Tamas I. Gombosi

Konstantin I. Gringauz Distinguished University Professor of Space Science
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PERSONAL

- Born in Budapest, Hungary.
- United States citizen.

EDUCATION

- Ph.D. (Physics), Loránd Eötvös University, Budapest, Hungary, 1974.
- M.S. (Physics), Loránd Eötvös University, Budapest, Hungary, 1970.
- *Post-PhD Degrees*
  - Candidate of Science (Physics), Hungarian Academy of Sciences, 1979.
  - Doctor of Science (Physics), Hungarian Academy of Sciences, 1983.

EMPLOYMENT

- *Konstantin I. Gringauz Distinguished University Professor of Space Science*, University of Michigan, 2014–present.
- *Rollin M. Gerstacker Endowed Professor of Engineering*, University of Michigan, 2007–present.
- *Chair*, Department of Atmospheric, Oceanic and Space Sciences, University of Michigan, 2003–2011.
- *Director*, Space Physics Research Laboratory, University of Michigan, 2003–2006.
- *Director*, Center for Space Environment Modeling, University of Michigan, 2002–present.
- *Associate Professor and Professor*, University of Michigan, 1987–2007.
- *Associate Research Scientist*, University of Michigan, 1985–87.
- *Associate Research Scientist, Research Scientist, Senior Research Scientist, Scientific Advisor*, Central Research Institute for Physics, Hungarian Academy of Sciences, 1970–85.

AWARDS & RECOGNITIONS

- Kristian Birkeland Medal for "outstanding scientific results in the field of Space Weather," 2018.
- Van Allen Lecturer (each year the Space Physics and Aeronomy Section of the American Geophysical Union honors a leader at the forefront of Magnetospheric Physics by selecting them to give the James A. Van Allen Lecture at their Fall Meeting), 2017.
- External Member, Hungarian Academy of Sciences, (eminent Hungarian scholars with outstanding achievements in their fields who live in foreign countries may be elected as External Members), 2016.
- Konstantin I. Gringauz Distinguished University Professor of Space Science, University of Michigan, 2014.
- Recipient of the American Geophysical Union's (AGU) inaugural Space Weather Prize, 2013.
- Rollin M. Gerstacker Endowed Professor of Engineering, The University of Michigan, 2007.
- Steven S. Attwood Award (the highest faculty achievement award in the College of Engineering), College of Engineering, The University of Michigan, 2002.
- Elected Full Member, International Academy of Astronautics (Corresponding Member 1993, Full Member 1997)
- Fellow of the American Geophysical Union (elected in 1996)
- *Other Awards*

- Ted Kennedy Family Faculty Team Excellence Award (Center for Space Environment Modeling), College of Engineering, University of Michigan, 2019.
- NASA Group Achievement Award (Cassini Interdisciplinary Scientists Team), 2018.
- NASA Group Achievement Award (University of Michigan Rosetta Modeling Team), 2017.
- NASA Group Achievement Award (MMS Instrument Suite Team), 2016.
- NASA Group Achievement Award (Cassini Interdisciplinary Scientists Team), 2009.
- NASA Public Service Group Achievement Award (Rosetta), 2007.
- Team Excellence Award, College of Engineering, University of Michigan, 1999.
- NASA Group Achievement Award (Cassini Orbiter Team), 1998.
- Research Excellence Award, College of Engineering, University of Michigan, 1992.
- Lajos Jánossy Award (the highest science award of the research center), Central Research Institute for Physics, Hungary, 1987.
- László Detre Award (young scientist award), Lóránd Eötvös Physical Society, Hungary, 1982.
- KFKI Award, Central Research Institute for Physics, Hungary, 1978.
- KFKI Award, Central Research Institute for Physics, Hungary, 1976.
- Albert Fonó Award (young scientist award), Hungarian Astronautical Society, 1976.

SCIENTIFIC BIOGRAPHY

A native of Hungary, Professor Gombosi was educated in theoretical physics. In the mid-1970s he was the first foreign national to do postdoctoral research at the Space Research Institute (IKI) in Moscow, where he participated in theoretical studies of the solar wind interaction with Venus and in data interpretation of the first Venus orbiters, Venera-9 and Venera-10. At IKI he worked under the direction of Konstantin Gringauz, Roald Sagdeev, Albert Galeev and Vitalii Shapiro. A few years later he came to the U.S. to participate in theoretical work related to NASA's Venus exploration.

In the early 1980s he played a leading role in the planning and implementation of the international VEGA mission to Venus and Halley's comet. As project scientist for Hungary he actively participated in the design of several *in situ* and remote sensing instruments (such as the imaging system, the energetic particle detector, and the plasma spectrometer). In addition to his involvement in cometary missions he also carried out pioneering theoretical work in the emerging field of cometary plasma physics.

In the mid 1980s he permanently moved to the U.S., and in 1987 he joined the faculty of the University of Michigan, where presently he is the Konstantin Gringauz Distinguished University Professor of Space Science, the Rollin M. Gerstacker Professor of Engineering, Professor of Space Science and Professor of Aerospace Engineering. In addition, he is the founding Director of the Center for Space Environment Modeling.

At Michigan he established close interdisciplinary collaborations with computational fluid dynamics and computational science faculty and formed a tightly integrated group of faculty and students that pioneered high performance simulation technology of space plasmas extending from the solar surface to cometary and planetary magnetospheres and ionospheres, to the outer edges of the solar system.

His present research includes:

- Development of the first generation of first-principles-based predictive global space weather simulation codes,
- Physics of planetary space environments (including Earth, planetary satellites and comets),
- Theoretical investigations of plasma transport in various regions of the heliosphere,
- Fundamental kinetic theory of gases and plasmas, and
- Multi-scale MHD simulations of solar system plasmas on solution adaptive unstructured grids.
- Physics-based, end-to-end modeling of space weather phenomena (from Sun to ground).

