



## DAFTAR PUSTAKA

- [1] S. Braccini, “Compact Mmedical Cyclotrons And Their Use for Radioisotope Production And Multi-disciplinary Research,” in *Proceedings of the 21st International Conference on Cyclotrons and their Applications*, 2016, pp. 229–234.
- [2] A. H. Shali, S. Silakhuddin, T. M. Atmono, T. Taufik, and R. S. Darmawan, “The Analysis of Cyclotronic Integrator in Cylindrical Coordinates for Simulation of Penning Ion Source of DECY-13 Cyclotron,” 2024.
- [3] V. Mironov, S. Bogomolov, A. Bondarchenko, A. Efremov, V. Loginov, and D. Pugachev, “Three-dimensional Modelling of Processes in Electron Cyclotron Resonance Ion Source,” *J. Instrum.*, vol. 15, no. 10, pp. 1–18, 2020, doi: 10.1088/1748-0221/15/10/P10030.
- [4] M. Leon *et al.*, “Development of A Novel Internal Radio-frequency Ion Source for Cyclotrons (IRISC),” in *20th International Conference on Ion Sources*, 2024, vol. 2743, no. 1, pp. 1–5, doi: 10.1088/1742-6596/2743/1/012037.
- [5] D. Winklehner, J. Conrad, J. Smolsky, L. Waites, and P. Weigel, “New Commissioning Results of the MIST-1 Multicusp Ion Source,” in *19th International Conference on Ion Sources –*, 2022, vol. 2244, no. 1, pp. 1–6, doi: 10.1088/1742-6596/2244/1/012013.
- [6] N. Y. Kazarinov *et al.*, “Axial Injection System of DC140 Cyclotron of FLNR JINR,” in *27th Russian Particle Acc. Conf.*, 2021, pp. 209–212, doi: 10.18429/JACoW-RuPAC2021-MOPSA50.
- [7] T. Kalvas, S. K. Hahto, J. H. Vainionpää, and S. B. W. K. N. Leung, “Multicusp Ion Source With External RF Antenna For Production of H- Ions,” 2007.
- [8] D. Leitner, D. Todd, and D. Winklehner, “Plasma Physics Fundamentals for Ion Sources,” in *U.S. Particle Accelerator School (USPAS) Lecture Note*, Lawrence Berkeley National Laboratory, 2018.
- [9] Q. Ji, X. Jiang, T. King, K. Leung, K. Standiford, and S. B. Wilde, “Improvement in Brightness of Multicusp-Plasma Ion Source,” 2002.
- [10] J. S. Fraser, “High Current Ion Sources for Accelerators,” *Nucl. Instruments Methods Phys. Res. Sect. A*, pp. 157–164, 1993.
- [11] Z. Xie and K. N. Leung, “Production of High-Charge State Ions Using an RF-Driven Ion Source,” *Rev. Sci. Instrum.*, pp. 421–423, 1995.
- [12] S. K. Hahto *et al.*, “Multicusp Ion Source With External RF Antenna for Production of Protons,” *Rev. Sci. Instrum.*, vol. 359, no. April 2003, pp. 355–359, 2004, doi: 10.1063/1.1642744.
- [13] C. Liu, W. Zhang, and J. Yang, “Simulation And Optimization of The Magnetic Field Configuration in RF-Driven Multicusp Ion Sources,” *J. Appl. Phys.*, 2013.
- [14] I. G. Brown, *The Physics and Technology of Ion Sources*. Wiley, 2004.
- [15] W. Zhang, C. Liu, and Y. Zhao, “Magnetic Field Configuration Study for Improved Plasma Confinement in RF Ion Sources,” *Vacuum*, vol. 144, pp. 220–225, 2017.
- [16] D. Leitner, D. Todd, and D. Winklehner, “Fundamentals of Ion Sources - Multicusp Ion Sources,” in *US Particle Accelerator School Lecture Note*, Berkeley Lab & USDOE, 2018.
