DEPOLARIZATION AND FARADAY EFFECTS IN 20 AGN JETS FROM 1.4 TO 15 GHz

**DE/REPOLARIZATION EFFECTS**

Effects influence on propagation of electromagnetic wave from place of origin to observer (Fraday 1933, Burn 1966, Gardiner & Whiteley 1966, Pacholczyk & Swihart 1967, Sokoloff et al. 1998):

\( v<1 \) regions (jet components)

- Simple Faraday-disk screen
  - Ionized media, located behind the region where emission originates.
  - Media is homogenous and containing regular magnetic field.
  - Fractional polarization is independent of frequency.

<table>
<thead>
<tr>
<th>N</th>
<th>Effect</th>
<th>Properties</th>
<th>m behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Simple Faraday-disk screen</td>
<td>Ionized media, located behind the region where emission originates. Media is homogenous and containing regular magnetic field.</td>
<td>[ \frac{\partial^2 P}{\partial \lambda^2} \text{ const} ]</td>
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<tr>
<td>2</td>
<td>Random magnetic fields</td>
<td>Random isotropic or anisotropic field, which can generally be imposed on regular (large-scale) field.</td>
<td>[ \frac{\partial P}{\partial \lambda} \text{ const} ]</td>
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<tr>
<td>3</td>
<td>Differential Faraday rotation</td>
<td>Emission originates and propagates in uniform or non-uniform magneto-ionic media, containing ordered magnetic field.</td>
<td>[ \frac{\partial P}{\partial \lambda} \text{ const} ]</td>
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<tr>
<td>4</td>
<td>Internal Faraday dispersion</td>
<td>Emission originates and propagates in uniform or non-uniform magneto-ionic media, containing ordered magnetic field. Characteristic of the depolarization is ( \alpha_{13} ), the dispersion of the intrinsic RM within telescope beam.</td>
<td>[ \frac{\partial P}{\partial \lambda} \text{ const} ]</td>
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</table>

\( v>1 \) regions (core components)

- External Faraday depolarization:
  - Beam depolarization
  - External, non-emitting foreground screen, containing turbulent magnetic field.

- Partially covering screen (Rossotti-Montanovi law)
  - External, non-emitting foreground screen, containing turbulent magnetic field, covers only part of the source. Characteristic parameter \( f_c \) – covered fraction of the source.

- RM gradient across the screen
  - Gradients of Faraday rotation measure (ARM) across the beam, originating in the external screen.

- Tribble depolarization
  - External, non-emitting foreground screen, containing turbulent magnetic field. The ratio of the telescope beam size to the size of RM fluctuations leads to a quadratic dependence of fractional polarization with wavelength \( \Delta \lambda \) is constant and \( B \) is polarization spectral index, varying from 2 to 0.

- Anomalous depolarization
  - Presence of helically shaped magnetic field or tangled large-scale field (A, B – parameters, depending on properties of the media and field).

\[ \frac{\partial P}{\partial \lambda} \text{ const} \]

**SOURCE**

Our sources were observed quasi-simultaneously with the NRAO VLBA at 1.41, 6.66, 22.89, 46.1, 50.0, 81.1, 84.3, and 15.36 GHz (Sokolovsky et al. 2011). The targets were subject of RM study (Kravchenko et al. in prep.) and showed median absolute values in jet components of 44 rad/m^2 and 25 to 699 rad/m^2 in core regions at 1.4–15.4 GHz in the observer's rest frame. The corresponding maximum values are 315 and 2996 rad/m^2.

**MODEL ACCEPTANCE**

To select the model, which better describes the data, Bayesian Information Criterion (Schwarz 1978) was used: \[ BIC = -2 \ln \hat{L} + n \ln n \], where \( L \) is the maximized value of log-likelihood of the model, \( n \) – number of free parameters and \( n \) is the sample size.

\[ BIC = -2 \ln \hat{L} + n \ln n \]

**RESULTS**

Results of the fit (most probable models) are given in the figures and in the table for jet and core components. Two of the sources do not show significant polarized flux density at any of the frequencies. We find that depolarization and Faraday effects are common in AGN jets (see also Barnes et al. 2014, Hovatta et al. 2012, O'Sullivan & Gabuzda 2009). Eight sources show similar wavelength dependence of fractional polarization for jet and core components.

Almost all effects, except the Burn and wavelength-independent depolarization, are found at possible interpretation of the data. In the majority of the sources the fractional polarization shows different kind of dependence in the two frequency ranges. It is best described at high (4–15 GHz) and low (1–5 GHz) frequency ranges by different laws. We plan to expand our analysis by modeling EVP versus wavelength dependence to improve statistics comparing the models.

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