The Very Best Limit on Cosmological Magnetic Fields

How Rotation Measures teach us everything about extra-Galactic Magnetic Fields

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So, QUESTIONS?

Introduction: We all want a good Magnetic Field

- Magnetic fields are just about everywhere in the Universe:
  - Planets and Stars
  - Galaxies and Clusters
  - Filaments
  - Voids?
  - The Entire Universe?
- Astro/Cosmo Physicists love some magnetic fields
  - Propagation of UHECRs
  - Structure formation
  - Very early Universe and beyond the Standard Model physics
  - Astrophysical plasmas, hydrodynamics
  - Radio-astronomy

Kronberg (1994); Grasso and Rubinstein (2001); Han and Wielebinski (2002); Vallée (2004); Govoni and Feretti (2004); Durrer and Neronov (2013); Subramanian (2015)

The Slide With The (One and Only) Formula

How do we look for extra-Galactic / Cosmological Magnetic Fields?

The Slide With The (One and Only) Formula

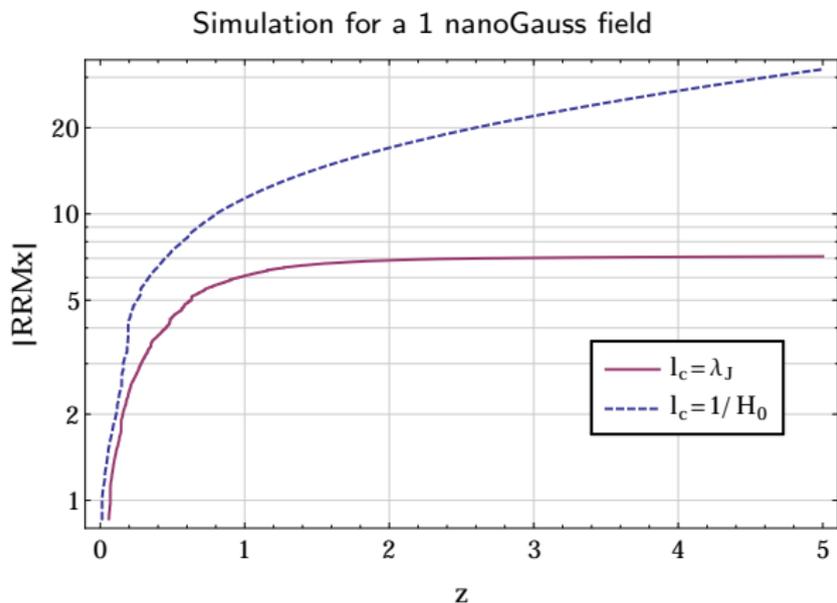**How do we look for extra-Galactic / Cosmological Magnetic Fields?**

$$\mathrm{RM} = 812 \int_{D}^{0} n_{\mathrm{e}}(z) B_{||}(z) \mathrm{d}l(z)$$

The polarisation angle of polarised light
ROTATES
when it travels through a magnetised medium

The Very Best Limits on egMF

M. S. Pshirkov, P. G. Tinyakov and FU, arXiv:1504.06546 [astro-ph.CO]
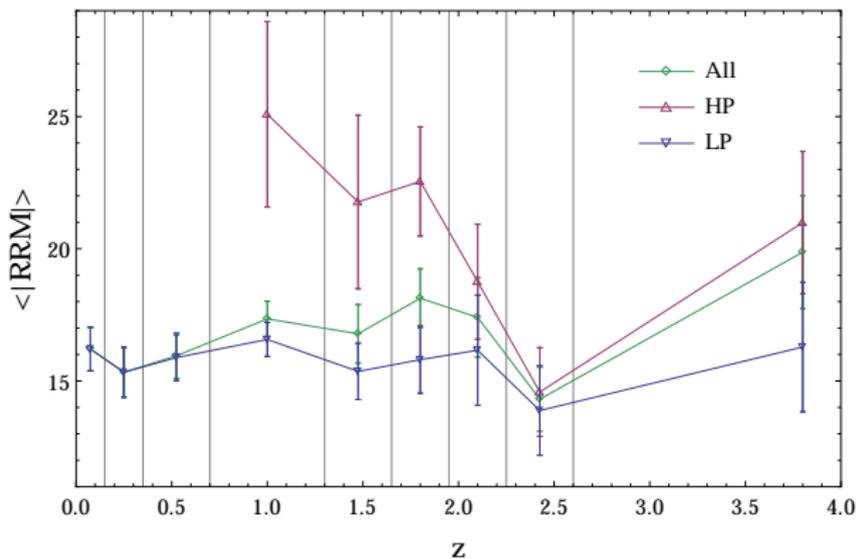
RM in theory