- [17] A. J. Lieberman and M. A. Lichtenberg, *Principles of Plasma Discharges and Materials Processing*. John Wiley & Sons, 2005.
- [18] K. N. Leung and L. T. Perkins, “RF-Driven Multicusp Ion Sources,” *Rev. Sci. Instrum.*, vol. 58, no. 2, pp. 235–240, 1987.
- [19] C. K. Birdsall and A. B. Langdon, *Plasma Physics via Computer Simulation*. New York: Taylor & Francis, 2005.
- [20] Y. Li, L. Wang, and C. Zhao, “Hybrid PIC-FDTD Simulation of Inductively Coupled





- Plasma Ion Thruster, *Plasma Sources Sci. Technol.*, vol. 28, no. 8, p. 085001, 2019.
- [21] G. J. Andriana, “Cyclotron Produced Radionuclides: Principles And Practice,” in *Technical Reports Series No. 465*, IAEA, 2008.
- [22] Petrucci et al., “Energetics of Nuclear Reactions,” in *General Chemistry*, .
- [23] S. Mraz, “What are the Differences Between Linear Accelerators, Cyclotrons, and Synchrotrons?,” *Machine Design Magazine*, 2017.
- [24] K. S. Krane, *Introductory Nuclear Physics*. Wiley, 1987.
- [25] Britannica, “Cyclotron,” *Encyclopedia Britanica*, 2024. <https://www.britannica.com/technology/cyclotron>.
- [26] S. Richtberg, “Calculation of the Cyclotron frequency (non-relativistic).” [https://virtuelle-experimente.de/en/b-feld/anwendung/zyklotron2.php?utm\\_source=copilot.com](https://virtuelle-experimente.de/en/b-feld/anwendung/zyklotron2.php?utm_source=copilot.com) (accessed Jan. 25, 2026).
- [27] F. K. Azadboni and M. Sedaghatizade, “Negative Ion Confinement in the Multicusp Ion Source,” *J Fusion Energ*, vol. 29, pp. 168–176, 2010, doi: 10.1007/s10894-009-9252-8.
- [28] J. H. Kim, “Numerical Simulation of a Multi-Cusp Ion Source for High Current H - Cyclotron at RISP,” *Phys. Procedia*, vol. 66, pp. 498–505, 2015, doi: 10.1016/j.phpro.2015.05.065.
- [29] K. W. Ehlers, K. N. Leung, and J. R. Hiskes, “Multicusp Ion Sources,” *Rev. Sci. Instrum.*, vol. 52, no. 7, pp. 1115–1120, 1981.
- [30] R. Geller, *Electron Cyclotron Resonance Ion Sources and ECR Plasmas*. Institute of Physics Publishing, 1996.
- [31] K. N. Leung and K. W. Ehlers, “Plasma Production With RF Induction Discharge for Negative Hydrogen Ion Sources,” *Rev. Sci. Instrum.*, vol. 54, no. 1, pp. 56–61, 1983.
- [32] T. S. Taylor and M. D. Williams, “Characterization of RF-driven Multicusp Ion Sources,” *Rev. Sci. Instrum.*, vol. 61, no. 1, pp. 325–330, 1990.
- [33] P. A. Miller and M. E. Riley, “Radio-frequency Discharges and Plasma Density Scaling,” *J. Appl. Phys.*, vol. 82, no. 8, pp. 3689–3699, 1997.
- [34] W. Kraus, “RF Ion Sources,” in *CERN Accelerator School*, 2012, pp. 1–30.
- [35] V. K. Abgaryan, A. V. Melnikov, A. Y. Kupreeva, and O. D. Peisakhovich, “Optimizing the Design Geometry of Radio-frequency Ion Thrusters and Ion Sources,” *J. Surf. Investig.*, vol. 17, no. 2, pp. 135–143, 2023.
- [36] K. N. Leung and K. W. Ehlers, “Plasma Confinement in Multicusp Ion Sources,” *Rev. Sci. Instrum.*, vol. 52, no. 12, pp. 1899–1906, 1981.
