

Magnetic Field Properties in Nearby Galaxy Clusters with POSSUM



Introduction

- Galaxy clusters are the largest self-gravitating structures.
- Most of their mass is in the intracluster medium, which also hosts their magnetic fields.
- A tool to probe cosmic magnetism is Faraday rotation:

$$\Delta\psi = RM\lambda^2$$

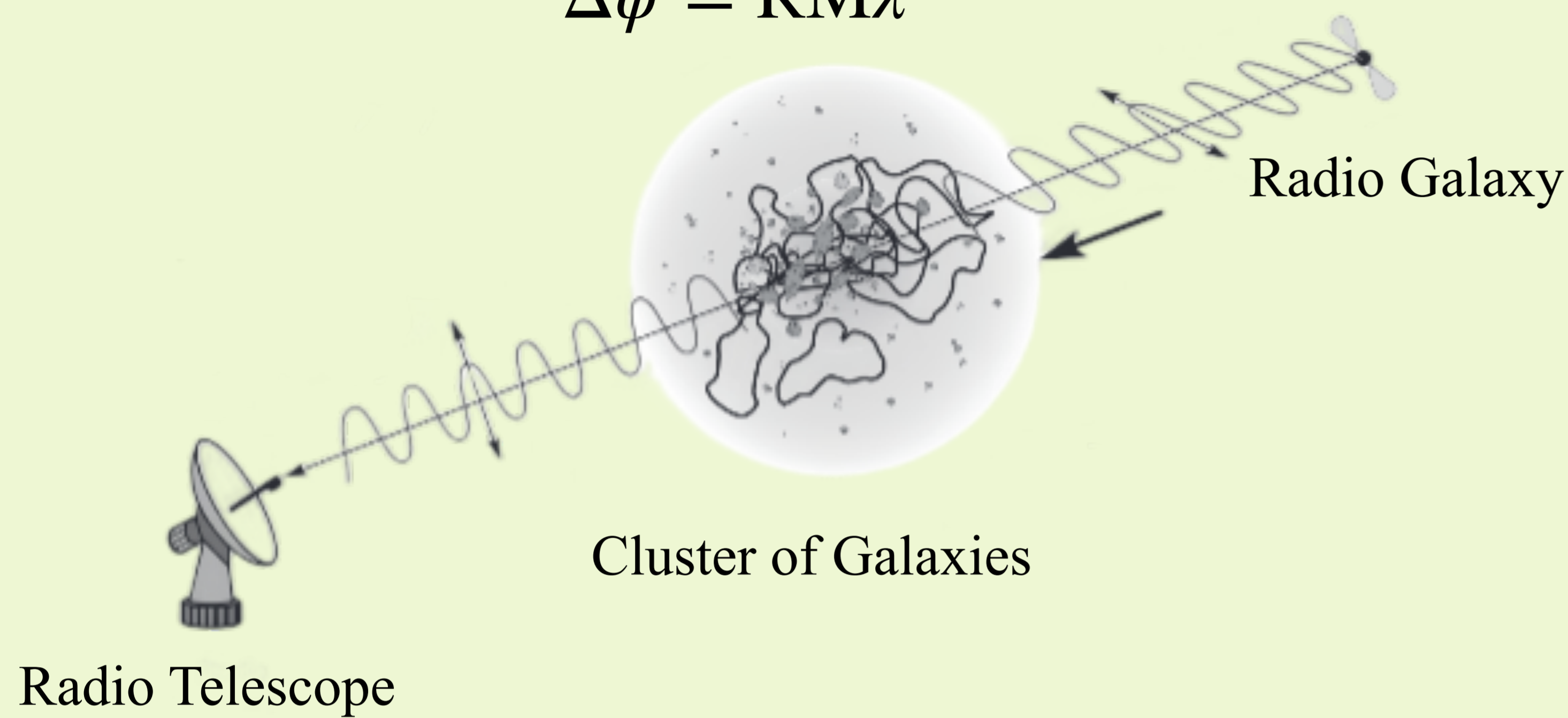


Figure 1: An illustration of Faraday rotation from Kronberg (2016).

Methods

- Used RM measurements from a POSSUM Pilot 1 field.
- Radio sources that had a signal-to-noise ratio below 10 were removed from the analysis.
- Made a correction to the Galactic RM using the RM map from Hutschenreuter et al. (2022) producing the RM profile shown in Figure 2.

