solar Probe: *A. A. Vidotto*
09:45 Measuring Magnetic Fields of Coronal Mass Ejection in Corona and Inner Heliosphere Using Wide Field of View Spectro-Polarimetric Radio Imaging: *Devojyoti Kansabanik, Angelos Vourlidas, Surajit Mondal, Divya Oberoi*
10:00 Coffee Break
10:25 ~~Space Weather Monitoring Using Pulsars as Probes: *Dilpreet Kaur, George Hobbs, Mark Cheung, Ron Ekers, John Morgan, Andrew Zic*~~
10:40 Advanced CME Models in EUHFORIA for Improved Geo-Effectiveness Predictions: *A. Maharana, L. Linan, S. Poedts, J. Magdalenic*
10:55 Assessing the Performance of Different Flux-Rope Models in Global MHD Simulations to Investigate the Space Weather Impact of CMEs: *Ranadeep Sarkar, Jens Pomoell, Emilia Kilpua, Eleanna Asvestari*
11:10 ~~Prediction of Geoeffective Halo CMEs Using Machine Learning Models: *Hemapriya Raju, Natchimuthuk Gopalswamy, Sachiko Yashiro Akiyama*~~
11:25 CME Arrival Time Prediction Based on Deep Learning: *Yi Yang, Fang Shen, Yucong Li, Rongpei Lin*
11:40 Comparison of Catalogs of Coronal Mass Ejection: *Grzegorz Michalek, Nat Gopalswamy, Seiji Yashiro*
11:55 Lunch
13:00 Application of the Global NM Network for the Study of Solar Energetic Particles and Their Space Weather Effects: *Alexander Mishev*

9. Solar and Stellar Extreme events, *Chair: Hiroyuki Maehara*

13:15 Astrospheres of Planet-Hosting Cool Stars and Beyond (Invited): *Konstantin Herbst*
13:35 Type-IV Radio Bursts from the Sun and an Active Non-Solar Type Star: *A. Mohan, S. Mondal, N. Gopalswamy, S. Wedemeyer*
13:50 Unveiling the Unseen: Analyzing CD-36 3202's Light Curve and Unprecedented Long-Duration Flare: *K. Bicz, R. Falewicz, M. Pietras*
14:05 Historical Extreme Events (Invited): *Fusa Miyake*
14:25 Analyses of Extreme Solar Storm in February 1872: *Hisashi Hayakawa*

Panel Discussion, *Chairs: Nat Gopalswamy, Aline Vidotto*

14:40 Joseph Callingham: Prospects for stellar activity studies with next-generation radio telescopes, The Netherlands
14:50 Moira Jardine: Stellar prominences and mass loss of low-mass stars, UK
15:00 Phillipe Lamy, Observing CMEs from the Sun, France
15:05 Kanya Kusano: Solar impact on Earth and human society: What should we do for it?, Japan
15:20 Stefan Poedts / Christine Verbeke: Solar and Stellar Flux Rope Modeling, Belgium
16:00 Closing Remarks, *Nat Gopalwamy, Grzegorz Michalek*

The project is financed from state budget funds allocated by the Ministry of Science and Higher Education, Republic of Poland

