

Summer research with Dr Cameron Van Eck

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Overview

- 1 Polarisation and magnetism
- 2 Correcting RMtools code
- 3 Correcting bandwidth depolarisation

Polarisation and magnetism

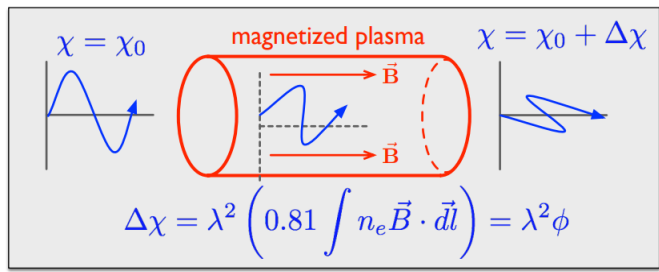
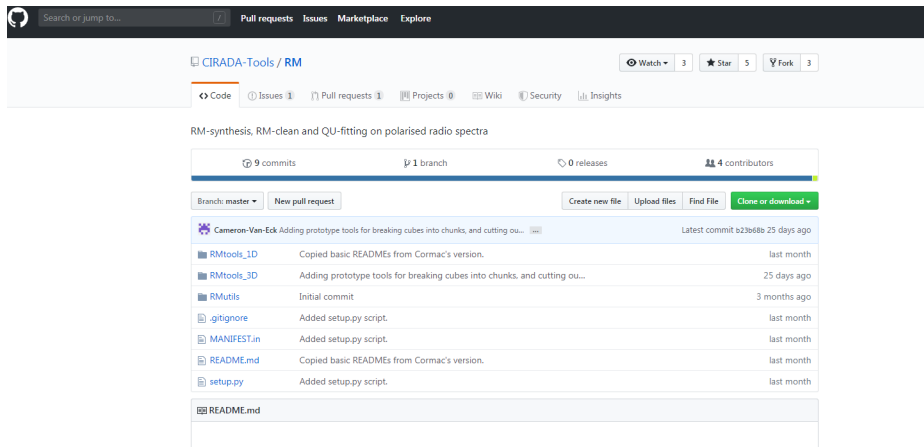


Figure: Faraday rotation

Correcting some codes in RMtools



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CIRADA-Tools / RM

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Code Issues 1 Pull requests 1 Projects 0 Wiki Security Insights

RM-synthesis, RM-clean and QU-fitting on polarised radio spectra

9 commits 1 branch 0 releases 4 contributors

Branch: master New pull request Create new file Upload files Find File Clone or download

Cameron-Van-Eck Adding prototype tools for breaking cubes into chunks, and cutting out... Latest commit b23b68b 25 days ago

RMtools_1D	Copied basic READMEs from Cormac's version.	last month
RMtools_3D	Adding prototype tools for breaking cubes into chunks, and cutting out...	25 days ago
RMutils	Initial commit	3 months ago
.gitignore	Added setup.py script.	last month
MANIFEST.in	Added setup.py script.	last month
README.md	Copied basic READMEs from Cormac's version.	last month
setup.py	Added setup.py script.	last month
README.md		

Figure: Github project

Rotation measure synthesis

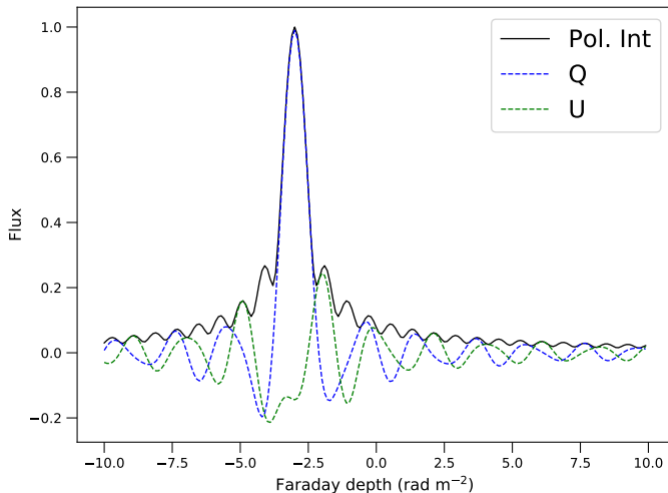


Figure: Faraday rotation measurement

correcting bandwidth depolarisation

what is bandwidth depolarisation ?