- [37] A. Nishida and K. N. Leung, “Magnetic Field Configuration and Plasma Parameters in Multicusp Ion Sources,” *J. Appl. Phys.*, vol. 83, no. 5, pp. 2920–2927, 1998.
- [38] K. N. Leung, “Studies of RF-driven Multicusp Ion Sources,” *Rev. Sci. Instrum.*, vol. 60, no. 5, pp. 723–728, 1998.
- [39] S. Mochalsky, “Numerical Modeling of RF Multicusp Ion Sources for Negative Hydrogen Ion Production,” *Plasma Sources Sci. Technol.*, vol. 19, no. 4, p. 045018, 2010.
- [40] M. Bacal and M. Wada, “Negative Hydrogen Ion Production Mechanisms,” *Appl. Phys. Rev.*, vol. 2, no. 2, p. 021305, 2015.
- [41] M. Shoji and K. Tsumori, “RF Power Coupling Efficiency in Inductively Coupled Plasma Sources With Different Antenna Geometries,” *Plasma Sources Sci. Technol.*, vol. 28, no. 6, p. 065004, 2019.
- [42] F. F. Chen, *Introduction to Plasma Physics and Controlled Fusion*. Springer, 2016.
- [43] D. Leitner, D. Todd, and D. Winklehner, “Fundamentals of Ion Sources - Multicusp Ion Sources,” in *US Particle Accelerator School*, 2016.
- [44] H. Bahari, E. Ebrahimibasabi, S. Mostafa, and M. Fathi, “Enhancing Ion Current Density in Multicusp Ion Sources: Insights From Magnetic Field Design and





- [45] B. S. Rawat, S. K. Sharma, V. Prahalad, and U. K. Baruah, "Magnetic Confinement of Primary Electrons in a Ring Cusp Ion Source," in *International Congress on Plasma Physics (ICPP-2022)*, 2022, vol. 49, no. 4, p. 3121519, doi: 10.1109/TPS.2021.3121519.
- [46] M. Dekker, *Magnetic Materials and Their Characteristics*. 2004.
- [47] S. Lee, M. Kang, and Y. Kim, "Effects of Length-to-Width Ratio on Magnetic and Microstructural Properties of Die-Upset Nd – Fe – B Magnets," *Materials (Basel)*., vol. 17, pp. 1–12, 2024.
- [48] S. R. Lawrie, D. C. Faircloth, A. P. Letchford, C. Gabor, and J. K. Pozimsky, "Plasma Meniscus And Extraction Electrode Studies of the ISIS H- Ion Source," *Rev. Sci. Instrum.*, vol. 81, no. 2, 2010.
- [49] M. Turek and P. Węgierek, "Suppressing of Co-Extracted Electrons in a Negative Ion Source – Numerical Simulations," *Adv. Sci. Technol. Res. J.*, vol. 16, no. 5, pp. 1–10, 2022.
- [50] K. N. Leung and K. W. Ehlers, "Characteristics of The RF-Driven Multicusp Ion Source," *Appl. Phys. Lett.*, vol. 43, no. 8, pp. 771–773, 1983.
- [51] A. George, S. Melanson, D. Potkins, T. Stewart, M. Dehnel, and Y. Shimabukuro, "Improvement in RF Multicusp Negative Ion Source," in *Proceedings of IPAC2019*, 2019, pp. 1928–1931, doi: 10.18429/JACoW-IPAC2019-TUPTS001.
- [52] P. Zhao, D. Chen, D. Li, W. Qi, K. Xie, and C. Zuo, "Electromagnetic Fields and Antenna Impedance Analysis of an RF Ion Source at HUST," 2017.
- [53] D. Boonyawan, N. Chiraphatpimol, and T. Vilaithong, "Characteristics of a 13.56 MHz Radiofrequency-Driven Multicusp Ion Source," *Plasma Sources Sci. Technol.*, vol. 11, no. 3, pp. 389–396, 2002.
