Summer research with Dr Cameron Van Eck

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Overview

1. Polarisation and magnetism
2. Correcting RMtools code
3. Correcting bandwidth depolorisation

Polarisation and magnetism

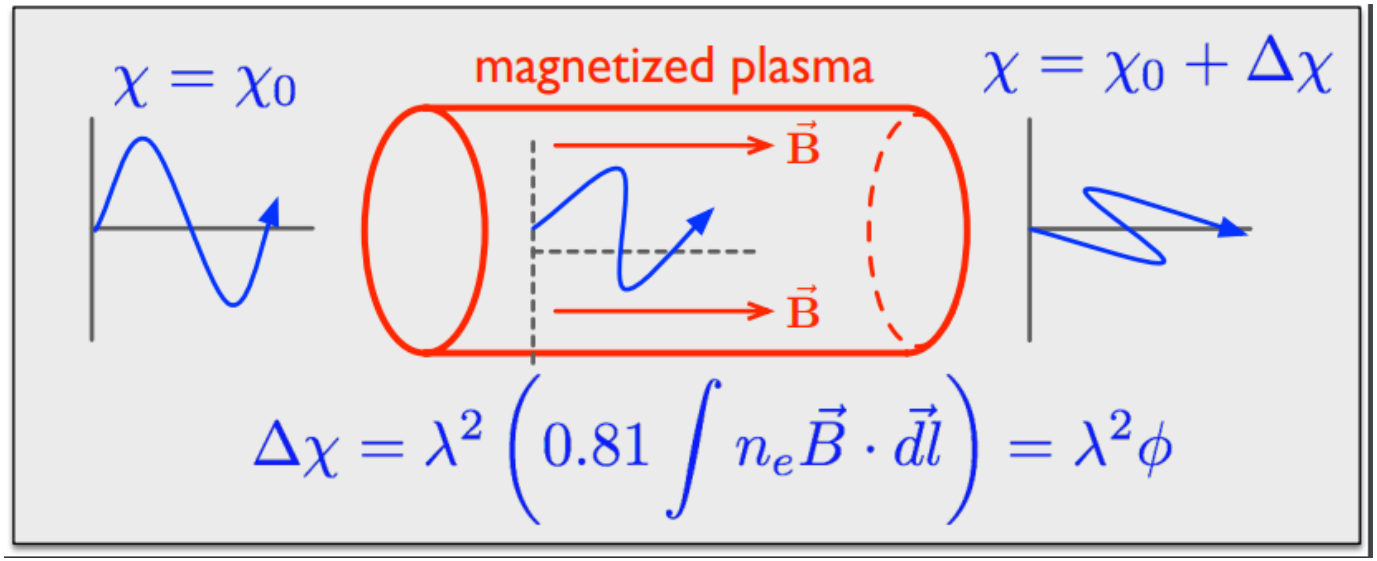

Figure: Faraday rotation

Correcting some codes in RMtools

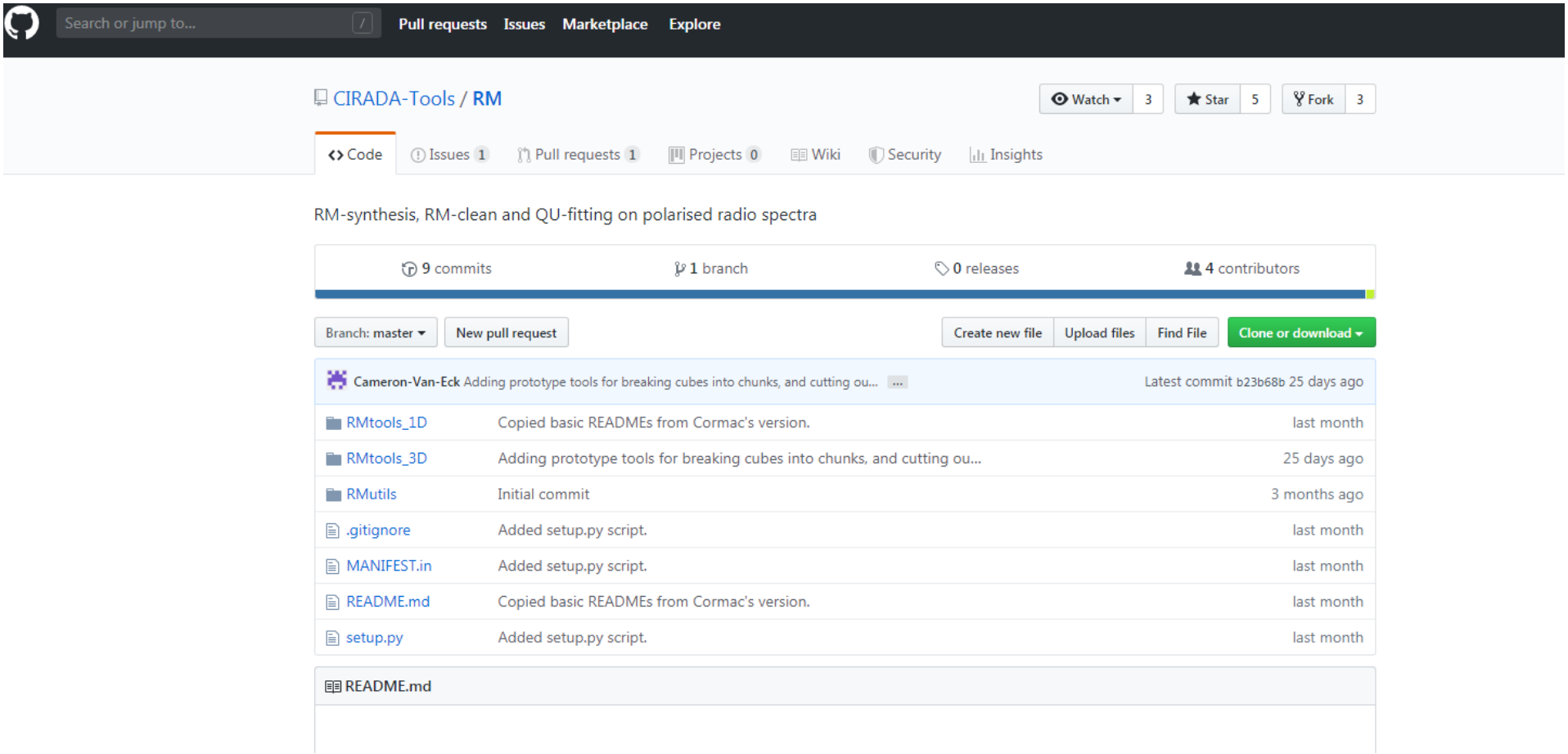

Figure: Github project