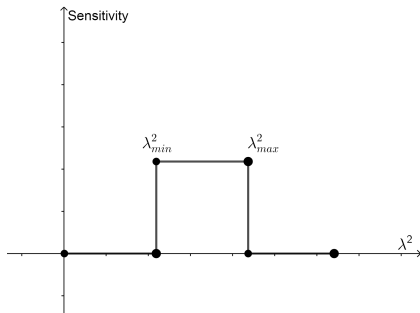


Figure: A channel with a top-hat response in wavelength squared

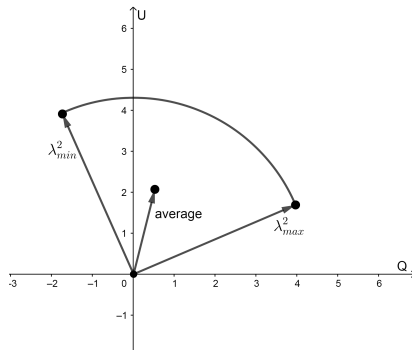


Figure: Sum of all the polarisation vectors along a channel

what is the problem with bandwidth depolarisation?

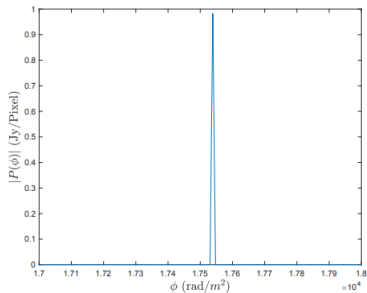


Figure: RM spectrum with depolarisation **CORRECTED**

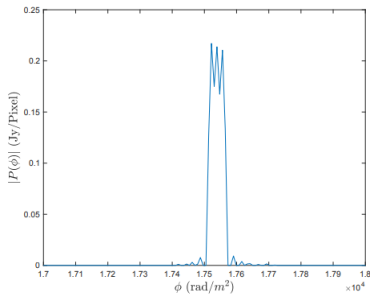


Figure: RM spectrum with depolarisation **NON-CORRECTED**

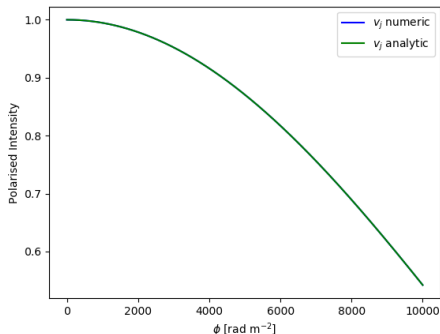
$$v_j = \int_{\lambda_{min}^2}^{\lambda_{max}^2} \frac{1}{(\lambda^2)^{\frac{3}{2}}} e^{-2iRM\lambda^2} d\lambda^2 \quad (2)$$

(derived from the paper: D.H.F.M. Schnitzeler, K.J. Lee. *Rotation measure synthesis revisited*, MNRAS, Nov 2014) is the sum of all the polarisation vector along a channel.

- v_j should simulate bandwidth depolarisation of a channel

-Inside RMtools, $\frac{1}{v_j}$ should correct the loss of flux during RMs because of bandwidth depolarisation.

result 1



We numerically tested the solution of v_j vs RM and it works perfectly.

It shows that **bandwidth depolarisation** becomes **stronger** at **large RM**, as expected.

Figure: Decreasing of v_j vs RM

result 2

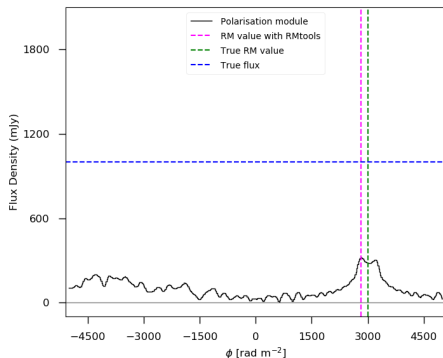


Figure: RM spectrum of 3000 rad/m² with the old RMtools non-corrected

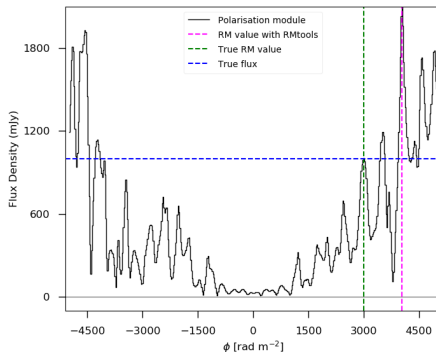


Figure: RM spectrum of 3000 rad/m² with the new RMtools corrected with $\frac{1}{v_j}$