Observed: EVPA ⊥ jet axis in most BL Lac jets
but tend to be more often oblique in quasar jets

B. Faraday rotation $e^- - p^+$ plasmas only

$$\Delta\chi = \frac{e^3}{2\pi m^2 c^2}\nu^{-2}\int_0^s n_e \vec{B}\cdot d\vec{s} = 7.3\times10^4\,\nu_{GHz}^{-2}\int_0^{s_{pc}} n_e B_{l.o.s.}\,ds \quad \text{radians}$$

$$n_e = n_e(\text{thermal}) + \frac{n_e(\text{relativistic})}{\langle\gamma\rangle^2}$$

If $n_e B_{l.o.s.}$ varies across source, + $\Delta\chi$ is large, effect causes depolarization from differential $\Delta\chi$'s

C. Circular Polarization

Tends to be at level $\Pi_{circ} \lesssim \gamma^{-1}(\nu)\,\frac{B^2_{unif}}{B^2_{unif}+B^2_{rand}}$ Legg + Westfold (1968, ApJ, 154, 499)
for optically thin source
typically $\Pi_{circ} \lesssim 0.1\%$ expected $\gamma(\nu) = 19\,\nu_{GHz}^{1/2} B^{-1/2}\left(\frac{1+z}{\delta}\right)^{1/2}$

Observed (Wardle, Homan, et al.): up to ~1% (e.g., 3C279)
→ Conversion of linear to circular polarization in optically thick region (plasma effect)

D. SSC Polarization   (Celotti + Matt 1994, MNRAS, 268, 451)
linear $\Pi \sim 50\%$ of synchrotron Π, same χ

V. Matter Content of Jets: $e^- - p^+$ or $e^- - e^+$? or both ~ equal?

Galactic cosmic-rays: $e^- - p^+$, $u(p^+) \sim 100\,u(e^-)$
$e^- - p^+$ advantages: more momentum, inertia → harder to disrupt, Γ = const. after initial acceleration, as observed in many objects ($\beta_{app} \approx$ const)
$e^- - e^+$ advantages: high-E processes make $e^- - e^+$ pairs, not much rest mass so easier to accelerate

Attempts to decide issue are all flawed or not definitive
- Power needed to feed lobes - depends on value of γ_{min} of $e^- - e^+$
- " " " create high-E emission - uses δ-function approx. for SSC that is incorrect for X-ray emission
- Circular polarization: Wardle + Homan claim low $\Delta\chi$ needed while high optical depth is present → mostly (80%) $e^- - e^+$ plasma
→ not true according to calculations by Ruszkowski + Begelman (2002, ApJ, 573, 485)