He also continues to participate in the exploration of the space environment and the solar system. He was Interdisciplinary Scientist of the international Cassini/Huygens mission to Saturn and its moon, Ti-

tan. He was Chair of Working Group X (providing modeling support for the mission) and Co-Investigator of the ROSINA ion-neutral mass spectrometer on the international Rosetta mission that explored comet 67P/Churyumov-Gerasimenko. Professor Gombosi is Co-Investigator of the IMPACT plasma instrument on NASA's STEREO mission to explore solar storms, and member of the science team of the Magnetospheric Multiscale (MMS) mission. In addition, he is Principal Investigator of several large interdisciplinary research efforts.

MAIN SCIENTIFIC ACCOMPLISHMENTS

His scientific contributions span across many areas of space and planetary physics. Here is an incomplete list of his most important scientific contributions:

- He was first author of the paper published in *Nature* that first established the directional anisotropy of $\sim 10^{14}$ eV galactic cosmic rays. In order to prove the existence of a 0.1% directional anisotropy, the arrival directions of over 100 million extensive air shower events were analyzed.
- Using theoretical calculations and plasma observations by the Venera-9 and -10 Venus orbiters he and his Russian colleagues were the first to establish that during solar minimum conditions energetic electrons originating from the solar wind are responsible for the maintenance of the nighttime ionosphere of Venus.
- He played a pioneering role in the development of modern cometary plasma physics. He made major contributions to the theoretical description of the cometary ion pick-up process, which essentially controls the cometary plasma environment. Also, he was among the first scientists to explain the acceleration of pick-up ions by self-generated low frequency MHD waves.
- He was a pioneer of modeling the complicated physical processes controlling the interface region between the comet nucleus and the continuously escaping cometary coma. His "friable sponge" model of cometary surface layers and his "icy-glue" model of cometary nuclei were essentially confirmed by spacecraft and remote optical observations. He was a leader in the development of the first detailed numerical model describing the strongly coupled dusty gas flow near cometary nuclei.
- He developed the first time-dependent model of the terrestrial polar wind, which accounted for the dynamics and energetics of the transonic ion outflows from the high-latitude ionosphere. His model calculations were the first to predict the solar cycle dependence of the H^+ outflow, the origin of O^+ in polar wind transients, and the effects of low-altitude frictional heating on the polar wind.
- He derived new transport equations from higher-order velocity moments of the Boltzmann equation using a non-isotropic Gaussian base-function. These equations are stable, hyperbolic, and ensure positivity of the velocity distribution function. These features make the new moment closures both tractable and well-suited for today's sophisticated numerical algorithms.
- Over the last 25 years he has been leading a group of faculty and students pioneering the development of a new generation of high-performance 3D MHD numerical simulation models using solution adaptive grids. This group has also developed the Space Weather Modeling Framework that couples state-of-the-art models describing the complex Sun-Earth system.

MANAGEMENT EXPERIENCE

Department Chair. From 2003 to 2011 Professor Gombosi was Chair of the Department of Atmospheric, Oceanic and Space Sciences (AOSS), College of Engineering, University of Michigan. Under his leadership AOSS grew significantly, while maintaining a balanced budget. When he took over the department, AOSS had 12 Full Professors and 3 tenured Associate Professors. When he stepped down as Chair of AOSS, the department had 16 Full Professors, 2 Associate Professors and 6 Assistant Professors, a 60% increase in tenure track faculty. He created a world-class climate program, hiring 7 new tenure track faculty in this area. He rejuvenated the space & planetary science side of the department by hiring 4 tenure track faculty in this field. In addition, the research faculty grew from 25 to 35. At the end of Professor Gombosi's chairmanship there were 45 undergraduates (a 250% increase), 60 Ph.D. students (a 20% increase), 50 professional Masters students (a 300% increase) enrolled and 12 postdoctoral researchers (100% increase)

trained in AOSS. At the same time departmental administration remained nearly constant (at 25 full time equivalent positions) and professional engineering support staff slightly increased (to 25). Today, AOSS is one of the top departments in the world in space and planetary science, and is among the best in climate science.

Center Director. In 2002 Professor Gombosi founded the Center for Space Environment Modeling (CSEM). This multidisciplinary center integrates the activities of space and planetary scientists, applied mathematicians and computer scientists. The collaboration resulted in the development and application of modern numerical algorithms and software practices to challenging space science problems. Under Professor Gombosi's leadership CSEM became the leading center of first-principles-based space weather modeling. Presently, CSEM includes about ten tenure track and an equal number of research faculty, several postdocs and approximately fifteen Ph.D. students.

Project Management Experience: He led the development of the high performance, multiphysics, grid-adaptive BATS-R-US code and the Space Weather Modeling Framework (SWMF). The development of BATS-R-US started in the early 1990s, while SWMF was developed a decade later. Over the last quarter of century about $50 million (200 person-years) were invested in the development of BATS-R-US and SWMF (including PhD students and postdocs). The average annual investment was two million dollars (about 8 people). It took a combination of $100K type research grants and large agency initiatives (NASA HPCC, DoD MURI, NSF KDI, NSF ITR, NSF CDI, NASA/NSF Space Weather Partnership, NASA Heliophysics Grand Challenges, NSF INSPIRE) to continuously maintain this effort.

Project Scientist. During the first part of the 1980s Professor Gombosi was Project Scientist for Hungary in the international VEGA (Venus-Halley) mission lead by the Soviet Union. In this capacity he played a critical role in establishing East-West collaborations. In effect, he was the mission's "ambassador" to ESA and NASA and provided behind-the-scenes communication channels between the Soviet space program and NASA and ESA during the height of the cold war (these were the "Evil Empire" years). At the same time he played a critical role in instrument and mission design of theVEGA mission. He worked on optical tracking strategies, nucleus and coma models, and was a leader of the plasma and energetic particle instruments.

