BUILDING LOW-COST RADIO ASTRONOMY CAPACITY IN NIGERIA WITH SDR-ENHANCED JOVIAN DAM OBSERVATIONS AT CBSS NSUKKA.

EUGENE IDOGBE
(Idoqbe E.A., Musa E.O., Oqbeiwi C.O., Ali J.O., Obieti F. N., & Ike J.C.)

2026 Conference

1.0 Overview

Jupiter emits strong natural radio emissions detectable from Earth, which provide valuable information about its magnetic environment [1][2].

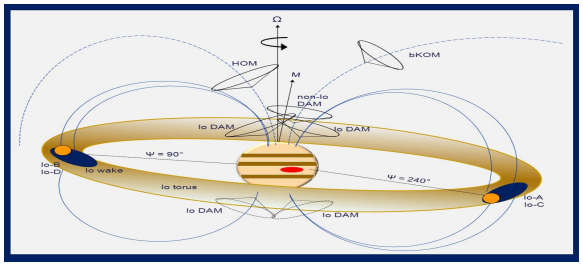

Figure 1. Jupiter Radio Emission Overview (*NASA RadioJOVE Science*)

Space- and ground-based observations have greatly improved our understanding of Jovian DAM emissions, while software-defined radio (SDR) has transformed radio instrumentation by providing flexible tuning, wide bandwidth, and advanced signal processing at low cost [3][4][5].

2.0 Materials and Methods

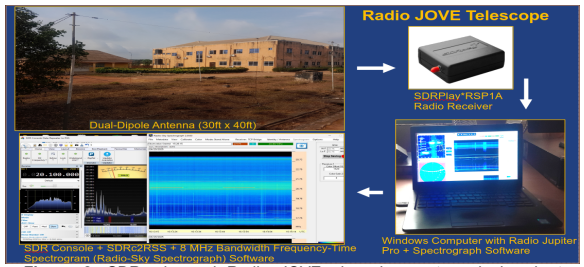

Figure 2. SDR-enhanced Radio JOVE observing system deployed at CBSS, Nsukka

The method involved setting up the station, scheduling observations, and collecting radio data within the 16.75–24.75 MHz range. Jovian signals were received, amplified, digitized, and converted into spectrograms using FFT. The data were then analyzed to identify DAM features and distinguish them from noise and radio-frequency interference

3.0 Results and Discussion

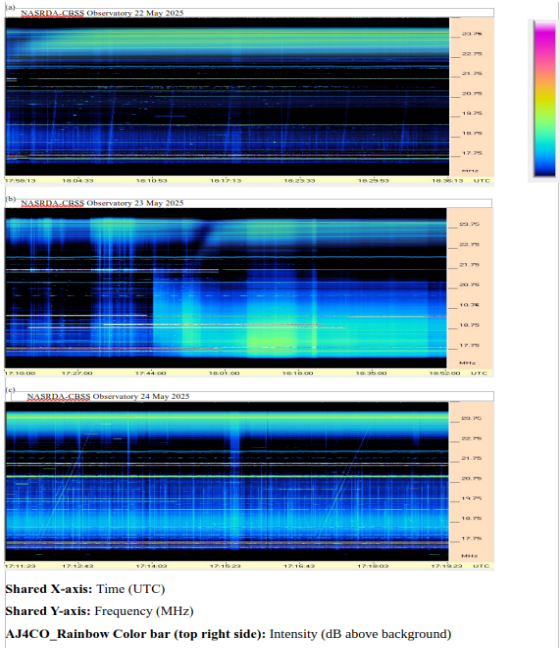

Figure 3. Dynamic spectra obtained with the SDR-enhanced Radio JOVE system at CBSS, Nsukka, during 22–24 May 2025.

(a) Broadband emission exhibiting L-burst structure characteristic of non-Io B DAM on 22 May (17:58–18:36 UTC) [1][6]. (b) Irregular, time-variable emission morphology consistent with non-Io A conditions on 23 May (17:10–18:52 UTC) [8]. (c) Weak emission interval typical of non-Io C conditions on 24 May (17:11–17:19 UTC) [1][7].

4.0 Conclusion

These findings confirm that SDR-enhanced Radio JOVE systems possess a practical platform for sustained low-frequency planetary radio astronomy and capacity building in emerging research environments. Future efforts will aim to extend observing campaigns, enhance RFI mitigation techniques, and improve data analysis skills to further augment scientific outcomes.

References

[1] Zarka, P. (1998). Auroral radio emissions at the outer planets: Observations and theories. *Journal of Geophysical Research*, **103**, 20159–20194. https://doi.org/10.1029/98JE01323

[2] Treumann, R. A. (2006), The electron-cyclotron maser for astrophysical application, *Astron. Astrophys. Rev.*, **13**, 229–315. https://doi.org/10.1007/s00159-006-0001-y

[3] Zarka, P., Queinnec, J., & Crary, F. J. (2001), Low-frequency radio astronomy from ground and space, *Planet. Space Sci.*, **49**, 1137–1149.

[4] Zheng, R., Wang, Y., Li, X., Wang, C., & Jia, X. (2023). Statistical study of the Jovian decametric radio emissions based on multiple-view observations from remote radio instruments. *Astronomy & Astrophysics*, *673*, A106.

[5] Wyglinski, A. M., Orofino, D. P., Ettus, M. N., & Rondeau, T. W. (2016). *Revolutionizing software-defined radio: Case studies in hardware, software, and education.* IEEE Communications Magazine, 54(1), 68–75.

[6] Carr, T. D., Desch, M. D., & Alexander, J. K. (1983), Phenomenology of magnetospheric radio emissions, in *Physics of the Jovian Magnetosphere*, ed. A. J. Dessler, 226–284, Cambridge Univ. Press.

[7] Genova, F., Zarka, P., & Lecacheux, A. (1989), Jupiter radio emissions controlled by the solar wind, *NASA Spec. Publ.*, **494**.