- [54] J. M. Mermet, "Inductively Coupled Plasma," *Encyclopedia of Analytical Science: Second Edition*. pp. 210–215, 2004, doi: 10.1016/B0-12-369397-7/00032-7.
- [55] K. N. Leung and K. W. Ehlers, "Plasma Confinement by Multicusp Magnetic Fields," *Rev. Sci. Instrum.*, vol. 53, no. 6, 1982.
- [56] K. Azadboni and Sedaghatzade, "Negative Ion Confinement in the Multicusp Ion Source," *J. Fusion Energy*, vol. 29, pp. 168–176, 2010.
- [57] M. Hoseinzade and A. Nijatje, "Development of H - Multicusp Ion Source," *Radiation Detection Technology and Methods*, vol. 2, no. 1. 2018, doi: 10.1007/s41605-018-0059-x.
- [58] D. Leitner, D. Todd, and D. Winklehner, "Fundamentals of Ion Sources - Ion Extraction," in *U.S. Particle Accelerator School (USPAS) Lecture Note*, 2018.
- [59] Reiser, *Theory and Design of Charged Particle Beams*, Wiley, 2008. Wiley, 2008.
- [60] F. F. Chen, *Introduction to Plasma Physics and Controlled Fusion*, 3rd ed. Springer, 2016.
- [61] K. Choe, K.-J. Chung, and Y. S. Hwang, "Modeling and Measurement of Hydrogen Ion Species Fractions in a Penning Plasma Discharge." 2016.
- [62] D. Leitner, D. Todd, and D. Winklehner, "Plasma Physics Fundamentals for Ion Sources," in *US Particle Accelerator School Lecture Note*, 2013.
- [63] A. Fridman, *Plasma Chemistry*, Cambridge University Press. Cambridge University Press, 2008.
- [64] T. E. Sheridan, *Plasma Physics and Engineering*. CRC Press, 2016.
- [65] D. Systèmes, "CST Studio Suite," <https://www.3ds.com/products/simulia/cst-studio-suite>.
- [66] R. Keller, "RF Driven Multicusp Ion Sources for High Current Applications," *Rev. Sci.*





- Instrum.*, vol. 63, no. 4, pp. 2762–2765, 1992.
- [67] K. N. Leung, “H<sup>-</sup> Production in A Multicusp Ion Source,” *Rev. Sci. Instrum.*, vol. 54, no. 1, pp. 56–59, 1983.
- [68] K. N. Leung, “High Current Ion Sources,” *IEEE Trans. Nucl. Sci.*, vol. 30, no. 4, pp. 2701–2707, 1983.
- [69] -----, “Pi Network Impedance Matching: Design and Solutions,” in *Cadence PCB Design & Analysis*, 2023.
- [70] Grebeinnikov, “Impedance Matching,” in *Lecture Note*, .
- [71] -----, “Pi-Match Impedance Matching Calculator.” .
- [72] M. Sharma, A. D. Patel, N. Ramasubramanian, R. Ganesh, and P. K. Chattopadhyay, “Leak Width IN A Multicusp Field Configuration,” in *27th IAEA Fusion ENergy Conference*, 2018, pp. 1–6.
- [73] T. Kalvas, O. Tarvainen, T. Ropponen, O. Steczkiewicz, and H. Clark, “IBSIMU: A three-dimensional simulation software for charged particle optics a ...,” *Rev. Sci. Instrum.*, vol. 81, no. 02B703, pp. 80–82, 2010, doi: 10.1063/1.3258608.
- [74] M. Xie, L. Liu, D. Liu, and H. Wang, “Three-dimensional simulation of electron extraction process and optimization of magnetic field based on multi-aperture structure of negative hydrogen ion source,” *Front. Phys.*, no. March, pp. 1–10, 2023, doi: 10.3389/fphy.2023.1131485.