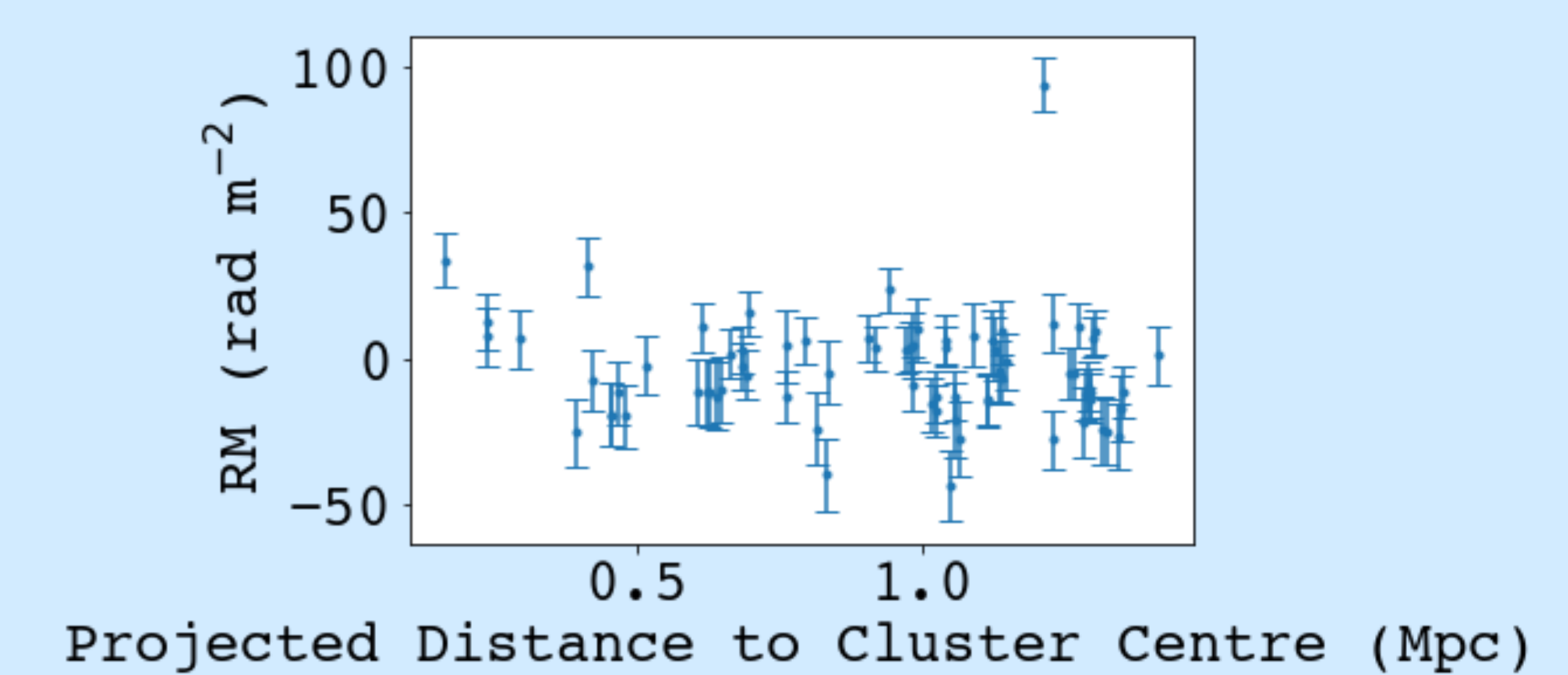


Figure 2: Distribution of RMs as a function of distance.

Results

- Looked for RM enhancement near cluster members. Figure 3 shows the RM scatter as a function of distance to the nearest cluster member.

