Theory of MHD Winds and Jets

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Abstract

A brief review will be given of selected results from our analytical and numerical work on the construction of time-independent and time-dependent models of MHD astrophysical winds and jets. First, 1-D outflows will be briefly discussed, namely the Parker thermally driven nonrotating wind, as the classical prototype of all astrophysical outflows and the Weber-Davis magnetocentrifugally driven wind. Then, we turn to the 2-D MHD problem for steady and non steady 2-D magnetized and rotating plasma outflows, wherein the only available exact solutions for such outflows are those in separable coordinates, i.e., with the symmetry of radial or meridional self-similarity. Physically accepted solutions pass from the fast magnetosonic separatrix surface in order to satisfy MHD causality. An energetic criterion is outlined for selecting radially expanding winds from cylindrically expanding jets. The basics of jet acceleration, collimation, minimum fieldline inclination and angular momentum removal are illustrated in the context of radially self similar models. Numerical simulations of magnetic self-collimation verify several results of analytical steady solutions. The outflow from solar-type inefficient magnetic rotators is very weakly collimated while that from a ten times faster rotating YSO produces a tightly collimated jet. We also shall outline a two-component model consisting of a wind outflow from a central object and a faster rotating outflow launched from the surrounding accretion disk which plays the role of the flow collimator. Applications include collimated outflows from star formation regions and jets from active galactic nuclei abd quasars.

Exoplanet Searches with Microlensing

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Abstract

Different regimes of gravitational lensing depend on masses of lens and correspond roughly an angular distance between images. If a gravitational lens has a typical stellar mass, this regime is named as microlensing because a typical angular distance between images is about microarcseconds in the case if sources and lenses are located at cosmological distances. An angular distance depends as a squared root of a lens mass, therefore, if a lens has a typical Earth-like planet mass 10^{-6} $M_{\odot}$, the regime is called such as nanolensing. Thus, generally speaking, one can call a regime with a planet mass lens such as nanolensing (independently on locations of lenses