

---

# MAGNETIC PROPERTIES OF FINITE TEMPERATURE PRIMORDIAL ELECTRON-POSITRON PLASMA

---

A PREPRINT

Cheng Tao Yang<sup>ID</sup>\*, Andrew Steinmetz<sup>ID</sup>, and Johann Rafelski<sup>ID</sup>  
Department of Physics, The University of Arizona, Tucson, AZ 85721, USA

May 21, 2023

## ABSTRACT

to be written

**Keywords** Early Universe · Magnetization · Plasma Physics · Cosmology

## 1 Introduction

Today's universe is

## 2 Literatue Review

This is a list of papers that will be cited, and what is valuable within them.

- [1] experimental searches for cosmic fields
- [2] our review on matter-antimatter
- [3] review of dynamo-magnetization of galaxies
- [4] redshift evolution of primordial fields
- [5] measurement of IGMF from AGN polarization
- [6] measurement of IGMF via blazars
- [7] review of experimental bounds on IGMF and gamma ray bounds

## References

- [1] B. M. Gaensler, R. Beck, and L. Feretti. The origin and evolution of cosmic magnetism. *New Astronomy Reviews*, 48(11-12):1003–1012, 2004. doi:[10.1016/j.newar.2004.09.003](https://doi.org/10.1016/j.newar.2004.09.003).
- [2] J. Rafelski, J. Birrell, A. Steinmetz, and C. T. Yang. A short survey of matter-antimatter evolution in the primordial universe. *MDPI Universe*, 2023. doi:[10.48550/arXiv.2305.09055](https://doi.org/10.48550/arXiv.2305.09055).
- [3] P. P. Kronberg. Extragalactic magnetic fields. *Reports on Progress in Physics*, 57(4):325, 1994. doi:[10.1088/0034-4885/57/4/001](https://doi.org/10.1088/0034-4885/57/4/001).
- [4] V. P. Pomakov, S. P. O’Sullivan, M. Brüggen, F. Vazza, E. Carretti, G. H. Heald, C. Horellou, T. Shimwell, A. Shulevski, and T. Vernstrom. The redshift evolution of extragalactic magnetic fields. *Monthly Notices of the Royal Astronomical Society*, 515(1):256–270, September 2022. doi:[10.1093/mnras/stac1805](https://doi.org/10.1093/mnras/stac1805).
- [5] T. Vernstrom, G. Heald, F. Vazza, T. J. Galvin, J. L. West, N. Locatelli, N. Fornengo, and E. Pinetti. Discovery of magnetic fields along stacked cosmic filaments as revealed by radio and X-ray emission. *Monthly Notices of the Royal Astronomical Society*, 505(3):4178–4196, 05 2021. doi:[10.1093/mnras/stab1301](https://doi.org/10.1093/mnras/stab1301).

---

\*Correspondence: Put Official Email Here!

- [6] A. M. Taylor, I. Vovk, and A. Neronov. Extragalactic magnetic fields constraints from simultaneous gev–tev observations of blazars. *Astronomy & Astrophysics*, 529:A144, 2011. doi:[10.1051/0004-6361/201116441](https://doi.org/10.1051/0004-6361/201116441).
- [7] R. A. Batista and A. Saveliev. The gamma-ray window to intergalactic magnetism. *Universe*, 7(7), 2021. ISSN 2218-1997. doi:[10.3390/universe7070223](https://doi.org/10.3390/universe7070223).