

TIME DEPENDENT ENERGY SUPPLY IN RADIO SOURCES AND MORPHOLOGY OF RADIO LOBES

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The fact that radio jets, which are often one-sided, are nevertheless associated with extended lobes of nearly equal luminosity indicates when analyzed in detail (1) that the energy supply by the nuclear engine to the lobes is strongly time-dependent. Time dependent ejection from the nucleus of a parent galaxy produces low density channels which are ploughed in the background medium by the passage of intermittently ejected radio emitting plasmons (2), (3), (4) and (5). An analysis of the dynamics of radio emitting plasmons in such channels leads to unique morphological features consistent with observations of both narrow jets (resulting from splashback or reflections from the channel ends) and conical lobes (resulting from slower hydrodynamic deceleration).

An outgoing plasmon upon striking a dense relic of previous ejecta at the end of a channel flows around the periphery and splashes back into the trailing channel. The plasmon's energy is thermalized causing its expansion to the sides and rapid expansion back down the evacuated channel. The reflected shock front is strongly collimated both by the two-dimensional Sedov radial density distribution in the channel (2) and by exponential atmosphere behind the plasmon (5). The blowout time (i.e. the lifetime of the reflection jet) is approximately 10^6 years. See figure 1 and compare it with maps of e.g. 3C 388 and NGC 6251.

After the plasmon - relic contact, quasistatic ram deceleration phase begins and secular nature of deceleration establishes pressure balance between dense compressed head material and hot tenuous channel gas, resulting in a formation of a conical lobe behind the head of a radio source. See figure 2 and compare it with a map of e.g. Cyg A.

REFERENCES

- (1) Christiansen, W.A. and Scott, J.S. 1981 (preprint)
- (2) Christiansen, W.A., Pacholczyk, A.G. and Scott, J.S. 1981 (preprint A)

- (3) Christiansen, W.A. 1973 M.N.R.A.S. 164, 211
- (4) Christiansen, W.A., Pacholczyk, A.G. and Scott, J.S. 1979 Nature 266, 593
- (5) Christiansen, W.A., Pacholczyk, A.G. and Scott, J.S. 1981 (pre-print B)

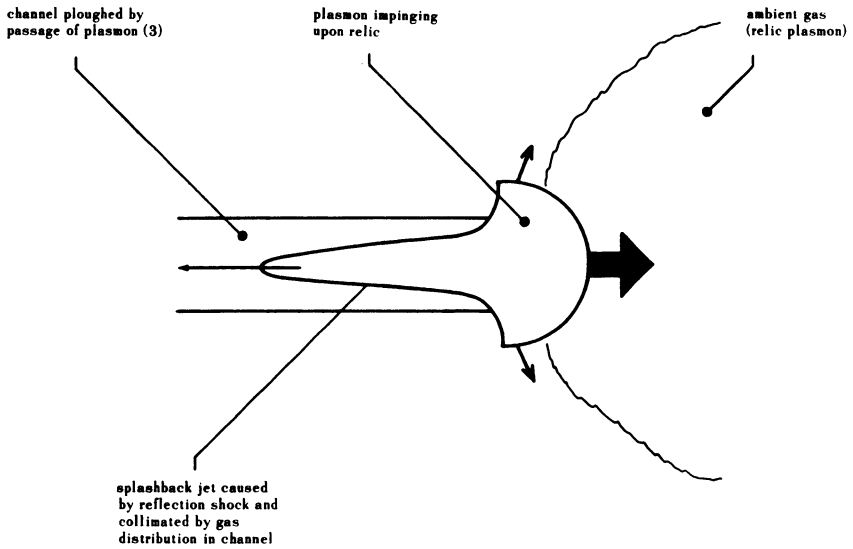


Figure 1. Transient splashbacks (first phase)

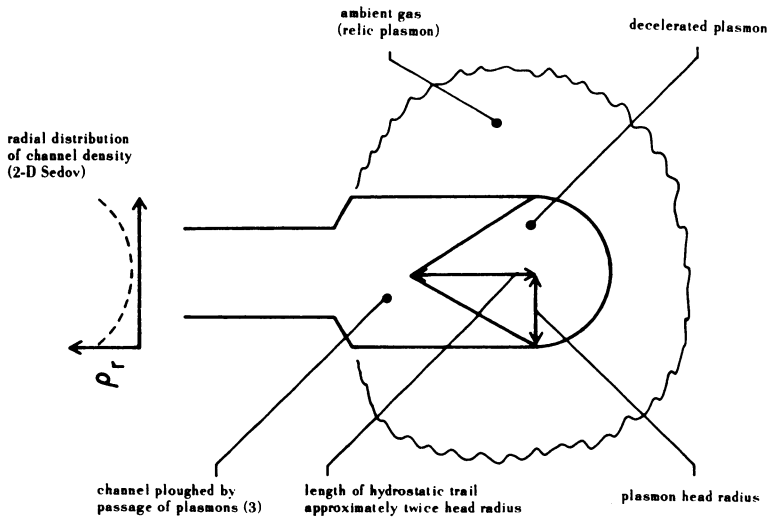


Figure 2. Hydrostatic trails (second phase)