

Guest Editorial

Special Issue—Golden Anniversary of TPS

IN LATE 2021, Dr. Steven Gitomer, the Editor-in-Chief of IEEE TRANSACTIONS ON PLASMA SCIENCE (TPS), approached me about organizing a Golden Anniversary Special Issue of TPS (I am the Guest Editor for review articles for the journal). This Special Issue was to commemorate both the 50th Anniversary of the IEEE TPS (vol. PS-1, Issue 1 appeared in March 1973) (Figs. 1 and 2) and the 50th Anniversary of the IEEE International Conference on Plasma Science (which I chaired in Santa Fe, NM, USA, on May 21–25, 2023) (Figs. 3 and 4). We discussed this Special Issue and agreed to target potential contributors. Twelve prospective lead authors were invited to contribute. Eight contributions were ultimately received, went through peer review, and appear in this Special Issue. Looking at the Table of Contents of the inaugural issue, it is clear that the focus areas of TPS have evolved over the past half century. Some of the articles in this Special Issue would fit in nicely with the collection of articles in the inaugural issue whereas others reflect the amazing breadth of the field of plasma science.

The first article [A1] is by Miller. This article would have fit comfortably in the inaugural issue of TPS. Miller had a 32-year career with General Electric and is an active consultant. The second article [A2] is by Tsurutani et al. Space plasma physics has matured as a field over the past half century. Tsurutani has been with the Jet Propulsion Laboratory (JPL), Pasadena, CA, USA, since 1973. The third article [A3] is by Ang and colleagues from the Singapore University of Design and Technology (SUDT), Singapore. This article takes the theory of field emission, which dates back to the dawn of the 20th century, and expands it to consider emerging two-dimensional Dirac-like materials and topological materials. The fourth article [A4] is by Domonkos and Tichá from the Czech Technical University in Prague, Prague, Czech Republic. This article describes the use of atmospheric pressure plasmas in industry. The fifth article [A5] is by Joshi of Texas Tech University, Lubbock, TX, USA, and collaborators. IEEE TPS has been publishing pulsed power-related articles since 1994. The sixth article [A6] is by Ramachandran of Michigan State University, Lansing, MI, USA, and collaborators. Particle-in-Cell methods have revolutionized much of plasma science since the early 1990s. The seventh article [A7] is by Huang et al. of the University of Regina, Regina, SK, Canada and collaborators. Machine learning and artificial intelligence are rapidly growing capabilities, and this article applies it

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Fig. 1. Table of Contents from IEEE TPS, Vol. PS-1, Issue 1.

It is a great pleasure to write the first words in the new IEEE Transactions on Plasma Science. For the first time, this exciting branch of human inquiry is now firmly established in the IEEE family. Until the creation of this journal, there existed no single publication outlet for engineers engaged in research in this rapidly growing field.

After nearly two years of negotiations with the Nuclear Science Group, the IEEE has authorized the publication of this newest of the IEEE Transactions, and has given its approval for the creation of the Nuclear and Plasma Sciences Society (S-NPS). This Society will continue to publish our sister journal, the Transactions on Nuclear Science, and, in doing so, becomes the only IEEE Society to publish two separate Transactions. It is our firm wish to draw together the scientific endeavors of those who are interested in the plasma science, not only by means of a common publication, but with technical meetings as well.

Fig. 2. Excerpt from the Guest Editorial of first IEEE TPS.

Color versions of one or more figures in this article are available at <https://doi.org/10.1109/TPS.2023.3292333>.

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to laser-induced breakdown spectroscopy with application to soil analysis. Finally, the eighth article [A8] is by Wang of Los Alamos National Laboratory, Los Alamos, NM, USA,



Fig. 3. IEEE TPS Editor-in-Chief Steve Gitomer presenting the History of IEEE TPS as part of the 50th Anniversary Panel that took place at the 50th Anniversary of ICOPS at the Eldorado Hotel in Santa Fe, NM, USA, on May 24, 2023.