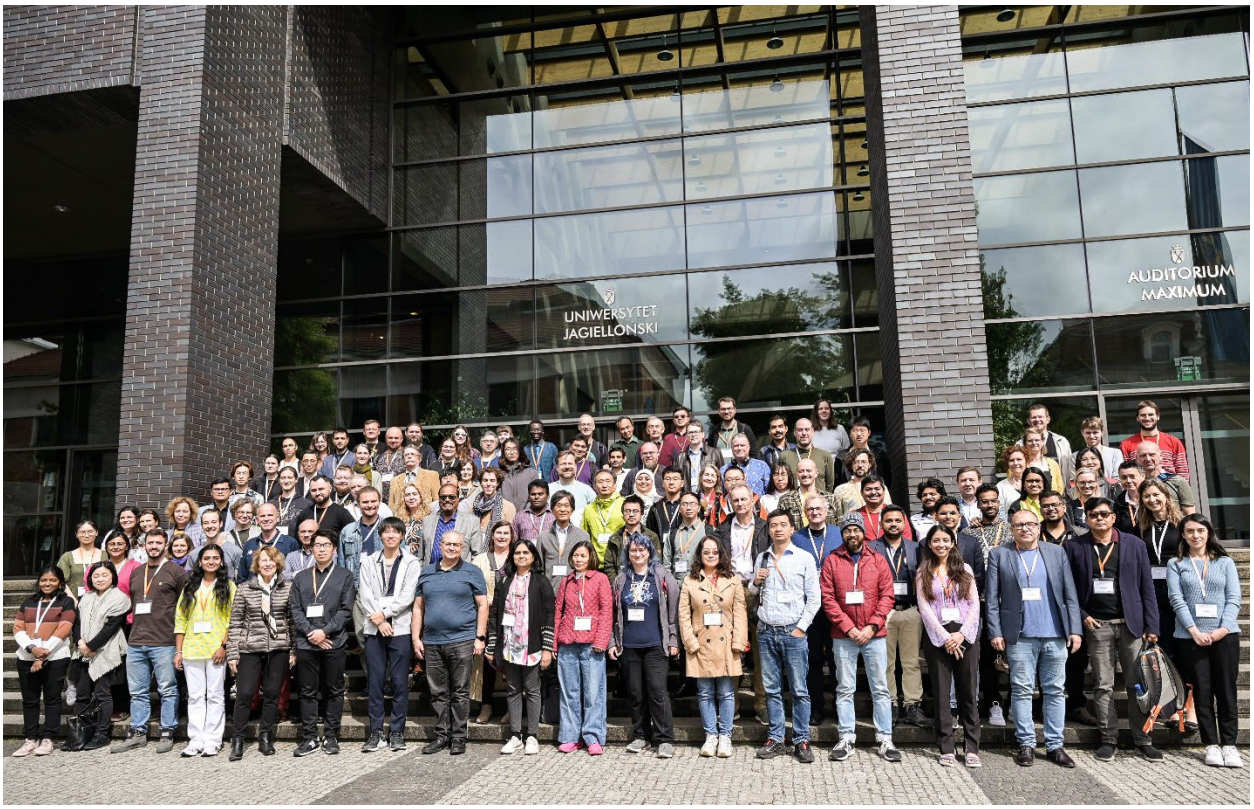

Image 1 – Group Photo at the IAUS388. Credit: The LOC.

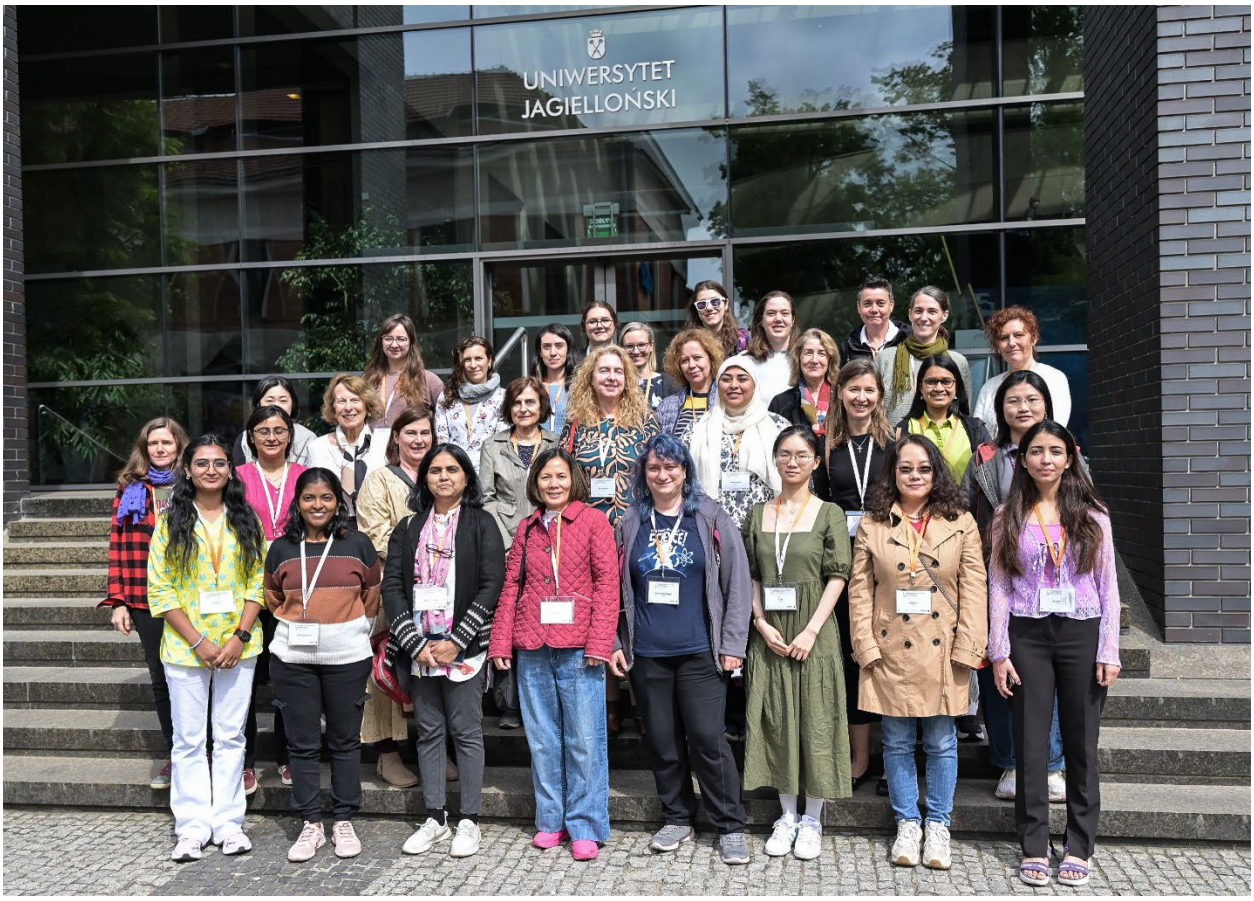

Image 2 – Women's meeting at the IAUS388. Credit: The LOC.