

Theoretical Formation and Ejection of Double Helix Plasma Structures
and Recent Observations on Astrophysical Jets*

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Double-helix plasma structures have been identified theoretically and shown to form in and propagate away from the time dependent plasma configurations in which Black Hole binaries are imbedded [1]. These structures are envisioned to extend up to magnetized plasma regions where they can be disrupted. By now experimental observations on the termination of jets have revealed that they can involve double-helix magnetic topologies [2]. Theoretically, these structures are found to emerge as non-linearly coupled torsional Alfvén waves, in the presence of a background magnetic field in both the formation and in the terminal plasma while evolving into ion-sound torsional waves when the background magnetic field vanishes [1]. They corotate with the binary and propagate in either of the two vertical directions. The coupling involves Intrinsic Gravitational Modes [3] originating in the circumbinary disk and Inner Gravitational Fluctuations emerging from the Swept Torus region [1] traced by the two (equal mass) Black Holes. In the regions where a magnetic field is present, its pressure is considered comparable to the plasma pressure.

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[1] B. Coppi, Invited Papers for the XVI Marcel Grossmann Conference on Relativistic Astrophysics (Session I), July 2021, and for the Asia Pacific Physical Societies Conference on Plasma Physics, (SA-II8), October 2021.

[2] A. Pagetto et al., Ap J. Letters, 923:L5 (2021).

[3] B. Coppi, Pl. Phys. Rep. (and Fizika Plazmy) 47, 9 (2021).