Fig. 4. Golden Anniversary Special Issue of TPS Guest Editor Ed Schamiloğlu (left) together with IEEE TPS Editor-in-Chief Steve Gitomer (right) following the awards banquet at the 50th Anniversary of ICOPS at the Eldorado Hotel in Santa Fe, NM, USA, on May 24, 2023.

and a long list of international contributors. A large amount of data and machine learning algorithms go hand in hand. Most plasma data, whether experimental, observational, or computational, are generated or collected by machines today.

This article highlights the latest development and progress in the interdisciplinary field of data-driven plasma science (DDPS).

I would like to thank the contributors to this Special Issue and the reviewers tasked with ensuring these articles merited publication in this Golden Anniversary Special Issue. I would like to thank Steve Gitomer and the TPS administrative staff for their support with this process.

The next 50 years will likely bring unimaginable advances to the field of plasma science and I hope the students of today will celebrate the 100th Anniversary of TPS and the 100th Anniversary of ICOPS in 2073!

APPENDIX: RELATED ARTICLES

- [A1] H. C. Miller, "Vacuum arcs," *IEEE Trans. Plasma Sci.*, vol. 51, no. 7, pp. 1585–1594, Jul. 2013, doi: [10.1109/TPS.2023.3261779](https://doi.org/10.1109/TPS.2023.3261779).
- [A2] B. T. Tsurutani et al., "Space plasma physics: A review," *IEEE Trans. Plasma Sci.*, vol. 51, no. 7, pp. 1595–1655, Jul. 2013, doi: [10.1109/TPS.2022.3208906](https://doi.org/10.1109/TPS.2022.3208906).
- [A3] W. J. Chan, C. Chua, Y. S. Ang, and L. K. Ang, "Field emission in emerging two-dimensional and topological materials: A perspective," *IEEE Trans. Plasma Sci.*, vol. 51, no. 7, pp. 1656–1670, Jul. 2013, doi: [10.1109/TPS.2022.3173469](https://doi.org/10.1109/TPS.2022.3173469).
- [A4] M. Domonkos and P. Tichá, "Low-temperature atmospheric pressure plasma treatment in the polymer and textile industry," *IEEE Trans. Plasma Sci.*, vol. 51, no. 7, pp. 1671–1681, Jul. 2013, doi: [10.1109/TPS.2023.3235266](https://doi.org/10.1109/TPS.2023.3235266).
- [A5] R. P. Joshi, A. L. Garner, and R. Sundararajan, "Review of developments in bioelectrics as an application of pulsed power technology," *IEEE Trans. Plasma Sci.*, vol. 51, no. 7, pp. 1682–1717, Jul. 2013, doi: [10.1109/TPS.2023.3281339](https://doi.org/10.1109/TPS.2023.3281339).
- [A6] O. H. Ramachandran, L. C. Kempel, J. P. Verboncoeur, and B. Shanker, "A necessarily incomplete review of electromagnetic finite element particle-in-cell methods," *IEEE Trans. Plasma Sci.*, vol. 51, no. 7, pp. 1718–1728, Jul. 2013, doi: [10.1109/TPS.2023.3257165](https://doi.org/10.1109/TPS.2023.3257165).
- [A7] Y. Huang, S. S. Harilal, A. Bais, and A. E. Hussein, "Progress toward machine learning methodologies for laser-induced breakdown spectroscopy with an emphasis on soil analysis," *IEEE Trans. Plasma Sci.*, vol. 51, no. 7, pp. 1729–1749, Jul. 2013, doi: [10.1109/TPS.2022.3231985](https://doi.org/10.1109/TPS.2022.3231985).
- [A8] Z. Wang, "Review of data-driven plasma science," *IEEE Trans. Plasma Sci.*, vol. 51, no. 7, pp. 1750–1838, Jul. 2013, doi: [10.1109/TPS.2023.3268170](https://doi.org/10.1109/TPS.2023.3268170).

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