Simulation for a 1 nanoGauss field

The main ingredient here is the LogN electron density distribution taken from Lyα data (Bi and Davidsen (1997))

RM in practice

We have ~ 4K NVSS sources (of 40K) with known redshift and luminosity

Pshirkov, Tinyakov and FU (2014)

Taylor, Stil and Sunstrum (2009); Hammond, Robishaw and Gaensler (2013)

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③ We simulate xRM, and put it together with the rest: we have our final distro!

KS p-values
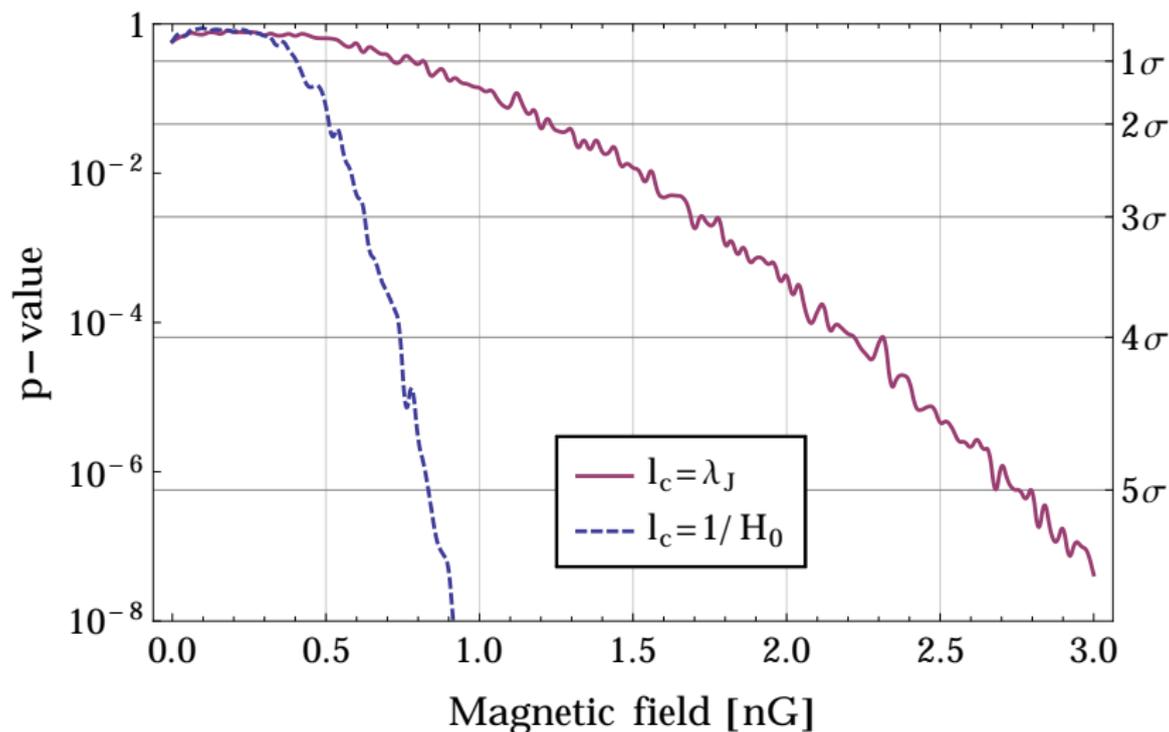
Conclusions

- RMs are a powerful tool to learn about the Universe's Magnetisation
- RMs of distant objects do not show any redshift evolution
- An egMF predicts a rising RM with redshift: compare with data!
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We win :)