Rotation measure synthesis

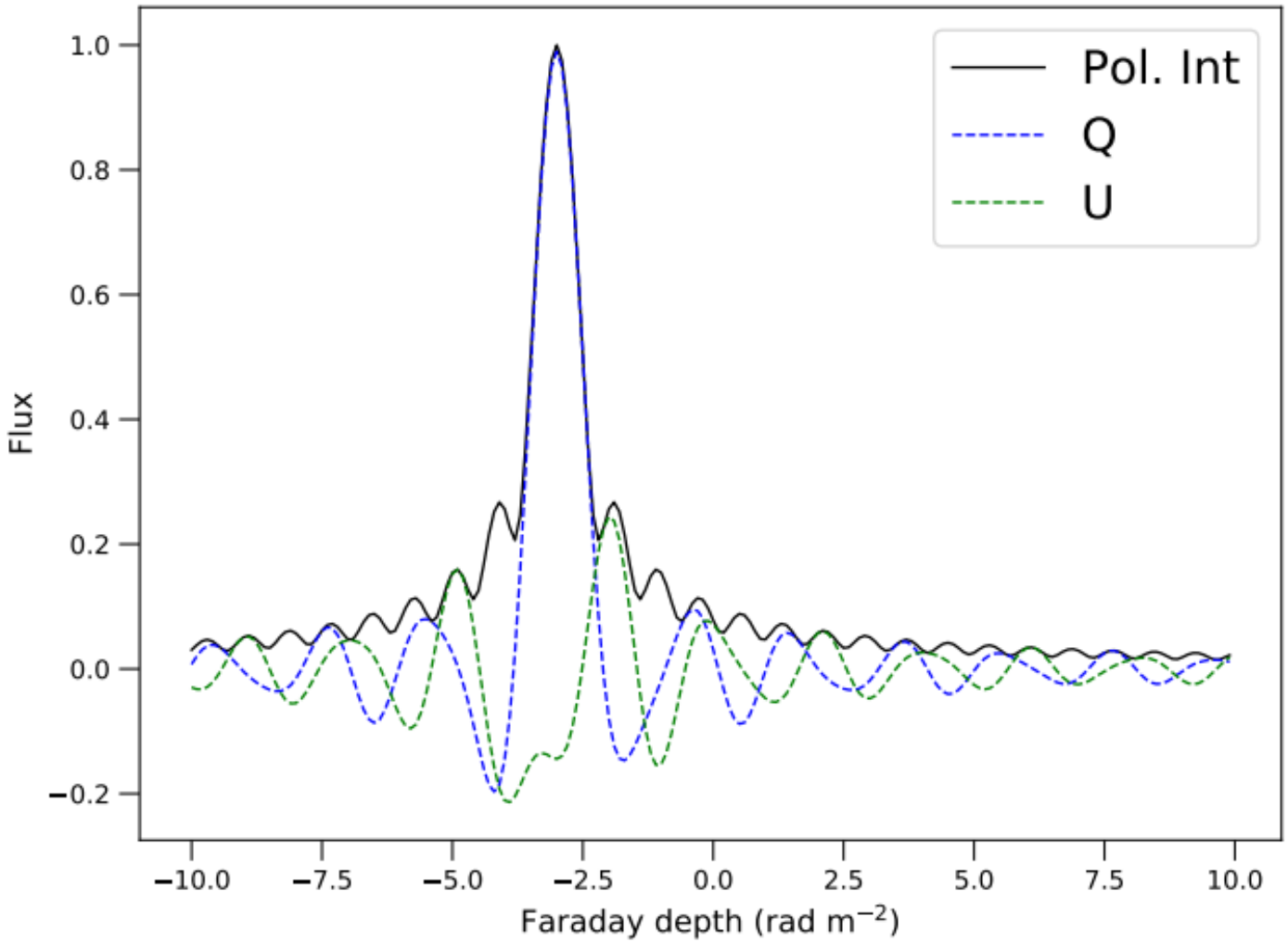

Figure: Faraday rotation measurement

correcting bandwidth depolorisation

what is bandwidth depolorisation ?

