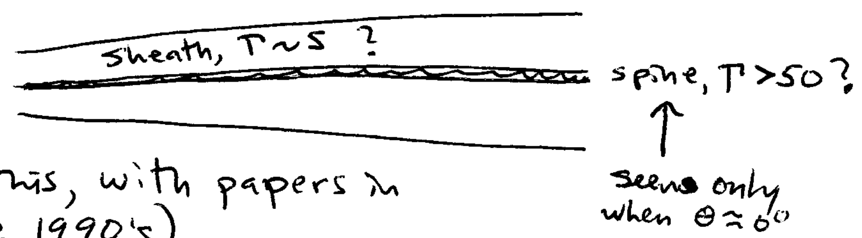
IX. Spine-Sheath Jet Model

On Kpc scales, there is evidence for velocity gradients between the jet axis + boundary (Laing is the primary proponent of this, with papers in MNRAS starting in the late 1990's)



In MKn 501, Giroletti et al. (2004 ApJ) interpret the observations on milliarcsec scales in the same way, but with $\Gamma_{spine} \sim 5$-10 and $\Gamma_{sheath} \sim 2$.

A number of researchers appeal to such structure in order to increase the number of free parameters when a model does not fit the variability data well. Beware! Occam's razor warns against this!

Problem with extreme version: There are not enough "parent population" objects (galaxies with $L > L_*$) to allow $\Gamma_{spine} > 50$ except for the most extreme, rare jet, unless the spine is invisible (carries energy but does not radiate).

X. "Scandals" - Plenty of Data, but Weak Models

The blazar field is still not "mature." Some examples:

a. We don't have a working model of the core - the most prominent feature in a jet - as seen at $\nu > \nu_m$.

b. Two of the most extreme objects - the TeV blazars MKn 421 + 501 - have slow apparent speeds + weak radio variability, but high $\delta \gtrsim 10$ and extreme variability are seen in X-ray + TeV γ-ray.

c. The shock model explains the occurrence of flares, superluminal knots, + decays of flares very well, but simple models for the rise don't exist

d. The flare shapes are typically ~symmetric with quasi-exponential rises + decays. No model I've seen reproduces this.

In general, flares with timescales limited by light-crossing time should have flat peaks.