

Erratum: Determining the composition of radio plasma via circular polarization: the prospects of the Cygnus A hot spots

Torsten A. Enßlin,^{a,b} Sebastian Hutschenreuter^{a,b} and Gopal-Krishna^c

^aMax Planck Institute for Astrophysics,
Karl-Schwarzschildstr. 1, 85741 Garching, Germany

^bLudwig-Maximilians-Universität München,
Geschwister-Scholl-Platz 1, 80539 Munich, Germany

^cAryabhata Research Institute of Observational Sciences (ARIES),
Manora Peak, Nainital — 263129, India

E-mail: ensslin@mpa-garching.mpg.de, hutsch@mpa-garching.mpg.de,
gopaltani@gmail.com

Received July 10, 2019

Accepted July 11, 2019

Published July 26, 2019

Erratum to: [JCAP01\(2019\)035](#)

ArXiv ePrint: [1808.07061](#)



It has been brought to our attention that our text contains two typographic errors, which unfortunately also found its way into our numerical calculations. These error only slightly affect the conclusions of the paper, and, as it turns out, even points to slightly more favorable conditions for observing CP in the Cygnus A hot spots.

More specifically, eq. (2.2) should read

$$j = \begin{pmatrix} j_I \\ j_Q \\ j_U \\ j_V \end{pmatrix} = \underbrace{j_0 n_e B_{\perp}^{\frac{p+1}{2}} \nu^{\frac{1-p}{2}}}_{j_I} \begin{pmatrix} 1 \\ q \\ u \\ v \end{pmatrix}, \quad (0.1)$$

where the correct exponent for the perpendicular component of the magnetic field is $(p+1)/2$ and not $p/2 + 1$ as previously stated. Since the units drop out in the numerical calculations, this error was not spotted by dimensional analysis.

Further more, the quantity j_1 defined in eq. (2.7) should correctly be defined as

$$j_1 = \frac{171}{250} \left(\frac{3ep}{2\pi m_e c} \right)^{1/2} = 0.6268 \left(\frac{p \text{ GHz}}{\text{Gauss}} \right)^{1/2}, \quad (0.2)$$

where we previously and incorrectly put the factor of $p^{1/2}$ in the denominator.

In the following, we list chronologically all equations and statements which are affected by these errors and eventual amendments to the text.

- *abstract: numerical value in last sentence is replaced:*

In case of an electron-proton plasma the electrons imprint their gyration onto the CP and we expect the hot spots of Cygnus A to exhibit a fractional CP at a level of $10^{-3}(\nu/\text{GHz})^{-\frac{1}{2}}$, which is challenging to measure, but not completely unfeasible.

- *page 5, the sentence after eq. (2.11) is replaced by:*

The expected mean of the emission is $\bar{J} = (\bar{I}, 0, 0, 0)^t$, with $\bar{I} = \bar{j}_I \mathcal{V}$ and $\bar{j}_I \approx 0.719 j_0 n_e B_{\perp}^{\frac{3}{2}} \nu^{\frac{-1}{2}}$ for $p = 2$.

- *page 5, eq. (2.12) is updated to:*

$$\begin{pmatrix} \sigma_I \\ \sigma_Q \\ \sigma_U \\ \sigma_V \end{pmatrix} = \begin{pmatrix} 0.190 \\ 0.106 \\ 0.106 \\ 0.0229 B_{\text{Gauss}}^{\frac{1}{2}} \nu_{\text{GHz}}^{-\frac{1}{2}} \end{pmatrix} \frac{j_0 n_e B_{\perp}^{\frac{3}{2}} \nu^{\frac{-1}{2}} \mathcal{V}}{\sqrt{N_{\text{cell}}}} \quad (0.3)$$

- *page 6, the numerical value in eq. (2.13) is updated to:*

$$\frac{\sigma_V}{\sigma_P} = \frac{\sigma_V}{\sqrt{\sigma_Q^2 + \sigma_U^2}} = 0.153 B_{\text{Gauss}}^{\frac{1}{2}} \nu_{\text{GHz}}^{-\frac{1}{2}}. \quad (0.4)$$

- *page 6, the numerical value for f_V in the sentence after eq. (2.13) is updated to:*

$$f_V = \sigma_V / \bar{I} \approx 1.3 \cdot 10^{-3} \nu_{\text{GHz}}^{-\frac{1}{2}} \quad (0.5)$$

– page 6, eq. (2.17) is updated to:

$$\sigma_{V_c} = \phi_c \lambda^3 \sigma_Q \approx 2.133 \cdot 10^{-7} \frac{j_0 n_e B^{\frac{3}{2}} \nu^{-\frac{1}{2}} \mathcal{V}}{\nu_{\text{GHz}}^3 \sqrt{N_{\text{cell}}}} \quad (0.6)$$

– page 6, eq. (2.18) is updated to:

$$\frac{\sigma_{V_c}}{\sigma_V} \approx 9.32 \cdot 10^{-6} \frac{1}{B_{\text{Gauss}}^{\frac{1}{2}} \nu_{\text{GHz}}^{2.5}}. \quad (0.7)$$

– page 6, the numerical value for ν in the last two sentences of this section is updated to:

$$\nu = 57 \text{ MHz} \quad (0.8)$$

– *in the conclusion*

An electron-proton jet is expected to give rise to a fractional CP at a level of $10^{-3}(\nu/\text{GHz})^{-\frac{1}{2}}$. Clearly, this is very challenging to measure, given the faintness of the signal and the systematic cross talk of polarized radio receivers.

We now deem CP in the hot spots of Cygnus A to be best observable slightly above 70 MHz, as opposed to 200 MHz as stated previously.

Acknowledgments

We would like to thank Richard Anantua and Razieh Emami for pointing out the typographical errors in our paper that lead to this erratum.