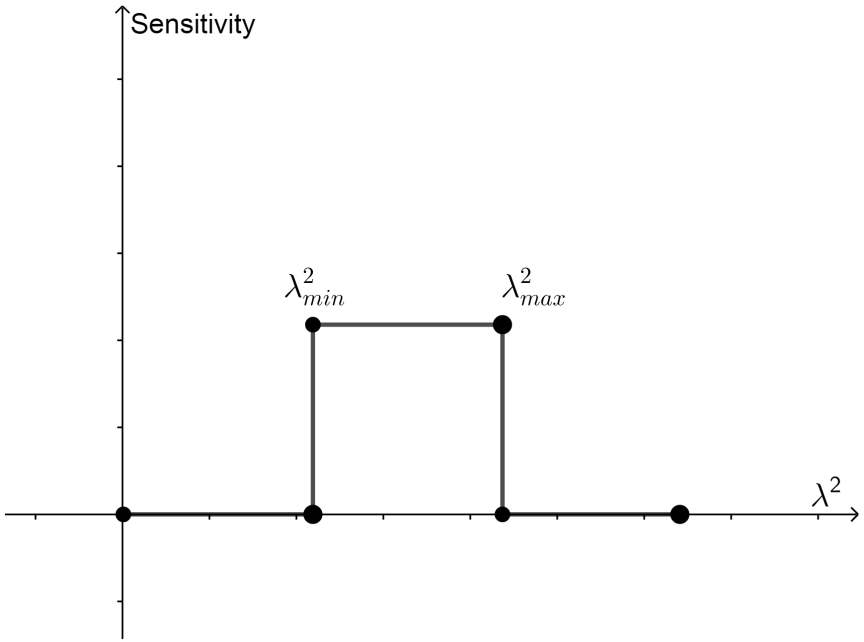

Figure: A channel with a top-hat response in wavelength squared

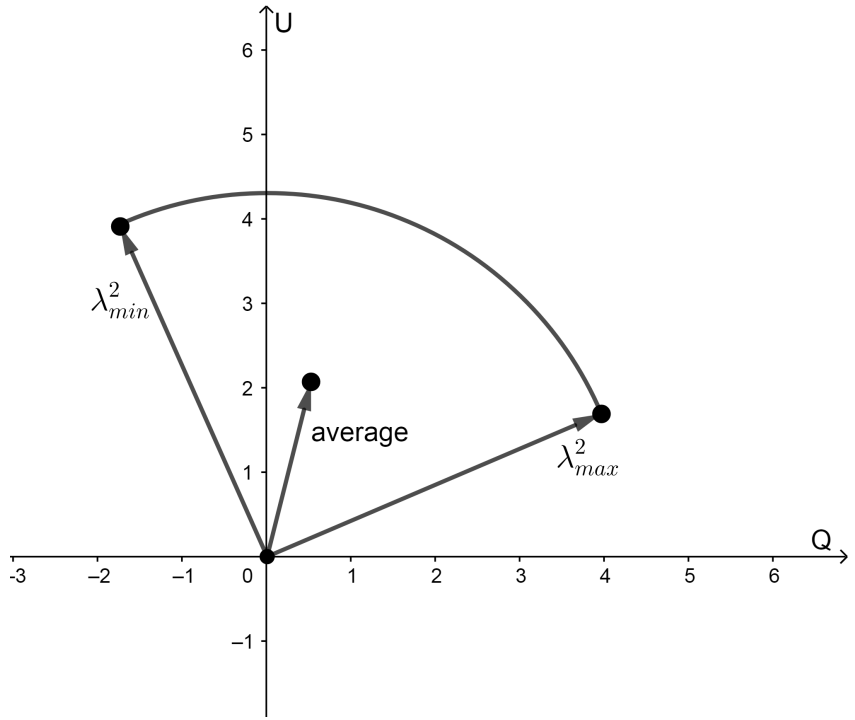

Figure: Sum of all the polarisation vectors along a channel

what is the problem with bandwidth depolorisation?

