INTERACTION OF JETS WITH CLOUDS IN EXTRAGALACTIC RADIO SOURCES

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Several points indicate that extragalactic jets can interact with dense gaseous obstacles which occur on their ways. Examples of these interactions are the knotty structure of the radio and optical jet in M 87 [1] and in other objects [2]. These observations have been interpreted by Blandford & Königl [3] in terms of collision of a jet with supernova remnants. We have reanalysed this idea taking into account new observations and improvements in the theory of diffusive shock acceleration. We find that the model [3] requires a very high supernova birthrate ($\sim$ 1 SN/year), which is not observed. It is more probable that the "obstacles" are formed by the stellar winds from the red giants. We estimate that the value of the magnetic field is $\sim 10^{-5}$ G in the interaction region (r=1kpc) (paper in preparation).

Seyfert galaxies are an other class of objects with jet-cloud interactions. Their NLR and their VLA images nearly coincide [4]. We have developped a model in which the non-relativistic jets (or anisotropic winds) collide with multiple NLR clouds. The resulting shocks produce particle acceleration and subsequent synchrotron emission. We have shown that such a model naturally explains the observational correlation between radio and optical properties of those objects [5].

We made a theoretical investigation of the hydrodynamics of 2-D jet-cloud interactions using a generalisation of [3]. We consider the penetration of the BLR clouds inside the jet. Depending on the physical conditions, the clouds may move through the jet without any deviation, be reflected, or be captured and entrained by the jet. These conditions are examined analytically and numerically (paper in preparation).

Finally, we consider a model for compact (VLBI) radio sources. The main idea is that the jets interact with BLR clouds, so that multiple (about 10^6) shock waves permanently exist. Particles are accelerated in these shocks and form "tracks" (like cometary tails). We calculate the kinetic properties of the particles in the "tracks", and their synchrotron emission. Along these lines, we interpret the superluminal compact radio sources (paper in preparation).

References

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