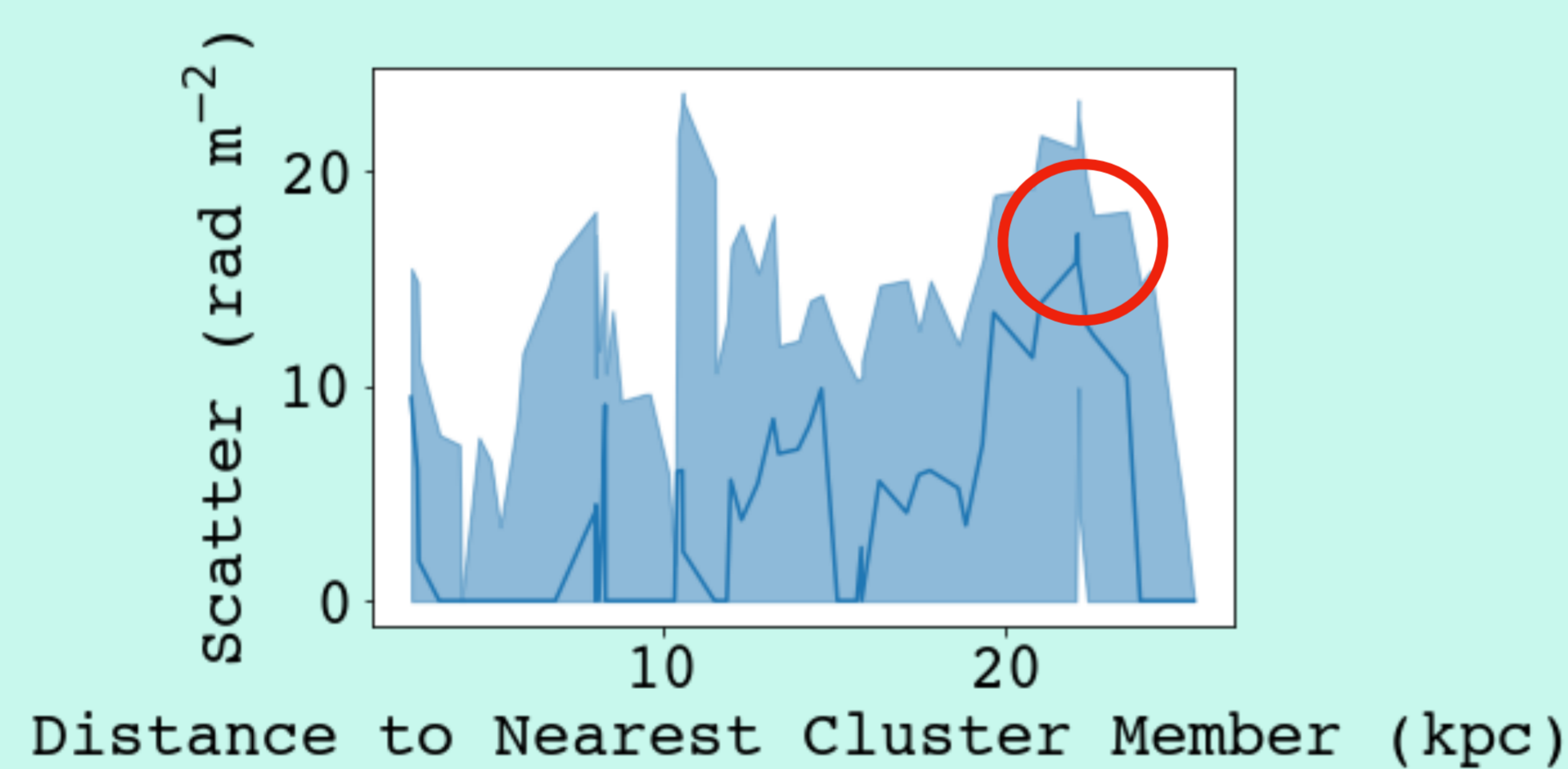


Figure 3: Scatter in the RMs as a function of projected distance to the closest cluster member.

- There is a peak in the RM scatter near 20 kpc from member galaxies, which is what is considered the distance from a galaxy where the inner edge of the circumgalactic medium is located (Kacprzak et al. 2010; Hummels et al. 2013).

- There is a negative RM filament that goes from the North-East to the South-West of the cluster as shown in Figure 4. This also corresponds to the location of some galaxy groups, indicating that we are likely probing a cosmic filament.

