

Transonic plasma flow in a magnetic channel and evaluation of gamma_i

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Production of a high-beta, transonic plasma flow is quite useful for basic researches and also various industrial applications. Measurement of velocity is prerequisite to evaluate plasma flow properties and its physical mechanisms.

When a high density plasma flows in a relatively weak magnetic field, where ions are unmagnetized and electrons are magnetized, a magnetic nozzle can be formed by the magnetized electrons and ions flows through the magnetic nozzle. Ions act as a normal fluid and M_i is expected to be unity at the throat of a Laval-type magnetic nozzle. Spatial profiles of M_i are measured by the Mach probe in several types of the magnetic channel. The obtained data are compared with theoretical ones calculated from an isentropic flow model. Ion specific heat ratio γ_i in a plasma would be different from that of an ordinary gas due to effects of ionization and excitation processes. We evaluated γ_i of a plasma flow passing through various magnetic channels.