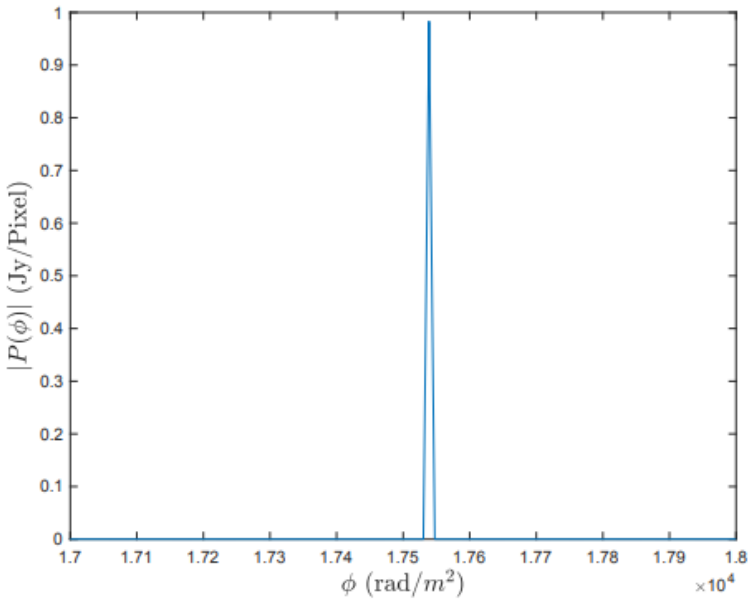

Figure: RM spectrum **with depolorisation CORRECTED**

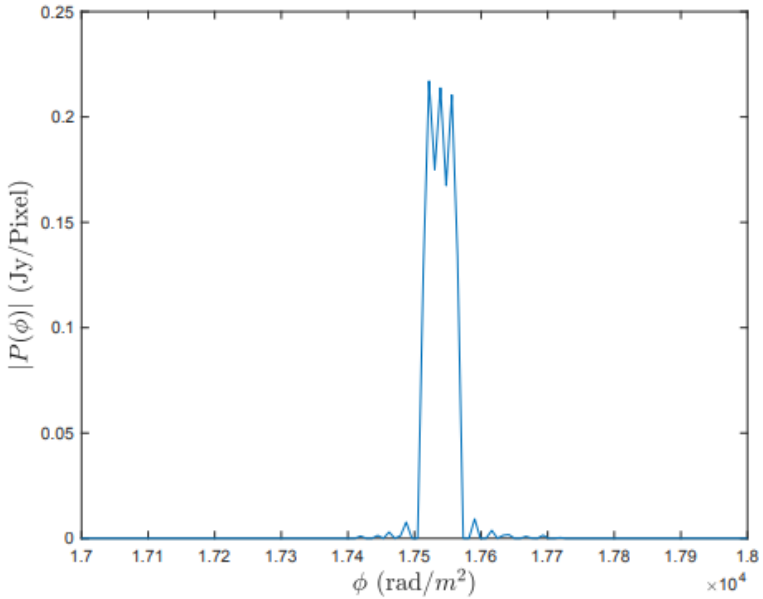

Figure: RM spectrum **with depolorisation NON-CORRECTED**

Solutions

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

(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 depolorisation of a channel**

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

result 1

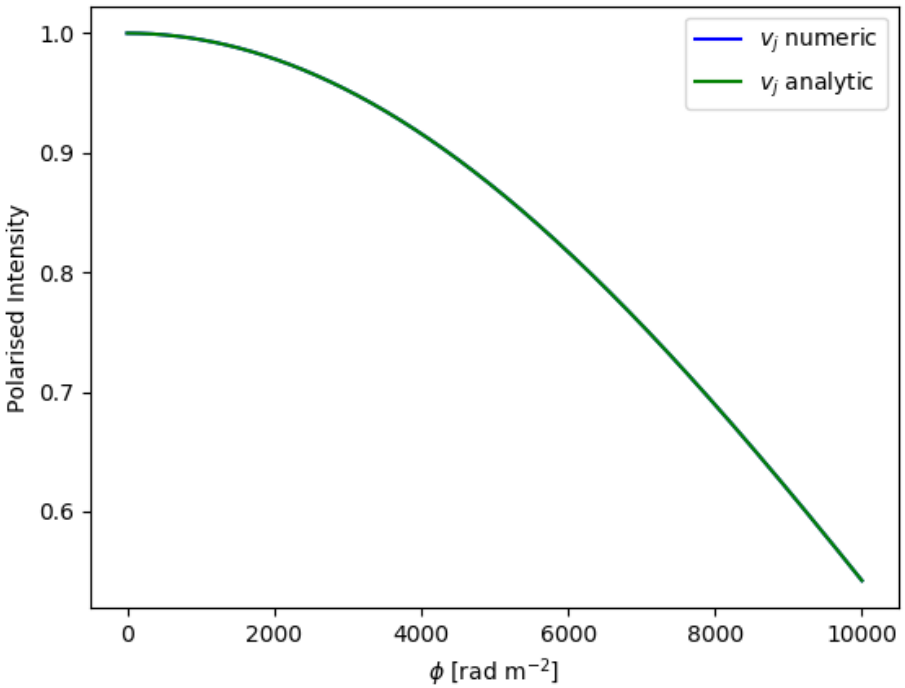

Figure: Decreasing of v_j vs RM

We numerically tested the solution of v_j vs RM and it works perfectly.
It shows that **bandwidth depolorisation** becomes **stronger** at **large RM**, as expected.

