RELATIVISTIC ELECTRON-POSITRON CLOUDS IN VLBI JETS

V. DESPRINGRE
Observatoire Midi-Pyrénées
14 Avenue Edouard Belin, 31400 Toulouse, France

AND

D. FRAIX-BURNET
Laboratoire d'Astrophysique de Grenoble
BP53X, 38041 Grenoble Cédex, France

1. Introduction

Extragalactic jets have always had two characteristics : the presence of knots and the requirement for particle acceleration. Shock fronts provide an explanation for both. However, the knotty appearance is less obvious at kp-scale on very high resolution observations from the VLA and the HST. The evidence for shock fronts is therefore weakened. At the pc-scale (or VLBI scale), a lot of these blobs are moving superluminally and they have been interpreted and modelled as shock fronts in a relativistic jet.

The first idea of the present work is to build an alternative model without shock fronts and to propose a different picture for VLBI jets. An exciting outcome of our model is that we will be able to extrapolate back toward the nucleus and synthesize a full spectrum of an AGN with a natural link between the high-energy and radio emissions.

2. Description of the model

We consider a cylindrical and non-relativistic jet. It is characterized by its orientation with respect to the line of sight. A cloud of relativistic e^--e^+ moves on the edges of the jet following a helicoidal trajectory at a relativistic speed. The axis and radius of this helix are assumed to be respectively the axis and the radius of the jet. The shape of the cloud is an ellipsoid. The

R. Ekers et al. (eds.), Extragalactic Radio Sources, 443–444.

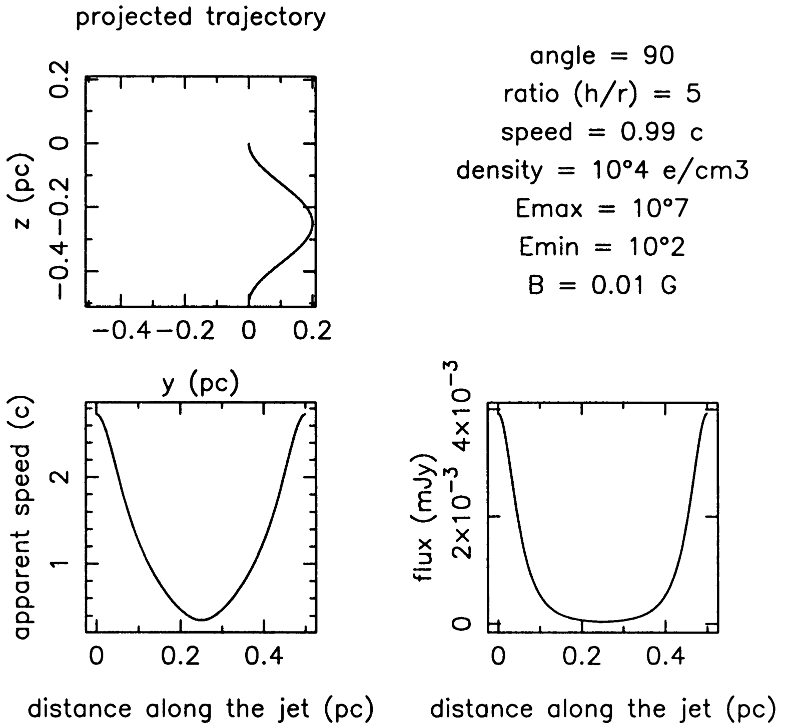

Figure 1.

magnetic field is taken parallel to the trajectory. The particle density inside the cloud is 10^5 cm^{-3} and the energy distribution is a power law of spectral index 2. The full transfer equation with the Stokes parameters is computed.

3. Results

An example of what it is possible to obtain is shown in Fig. 1 with the physical parameters that are used. The evolution of the apparent speed and the intensity vs the distance (projected onto the plane of the sky) along the jet from the core are plotted, as well as the projected trajectory. The preliminary results of this study demonstrate that it is possible to reproduce observed VLBI jets, notably with apparent superluminal speeds even for a jet in the plane of the sky (see Fig. 1).

https://doi.org/10.1017/S0074180900081390 Published online by Cambridge University Press