BOOKS, PUBLICATIONS & PRESENTATIONS

Gaskinetic Theory. Professor Gombosi's first graduate level textbook was published by Cambridge University Press in 1994. *Gaskinetic Theory* was written based on the course he taught at the University of Michigan to aerospace engineers and space scientists. It is an introductory text on the molecular theory of gases and on modern transport theory suitable for upper division undergraduates in physics and first year graduate students in aerospace engineering, upper atmospheric science and space research. The first part introduces basic concepts, including the distribution function, classical theory of specific heats, binary collisions, mean free path, and reaction rates. Transport theory is used to express coefficients such as viscosity and heat conductivity in terms of molecular properties. The second part of the book covers advanced transport theory. Generalized transport equations are derived from the Boltzmann equation. The Chapman-Enskog and the Grad methods are discussed to obtain higher order transport equations for low density gases. The aerodynamics of solid bodies is explored and the book concludes with the kinetic description of shock waves. The book is widely used by aerospace departments around the world.

Physics of the Space Environment. Professor Gombosi's second graduate level textbook was published in 1998 by Cambridge University Press. *Physics of the Space Environment* provides a comprehensive introduction to the physical phenomena that result from the interaction of the Sun and the planets -often termed space weather. It explores the basic processes in the Sun, in the interplanetary medium, in the near-Earth space, and down into the atmosphere. The first part of the book summarizes fundamental elements of transport theory relevant for the atmosphere, ionosphere and the magnetosphere. This theory is then applied to physical phenomena in the space environment. The fundamental physical processes are emphasized throughout, and basic concepts and methods are derived from first principles. This book is unique in its

balanced treatment of space plasma and aeronomical phenomena. It is used by several universities with graduate programs in space science.

Publications. At this time Professor Gombosi has written two textbooks, edited four scientific monographs and authored or co-authored over 430 peer reviewed publications. Of these, 10 were published in *Science* and 8 in *Nature*, the most prestigious periodicals in planetary and space science. Most of the other papers were published in the *Journal of Geophysical Research*, the *Astrophysical Journal*, *Icarus* or *Geophysical Research Letters*. According to the *Web of Science* data base (Researcher ID is G-4238-2011) Professor Gombosi's work has been cited more than 13,700 times and his Hirsch index (h-index) is 57. According to Google Scholar his citation number is over 22,500 and his Hirsch index is 77.

Presentations. Professor Gombosi gave or significantly contributed to more than 150 invited and over 700 contributed presentations at major national and international conferences. The majority of these more than 700 presentations were given at meetings of the American Geophysical Union (AGU), Committee of Space Resaerch (COSPAR), International Association of Geomagnetism and Aeronomy, part of the International Union of Geodesy and Geophysics (IAGA/IUGG), the European Geophysical Union (EGU) and the Division of Planetary Sciences of the American Astronomical Society (DPS/AAS). In addition, he gave over a hundred colloquia at major universities and research centers around the world. Professor Gombosi also gave a number of public lectures about space exploration at all levels, from elementary schools to high schools, to large national public events.

PROFESSIONAL ACTIVITIES

- Space Missions.
  - Worked on the interpretation of particles and fields data obtained by the first Venus orbiters, Venera–9 and –10.
  - Participated in the scientific analysis of particles and fields data returned by NASA's Pioneer–Venus Orbiter.
  - Played a leading role in the VEGA mission to comet Halley, and in international activities related to the 1986 apparition of Halley's comet. In 1982–83 he served as Project Scientist for Hungary in the International Venus–Halley (VEGA) Mission.
  - Interdisciplinary Scientist (Magnetosphere and Plasma) of the Cassini mission to Saturn.
  - Co-Investigator, Rosetta Ion-Neutral Analyser (ROSINA) and the Plasma Investigation on the Rosetta comet rendezvous mission.
  - Co-Investigator, IMPACT instrument, STEREO mission.
  - Co-Investigator, MMS/SMART mission.
- Research Funding. Presently he is Principal Investigator (PI) or Co-PI of research grants totalling over $2M per year. His research is, or has been supported by several major awards, including
  - Two NASA High Performance Computing and Communications (HPCC) awards to develop modern high performance adaptive MHD codes and the Space Weather Modeling Framework (SWMF).
  - A DoD Multidisciplinary University Initiative (MURI) grant to develop a physics-based Sun-to Earth space weather model chain.
  - An NSF Knowledge and Distributed Intelligence (KDI) award to develop high performance coupled ionosphere-thermospehere-magnetosphere codes.
  - a NSF Information Technology Research (ITR) award supporting further development of the Space Weather Modeling Framework, research in grid computing and data assimilation.
  - a NASA-NSF-AFOSR grant to develop a comprehensive model of the heliosphere for the Living with a Star and the National Space Weather Program,
  - An NSF Cyber-Enabled Discovery and Innovation (CDI) award to develop new data assimilation and tomographic methods for space weather applications.
- Editorial Experience. He was Senior Editor of the *Journal of Geophysical Research – Space Physics* (1992-1997). This journal publishes about 600 papers annually, and is the word's leading publication

in the area of aeronomy, magnetospheric physics, and solar system astrophysics. Additional editorial experience includes:

- Member, Publishing Policy Committee, American Institute of Physics (AIP), 1998–2000.
- Editor of four scientific monographs.
- Associate Editor, *Icarus*, 1991–1997.
- Member, Translation Journals Board, American Institute of Physics (AIP), 1993–1997.
- Member, Publications Committee, American Geophysical Union, 1990–1992.
- Associate Editor, *Geophysical Research Letters*, 1986–1988.

