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ACCELERATION AND EJECTION OF RING VORTICES AS A MECHANISM FOR FORMATION OF JET COMPONENTS IN AGN

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Exact solutions are obtained for the two-dimensional hydrodynamic equations for symmetric configurations of two and four vortices in the presence of an arbitrary flow with a point singularity. These solutions describe the dynamics of a dipole toroidal vortex in accretion and wind flows within the active nuclei of galaxies. It is shown that in a converging (accretion) flow, as they are compressed along their major radius, toroidal vortices are ejected with acceleration along the axis of symmetry of the active nucleus, to form the components of a bilateral jet. For a symmetric flow, the increase in the velocity of the vortices is determined by the monopole component of the flow, and, when there is an asymmetry in the flow, also by the dipole component of the flow, which controls the asymmetry of the ejection.
Keywords: ring vortex: acceleration and ejection: mechanism for formation

1. Introduction

Many papers [1] have dealt with the development of jets. (See, also, the book by Beskin [2].) In most of these a strong magnetic field, either "external" or one arising from instabilities in the plasma of an accretion disk, plays a dominant role [3-5]. This field serves to control the motion of particles driven by electromagnetic, centrifugal, and gravitational forces, allowing them to move against the force of gravity and remove angular momentum. The latter is necessary for efficient accretion of the sort responsible for the activity of nuclei [6-8]. Because of the complexity of the problem, powerful computational methods are used in addition to analytical methods [9-10]. At the same time,

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