result 2

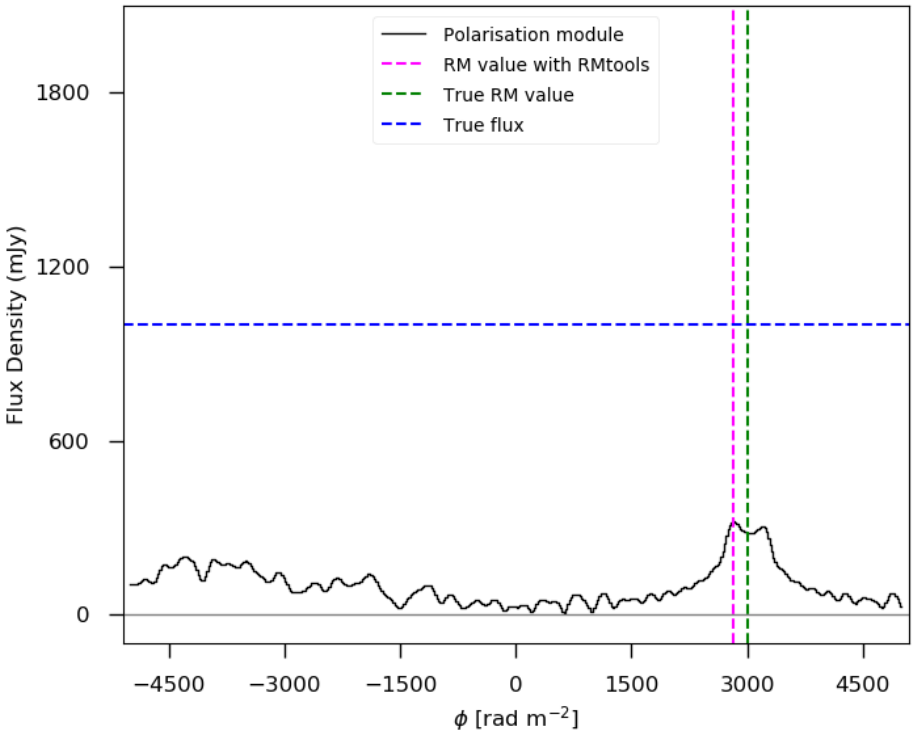

Figure: RM spectrum of 3000 rad/m^2 with the old RMtools non-corrected

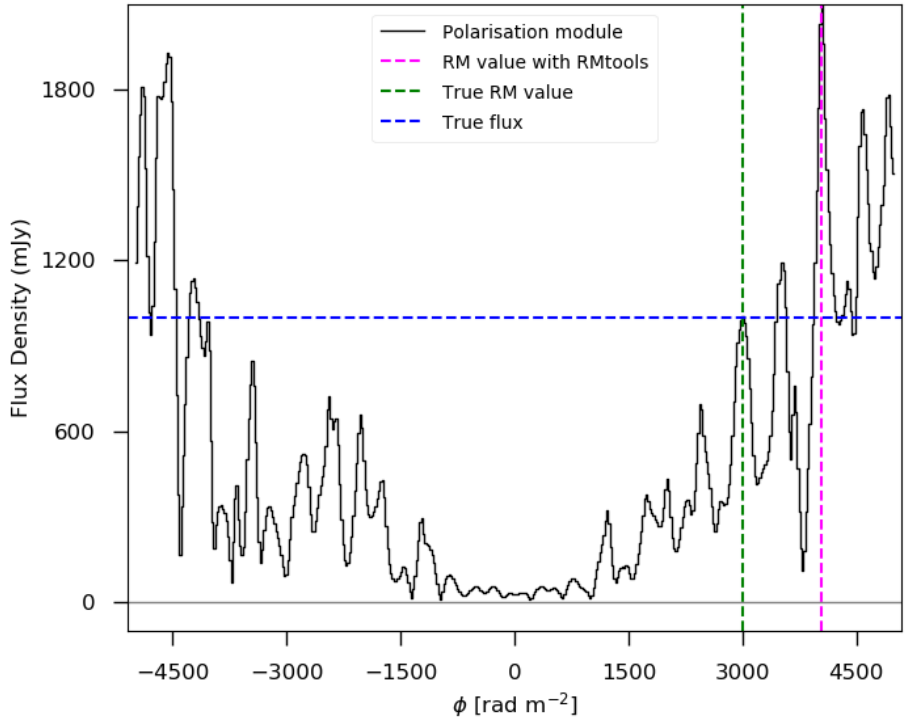

Figure: RM spectrum of 3000 rad/m^2 with the new RMtools corrected with $\frac{1}{\nu_j}$