PHD THESIS SUPERVISION

1. John Haiducek (Ph.D. 2018, presently postdoc at NRL)
2. Judit Szente (Ph.D. 2018, presently postdoc in CLaSP)
3. Dimitriy Borovikov (Ph.D. 2017, presently postdoc at University of New Hampshire)
4. Yuxi Chen (Ph.D. 2017, presently postdoc in CLaSP)
5. Zhenguang Huang (Ph.D. 2014, presently Assistant Research Scientist in CLaSP)
6. Meng Jin (Ph.D. 2014, presently researcher at Solar & Astrophysics Laboratory, Lockheed-Martin)
7. Rona Oran (Ph.D. 2014, presently researcher at MIT)
8. Xing Meng (Ph.D. 2013, presently Staff Scientist at NASA/JPL)
9. Fang Fang (Ph.D. 2012, presently Research Assistant Professor at University of West Virginia)
10. Alex Glocer (Ph.D. 2008, presently Staff Scientist at NASA GSFC)
11. Daniel Welling (Ph.D. 2008, presently Assistant Professor at University of Texas at Arlington)
12. Ofer Cohen (Ph.D. 2008, presently Assistant Professor at University of Massachusetts at Lowell)
13. Noé Lugaz (Ph.D. 2006, presently Research Scientist at University of New Hampshire)
14. Kenneth C. Hansen (Ph.D. 2001, presently Program Scientist at NASA HQ)
15. Konstantin Kabin (Ph.D. 2000, presently Professor at Royal Military College, Canada)
16. Timur Linde (Ph.D. 1998, presently financial analyst on Wall Street)
17. Madai Frey (Ph.D. 1997, presently spacecraft designer at Northrop-Grumman)
18. Michael Liemohn (Ph.D. 1996, presently Professor in CLaSP)
19. Nathan A. Schwadron (Ph.D. 1996, presently Professor at the University of New Hampshire)
20. Claudia J. Alexander (Ph.D. 1993, deceased)
21. Kenneth M. Chick (Ph.D. 1993, presently scientist at the Carnegie Institution for Science)
22. Steven M. Guiter (Ph.D. 1992, presently scientist in Canada)
23. Richard W. Cannata (Ph.D. 1990, deceased)
24. Ákos Kőrösmezey (Ph.D. 1984, presently software engineer at Ericsson, Hungary)
25. Mihály Horányi (Ph.D. 1982, presently Professor at the University of Colorado)
26. Erzsébet Merényi (Ph.D. 1980, presently Professor at Rice University)

POSTDOC SUPERVISION

1. Dmitry Borovikov (2017–18), Presently postdoc, University of New Hampshire
2. Zhenguang Huang (2014–2017), Presently Assistant Research Scientist, University of Michigan
3. André Bieler (2013–16), Presently software engineer in Switzerland
4. Lars Daldorff (2010–14), Presently Scientist, Applied Physics Laboratory, Johns Hopkins University
5. Xienzhe Jia (2009–10), Presently Associate Professor, CLaSP, University of Michigan
6. Martin Rubin (2006–08), Presently Associate Professor of Physics, University of Bern, Switzerland
7. Merav Opher (2001–04), Presently Associate Professor of Astronomy, Boston University
8. Ilia Roussev (2001–02), Presently Program Director, National Science Foundation
9. Ward Manchester (2000–01), Presently Associate Research Professor, CLaSP, University of Michigan
10. Roman Häberli (1996–97), Presently works in Swiss industry
11. Clinton Groth (1995–96), Presently Professor of Aerospace Engineering, University of Toronto
12. Darren De Zeeuw (1992–93), Presently Associate Research Scientist, CLaSP, University of Michigan

COURSES During his three decades at the University of Michigan Professor Gombosi taught many courses. A list of courses which were developed or significantly modified by Professor Gombosi includes:

- AOSS-464 (Space Environment). This course describes simple mathematical models of the upper atmosphere, ionosphere, magnetosphere, the interplanetary medium and the sun. This material formed the basics of Professor Gombosi's second textbook, Physics of the Space Environment, published by Cambridge University Press in 1998.
- AERO-532 (Gaskinetic Theory). This course was originally developed in the 1960s as an introduction to the kinetic theory of gases. Prof. Gombosi fundamentally revised the course, expanded its mathemathical rigor and included modern subjects, such as generalized transport equations and free-molecular interactions. This revised course formed the basics of his first textbook (Gaskinetic Theory) that was published by Cambridge University Press in 1994.
- AOSS-574 (Advanced Space Environment). This is a higher level version of AOSS-464 primarily serving advanced Ph.D. students in the AOSS and later the CLaSP department.
- AOSS-596 (Kinetic Theory). This course focuses on the kinetic theory of rarified gases and plasmas. Special attention is focused on the waves and instabilities developing in magnetized plasmas.
- AOSS-597 (Space Plasma Physics). This course explores the plasma transport and wave modes that describe plasma behavior in our solar system. Special attention is paid to waves in cold, hot and warm plasmas and the ways these waves interact with the radiation belts, transport of energetic particles and the energization of the solar wind.