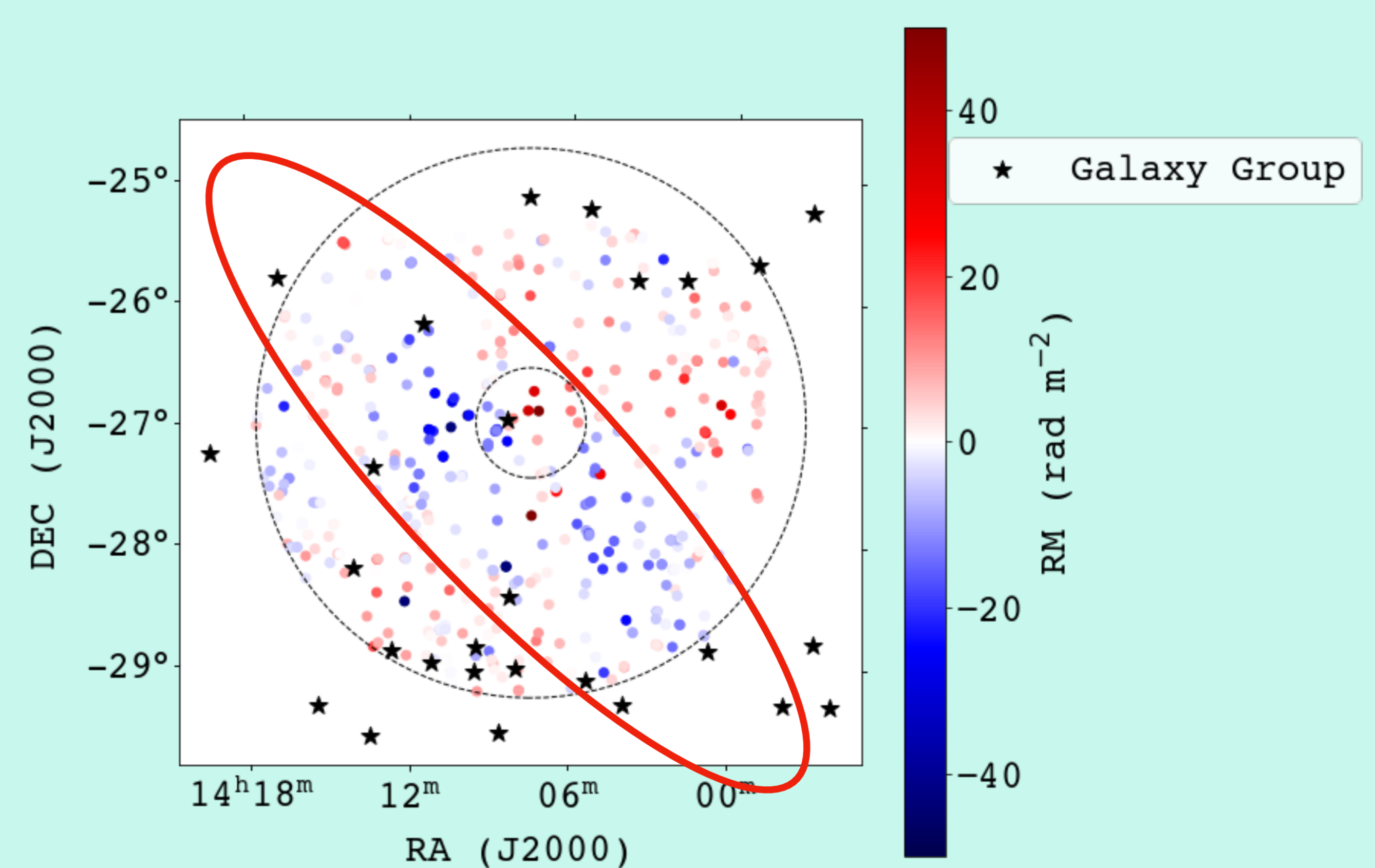


Figure 4: RM scatter plot along with galaxy groups overplotted from the 2MASS catalogue.

Conclusion

- There is possible RM enhancement near the inner edge of the CGM.
- We see a cosmic filament with negative RM.
- Analysis limited by number of polarised radio sources; other nearby clusters are future work.

References

- Gaensler, B. M., Landecker, T. L., Taylor, A. R., & POSSUM Collaboration. 2010, in American Astronomical Society Meeting Abstracts, Vol. 215, American Astronomical Society Meeting Abstracts #215, 470.13
- Vanderwoude, S., West, J. L., Gaensler, B. M., et al. 2024, AJ, 167, 226, doi: 10.3847/1538-3881/ad2fc8
- <https://possum-survey.org/>