Functional form for plasma velocity in a rapidly rotating tokamak discharge

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Abstract

A recently developed technique using charge exchange spectroscopy determines the ion poloidal rotation in tokamak plasmas from the poloidal variation in the toroidal angular rotation speed. The basis for this technique is the functional form for the plasma velocity calculated from the equilibrium equations. The initial development of this technique utilized the functional form determined for conditions where the ion toroidal rotation speed is much smaller than the ion thermal speed. There are cases, however, where the toroidal rotation can be comparable to the ion thermal speed, especially for high atomic number impurities. The present paper extends the previous analysis to this high rotation speed case and demonstrates how to extract the poloidal rotation speed from measurements of the toroidal angular rotation speed at two points on a flux surface.

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