SERVICE

- National/International Organizations and Committees. Served on a large number of NASA and NSF selection committees. An incomplete list of other committee service is:
  - Member, NASA Living with a Star Targeted Research and Technology Stearing Committee, 2012–2013.
  - Member, NRC Decadal Survey of Heliophysics, R2O/O2R Subcommittee, 2010–2011.
  - Chair, NSF Advisory Subcommittee for Atmospheric and Geospace Sciences, 2009–2010.
  - Member, NSF Advisory Committee for Geosciences, 2008–2010.
  - Chair, Committee of Visitors, NSF Upper Atmosphere Section, 2008.
  - Chair, NASA Living with a Star Targeted Research and Technology Steering Committee, 2005–2007.
  - Co-Chair, NASA Advanced Modeling & Simulation Technology Capability Roadmap team, 2004–2005.
  - Member, NASA Living with a Star Targeted Research and Technology Stearing Committee, 2004–2005.
  - Member, NSF Petascale Computing for Geosciences Committee, 2004–2005.
  - Member, NSF Steering Committee for Cyberinfrastructure Research and Development in the Atmospheric Sciences (CyRDAS), 2003–2004.
  - Chair, Committee on Space Research (COSPAR) Commission D (Space Plasmas including Planetary Magnetospheres), 1996–2000.
  - Member, Committee on Solar and Space Physics, Space Studies Board, US National Research Council, 1996–1999.
  - Member, NASA Planetary Atmospheres Management Operations Group, 1991–93.
  - Member, NASA Space Physics Theory Working Group, 1990–93.
  - Executive Committee Member, COSPAR Commission B1, 1984–88.
  - Executive Committee Member, COSPAR Commission D, 1982–86.
  - Member, Plasma Science and Halley Environment Working Groups, Inter-Agency Consultative Group (IACG), 1982–86.
  - Chair (1987–91) and Co-Chair (1979–87), International Association of Geomagnetism and Aeronomy (IAGA) Division IV (Solar Wind and Interplanetary Magnetic Field).

- University of Michigan Committees An incomplete list of his committee service is:
  - Chair, Shasha Zou's Reappointment Coommittee, 2017–2018
  - Member, CoE's Endowed/Collegiate Professorship Advisory Committee, 2017
  - Chair, Justin Kasper's Reappointment Committee, 2016–2017
  - Member, CLaSP Awards Committee, 2016–present
  - As department Chair, *Ex Officio* Chair/Member of a large number of AOSS and College of Engineering committees, 2003–2011.
  - Member, Russel Awards Faculty Advisory Committee, 2006–2008.
  - Member, AERO-AOSS Merge Committee, 2002–2003.
  - Chair, AOSS Space Physics Tenure-Track Faculty Search Committee, 1998–1999.
  - Member, AOSS Departmental Review Committee, 1998.
  - Chair, SPRL Review Committee, 1998.
  - Program Advisor, Interdepartmental Graduate Program in Space and Planetary Physics, 1996–2006.
  - Program Advisor, Master of Engineering in Space Systems, 1995–2003.
  - Member, Aerospace Engineering Department Chair Search Committee, 1995-1996.
  - Member, Graduate Committee, Department of Atmospheric, Oceanic & Space Sciences (AOSS), 1986–89 and 1993–95.
  - Executive Committee Member, AOSS, 1986–89 and 1993–95.
  - Chair, Honors and Awards Committee, College of Engineering, 1993–94.
  - Seminar Chair, AOSS, 1991–92.
  - Member, Computer Committee, SPRL and AOSS, 1984–92.
  - Member, Laboratory for Scientific Computations (LaSC) review committee, 1990.
  - Co-Chair, Space Physics Research Laboratory (SPRL) Director Search Committee, 1989–90.
  - Member, SPRL Review Committee, 1989.
  - Executive Committee Member, SPRL, 1986–87.

MEMBERSHIPS IN SCIENTIFIC SOCIETIES

- American Association for the Advancement of Science.
- American Geophysical Union.
- American Physical Society.
- Division for Planetary Sciences, American Astronomical Society.
- European Geophysical Union.

PUBLICATIONS
Tamas I. Gombosi

Books and Edited Books

1. T. I. Gombosi, **Physics of the Space Environment**, Cambridge University Press, Cambridge, UK, doi: 10.1017/CBO978051152947
2. T. I. Gombosi, **Gaskinetic Theory**, Cambridge University Press, Cambridge, UK, doi: 10.1017/CBO9780511524943,1994.
3. T. I. Gombosi (ed.), **Plasma Environments of Non-Magnetic Planets**", Pergamon Press, Oxford, United Kingdom, 1993.
4. T. I. Gombosi, S. K. Atreya, E. Grün and M. S. Hanner (eds.), **Cometary Environments**, Pergamon Press, Oxford, United Kingdom, 1989.
5. T. I. Gombosi (ed.), **Cometary Exploration**, KFKI Press, Budapest, Hungary, 1983.
6. M. Beöthy and T. Gombosi (eds.), **A Magyar Űrkutatás 10 Éve**, KFKI Press, Budapest, Hungary, 1981.

Articles in Peer Reviewed Journals

2020

1. Altwegg, K., H. Balsiger, N. Hänni, M. Rubin, M. Schuhmann, I. Schroeder, T. Sèmon, S. Wampfler, J.-J. Berthelier, C. Briois, M. Combi, T. I. Gombosi, H. Cottin, Jo. DeKeyser, F. Dhooghe, B. Fiethe, S. A. Fuselier, Evidence of ammonium salts in comet 67P as explanation for the nitrogen depletion in cometary comae, **Nature Astronomy**, **???**, ???, doi: 10.1038/s41550-019-0991-9, 2020. [PDF]
2. S. P. Moschou, S.P., I. V. Sokolov, O. Cohen, G. Toth, J. J. Drake, Z. Huang, C. Garraffo, J. D. Alvarado-Gomez and T. Gombosi, Coupled MHD – Hybrid Simulations of Space Plasmas, **arXiv**, **???**, eprint=1911.08660, doi: ???, 2020. [PDF]
3. Combi, M.R., Y. Shou, N. Fougere, V.Tenishev, K.Altwegg, M. Rubin, D. Bockelée-Morvan, F Capaccioni, Y.-C. Cheng, U. Fink, T.I. Gombosi, K.C. Hansen, Z. Huang, D. Marshall, G. Toth, The Surface Distributions of the Production of the Major Volatile Species, H2O, CO2, CO and O2, from the Nucleus of Comet 67P/Churyumov-Gerasimenko throughout the Rosetta Mission as Measured by the ROSINA Double Focusing Mass Spectrometer, **Icarus**, **335**, 113421, doi: 10.1016/j.icarus.2019.113421, 2020. [PDF]

2019

4. Hoang, M., Garnier, P., Gourlaouen, H., Lasue, J., Rème, H., Altwegg, K., Balsiger, H., Beth, A., Calmonte, U., Fiethe, B., Galli, A., Gasc, S., Jäckel, A., Korth, A., Le Roy, L., Mall, U., Rubin, M., Sémon, T., Tzou, C.-Y., Waite, J. H., Wurz, P., Two years with comet 67P/Churyumov-Gerasimenko: H2O, CO2, and CO as seen by the ROSINA/RTOF instrument of Rosetta, **Astron. Astrophys.**, **630**, A33, doi:10.1051/0004-6361/201834226, 2019. [PDF]
5. DeKeyser, J., A. Gibbons, F. Dhooghe, K. Altwegg, H. Balsiger, J.-J. Berthelier, S.A. Fuselier, T.I. Gombosi, E. Neefs, M. Rubin, Calibration of parent and fragment ion detection rates in Rosettas ROSINA/DFMS mass spectrometer, **Int. J. Mass Spectrometry**, **446**, 116233, doi:10.1016/j.ijms.2019.116233, 2019. [PDF]
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32. T. Gombosi, Koronalyukak szerepe a Nap-Föld kapcsolatokban (Coronal holes and solar-terrstrial relations), in "*Ionoszféra és Magnetoszféra Fizika VII*", 7-38, 1979.

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35. T. Gombosi, A napszél és a Föld tipusú bolygók kölcsönhatása (Solar wind interaction with terrestrial planets), in "*Csillagászati Évkönyv az 1978 évre*", 205-219, Gondolat, Budapest, Hungary, 1977.

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37. T. Gombosi, Szoláris kozmikus sugárzás vizsgálatok a PROGNOZ-3 automatikus ürállomás segitségével (Solar cosmic ray studies on board the PROGNOZ-3 satellite), in "*Ionoszféra és Magnetoszféra Fizika III*", 37-46, 1975.

38. T. Gombosi, A külsö geomágneses tér vizsgálata 1-100MeV-es töltött részecskék segitségével (The study of external geomagnetic fields by means of 1-100MeV particles), in "*Ionoszféra és Magnetoszféra Fizika I.*", 85-106, 1973.

Invited Talks

2018

1. T. I. Gombosi, Space Weather Modeling, *International Symposium and School on Space Simulations (ISSS-13)*, Los Angeles, CA, September 6–14, 2018.
2. T. I. Gombosi, Simulating Space Weather, *Gringauz 100: Plasmas in the Solar System*, Moscow, Russia, June 13 – 15, 2018.
3. T. I. Gombosi, Simulations of the 67P/CG plasma environment, *Rosetta Science Workshop*, Rhodes, Greece, May 28 – June 1, 2018.

2017

4. T. I. Gombosi, Magnetosphere Modeling: From Cartoons to Simulations, Van Allen Lecture, *2017 Fall AGU Meeting*, New Orleans, LA, December 11–15, 2017.

2016

5. K. Altwegg, H. Balsiger, A. Bar-Nun, J.-J. Berthelier, A. Bieler, P. Bochsler, C. Briois, U. Calmonte, M. Combi, J. De Keyser, F. Dhooghe, B. Fiethe, S. A. Fuselier, S. Gasc, T. I. Gombosi, K. C. Hansen, M. Hässig, E. Kopp, A. Korth, L. Le Roy, U. Mall, B. Marty, O. Mousis, T. Owen, H. Rème, M. Rubin, T. Sémon, C.-Y. Tzou, J. H. Waite, P. Wurz, Highlights of the Rosetta mission from the Rosetta orbiter spectrometer for Ion and Neutral Analysis (ROSINA), *Comets: A New Vision after Rosetta and Philae*, Toulouse, France, November 14–18, 2016.
6. Michael R. Combi, Kathrin Altwegg, Andre Bieler, Fabrizio Capaccioni, Dominique Bockelée-Morvan, Nicolas Fougere, Tamas I. Gombosi, Kenneth C. Hansen, Alessandra Migliorini, Martin Rubin, Valeriy Tenishev, Modeling Comet Activity: Connecting In Situ and Remote Sensing Measurements, *Comets: A New Vision after Rosetta and Philae*, Toulouse, France, November 14–18, 2016.
7. Tamas I. Gombosi, Andre Bieler, Michael R. Combi, Nicolas Fougere, K.C. Hansen, Zhenguang Huang, Yinsi Shou, Valeriy Tenishev, Gabor Toth Kathrin Altwegg and Martin Rubin, Modeling Cometary Activity, *"From Giotto to Rosetta" 50th ESLAB Symposium*, Leiden, The Netherlands, March 14–18, 2016.

2015

8. T. I. Gombosi, Fully two-way coupled 3D PIC-MHD simulation, *12th International School/Symposium for Space Simulations (ISSS-12)*, Prague, Czech Republic, July 3–10, 2015.
9. T. I. Gombosi, Cassini's Grand Finale and Going Back to Jupiter, *Magnetospheres of Outer Planets 2015*, Atlanta, Georgia, June 1–5, 2015.

2014

10. T. I. Gombosi, Cassini at Saturn: Science Today and in the Final Three Years, *2014 Fall AGU Meeting*, San Francisco, CA, December 15–19, 2014.
11. T. I. Gombosi, MHD modeling of the solar wind interaction with planets, *40th COSPAR Scientific Assembly*, Moscow, Russia, August 2–10, 2014.
12. T. I. Gombosi, Model developer's view: Role of CCMC in R2O, *2014 CCMC Workshop*, Annapolis, Maryland,

March 31–April 4, 2014.

13. T. I. Gombosi, G. Toth, I. V. Sokolov, B. van der Holst, D. Welling, AWSOM and MARCIE: Transitioning space weather simulation tools to operations, *6th Isradynamics Conference*, Ein Bokek, Israel, March 16–22, 2014.

2013

14. Bart van der Holst, Ward Manchester, Igor Sokolov, Gabor Toth, Tamas I. Gombosi, The scientific challenges to forecasting the propagation of space weather through the heliosphere, *2013 Fall AGU Meeting*, San Francisco, CA, December 9–13, 2013.
15. Spiro K. Antiochos, Judith T. Karpen, C Richard DeVore, Tamas I. Gombosi, Bart van der Holst, Ward Manchester, Igor Sokolov, Modeling Flares/CMEs from their Solar Origins to their Interplanetary Impacts, textit2013 Fall AGU Meeting, San Francisco, CA, December 9–13, 2013.
16. T.I. Gombosi, X. Jia, J.A. Slavin, L.K.S. Daldorff, Simulations of Mercury's Magnetosphere, *Fundamental Properties and Processes of Magnetotails*, AGU Chapman Conference, Reykjavik, Iceland, March 10-15, 2013.
17. T.I. Gombosi, B. van der Holst, I. Sokolov, W.B. Manchester, R. Oran, and M. Jin, A new two-temperature model of the solar wind and CMEs, *5th Earth-Sun System Exploration Conference*, Kona, Hawaii, January 14–18, 2013.

2012

18. T.I. Gombosi, G. Toth, B. van der Holst, I. Sokolov, W.B. Manchester, L.K.S. Daldorff, D. DeZeeuw, D.T. Welling, A.J. Ridley, M.W. Liemohn, R. Oran, X. Meng, M. Jin, New Adventures with the Space Weather Modeling Framework, *2012 Fall AGU Meeting*, San Francisco, CA, December 3–7, 2012.
19. T.I. Gombosi, Multiscale Simulations of Space and High Energy Density Plasmas, *Computational Challenges in Magnetized Plasma*, IPAM Workshop, UCLA, Los Angeles, CA, April 16-20, 2012.

2011

20. T.I. Gombosi, The Physical Origins of Space Weather Impacts: Modeling Challenges, *2011 Fall AGU Meeting*, San Francisco, CA, December 5–9, 2011.
21. R.A. Frazin, A.M. Vasquez, B. van der Holst, W.B. Manchester, R. Oran, Z. Huang, M. Jin, T.I. Gombosi, Integrating Tomography and Global Simulation, *2011 Fall AGU Meeting*, San Francisco, CA, December 5–9, 2011.
22. T.I. Gombosi, K.C. Hansen, X. Jia, and M.G. Kivelson, The Magnetosphere of Saturn, *Joint EPSC-DPS meeting*, Nantes, France, October 3-7, 2011.
23. T.I. Gombosi, Computational MHD in Space Physics, *The 2011 Solar/Space MHD International Summer School*, University of Science and Technology of China, School of Earth and Space Sciences, Hefei, Anhui, China, 15–21 July, 2011.
24. T.I. Gombosi, MHD simulations of solar system plasmas, *Advanced Magnetohydrodynamics*, Leiden, The Netherlands, April 11-15, 2011.

2010

25. Y. Jia, C.T. Russell, K.K. Khurana, T.I. Gombosi, Modeling Enceladus and its torus in Saturn's magnetosphere, *2010 Fall AGU Meeting*, San Francisco, CA, December 13-17, 2010.
26. X. Jia, K.C. Hansen, T.I. Gombosi, M.G. Kivelson, G. Tóth, D. De Zeeuw, A.J. Ridley, Global MHD simulations of the interaction between Saturn's magnetosphere and the solar wind, *2010 Fall AGU Meeting*, San Francisco, CA, December 13-17, 2010.
27. W.B. Manchester, B. van der Holst, R.A. Frazin, A.M. Vasquez, G. Tóth, T.I. Gombosi, Numerical Simulation of Earth Directed CMEs with an Advanced Two-Temperature Coronal Model, *2010 Fall AGU Meeting*, San Francisco, CA, December 13-17, 2010.
28. A. Glocer, G. Tóth, M.H. Fok, T.I. Gombosi, D.T. Welling, Modeling Ionospheric Outflows In Global Models, *2010 Fall AGU Meeting*, San Francisco, CA, December 13-17, 2010.
29. B. van der Holst, M. Jin, W.B. Manchester, R.A. Frazin, A.M. Vasquez, P.L. Lamy, A. Llebaria, T.I. Gombosi, Multispacecraft Validation of a Global Two-Temperature Corona and Inner Heliosphere Model, *2010 Fall AGU*

Meeting, San Francisco, CA, December 13-17, 2010.

30. B. van der Holst, M. Jin, W.B. Manchester, R.A. Frazin, A.M. Vasquez, P.L. Lamy, A. Llebaria, T.I. Gombosi, Partition of Proton and Electron Heating in the Solar Wind, *2010 Fall AGU Meeting*, San Francisco, CA, December 13-17, 2010.
31. T.I. Gombosi, G. Tóth, I.V. Sokolov, D.L. De Zeeuw, B. van der Holst, A.J. Ridley, W.B. Manchester, The Space Weather Modeling Framework (SWMF): Models and validation, *38th COSPAR Scientific Assembly*, Bremen, Germany, July 18-25, 2010.
32. T. I. Gombosi, D. L. De Zeeuw, W. B. Manchester, A. J. Ridley, I. V. Sokolov, G. Tóth, B. van der Holst, Is SWMF ready for R2O?, *Space Weather Workshop*, Boulder, CO, April 29, 2010.
33. T.I. Gombosi, Toward forecasting space weather, *Isradynamics 2010*, Ein Bokek, Dead Sea, Israel, April 11-16, 2010.

2009

34. T. I. Gombosi, D. L. De Zeeuw, W. B. Manchester, A. J. Ridley, I. V. Sokolov, G. Tóth, B. van der Holst, The Space Weather Modeling Framework: Progress and Challenges, *11th IAGA Scientific Assembly*, Sopron, Hungary, Aug 23-30, 2009.

2008

35. Gombosi, T.I., T.P. Armstrong, C.S. Arridge, K.K. Khurana, S.M. Krimigis, N. Krupp, A.M. Persoon and M.F. Thomsen, Saturn's Magnetospheric Configuration, *Saturn Book Symposium*, London, United Kingdom, July 28 - August 1, 2008.
36. Gombosi, T.I., G. Tóth, I.V. Sokolov, D.L. De Zeeuw, B. van der Holst, O. Cohen, A. Glocer, W.B. Manchester, A.J. Ridley, Multi-physics simulations of space weather, *37th COSPAR Scientific Assembly*, Montreal, Canada, July 13-26, 2008.
37. Opher, M., E. Stone, J. Richardson, G. Tóth, D. Alexashov, V. Izmodenov, T.I. Gombosi, When magnetized winds collide: Role of the interstellar magnetic field shaping the heliosphere, *37th COSPAR Scientific Assembly*, Montreal, Canada, July 13-26, 2008.
38. T. I. Gombosi, A. Glocer, G. Tóth, A. J. Ridley, I. V. Sokolov, D. L. De Zeeuw, Multi-Fluid Simulations of a Coupled Ionosphere-Magnetosphere System, *2008 Spring AGU Meeting*, Fort Lauderdale, FL, May 27-30, 2008.
39. T.I. Gombosi, G. Tóth, I. Sokolov, D.L. De Zeeuw, W.B. Manchester, A.J. Ridley, R.A. Frazin, B. van der Holst, O. Cohen, A. Glocer, D. Welling, Validation Studies with the Space Weather Modeling Framework, *Space Weather Workshop*, Boulder, CO, April 29-May 2, 2008.
40. T.I. Gombosi, Simulating everything under the Sun: Coupled model of solar and heliospheric disturbances, Earth-Sun System Exploration Conference, Kona, Hawaii, January 14-18, 2008.

2007

41. T.I. Gombosi, G. Tóth, I. Sokolov, D.L. De Zeeuw, O. Cohen, A. Glocer, Y. Ma, K.C. Hansen, W.B. Manchester, A.J. Ridley, K.G. Powell and Q.F. Stout, Adventures with the Space Weather Modeling Framework, *Space Weather Workshop*, Boulder, CO, April 24-27, 2007.
42. Gombosi, T.I., Glocer, A., Tóth, G., Hansen, K.C., Ridley, A.J., Modeling ionospheric outflows with the Space Weather Modeling Framework, *2007 EGU General Assembly*, Vienna, Austria, April 16-20, 2007.
43. Ridley, A., Wang, H., Yu, Y., Tóth, G., De Zeeuw, D., Gombosi, T., Modeling Results From the Space Weather Modeling Framework During a Variety of Storms, *2007 EGU General Assembly*, Vienna, Austria, April 16-20, 2007.
44. Manchester, W.B., Gombosi, T.I., Sokolov, I.V., Cohen, O., Simulated CMEs and predictions for STEREO, *2007 EGU General Assembly*, Vienna, Austria, April 16-20, 2007.
45. T.I. Gombosi, G. Tóth, I.V. Sokolov, D.L. De Zeeuw, Y. Ma, A.J. Ridley, K.C. Hansen and W.B. Manchester, New Adventures with the Space Weather Modeling Framework, *8th International School/Symposium for Space Simulations*, Kauai, HI, February 25 - March 3, 2007.

2006

46. Ridley, A.J., Tóth, G., Sokolov, I.V., De Zeeuw, D.L., Liemohn, M.W., Gombosi, T.I., Computational Considerations in Modeling the Space Environment, *2006 Fall AGU Meeting*, San Francisco, CA, December 11-15, 2006.
47. Desai, M.I., Cohen, C.M., Smith, C.W., Lee, M.A., Litvinenko, Y., Reames, D.V., Ng, C.K., Tylka, A.J., Kota, J., Giacalone, J., Jokipii, J.R., Sokolov, I., Gombosi, T.I., Roussev, I.I., Li, G., Zank, G.P., Tessein, J., Recent Results of the 2005 LWS TR&T Focus Team for Solar Energetic Particles, *2006 Fall AGU Meeting*, San Francisco, CA, December 11-15, 2006.
48. T.I. Gombosi, G. Tóth, I.V. Sokolov, D.L. De Zeeuw, A.J. Ridley, Coupled Modeling with the Space Weather Modeling Framework, *Challenges to Modeling the Sun-Earth System (Huntsville 2006 Workshop)*, Nashville, Tennessee, October 2-6, 2006.
49. T.I. Gombosi, G. Tóth, I.V. Sokolov, D.L. De Zeeuw, A.J. Ridley, W.B. Manchester, Sun-to-Earth Simulations with the Space Weather Modeling Framework, *International Symposium on Recent Observations and Simulations of the Sun-Earth System (ISROSES)*, Varna, Bulgaria, September 17-22, 2006.
50. T.I. Gombosi, End-to-end space weather simulations, *Isradynamics*, Dead Sea, Israel, May 8-15, 2006.
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10. Five-moment Two-Electron Plasma Simulation for Comet 67P/Churyumov-Gerasimenko, Zhenguang Huang, Gabor Toth, Tamas Gombosi, Xianzhe Jia, Michael Combi, Kenneth Hansen, Yinsi Shou, Valeriy Tenishev, Kathrin. Altwegg, and Martin Rubin, *2019 EGU General Assembly*, Vienna, Austria, April 7–12, 2019.
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