Strong Dependence of Intrinsic Rotation on X-Point Position

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Objectives

- Test theoretical prediction of strong dependence of intrinsic rotation on major-radial position of the X-point.
- Explore effects of X-point position on intrinsic rotation, useful as a tool for tailoring rotation in future experiments.
- Challenges of this study:
  - Production of stable plasmas with a wide variety of X-point positions.

Accomplishments

- Stable plasma discharges without momentum input were produced for a wide variety of X-point positions (Fig. 1).
- CXRS measurements of edge rotation v_{exp} verified the predicted X-point position (R_X) dependence of edge intrinsic rotation [Fig.2(a)], and showing a resulting large, nearly rigid shift of the entire rotation profile [Fig.2(b)].

Impact

- Experimental verification of a theoretical explanation of the edge intrinsic toroidal rotation.
- Exposed X-point position as a very effective knob to change the edge intrinsic rotation, enabling future dedicated investigations of core and edge intrinsic rotation and their effects on confinement.

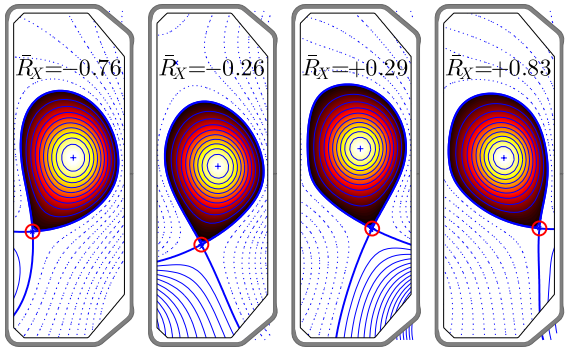

Fig.1. Representative plasma equilibria, showing the variation of X-point position.

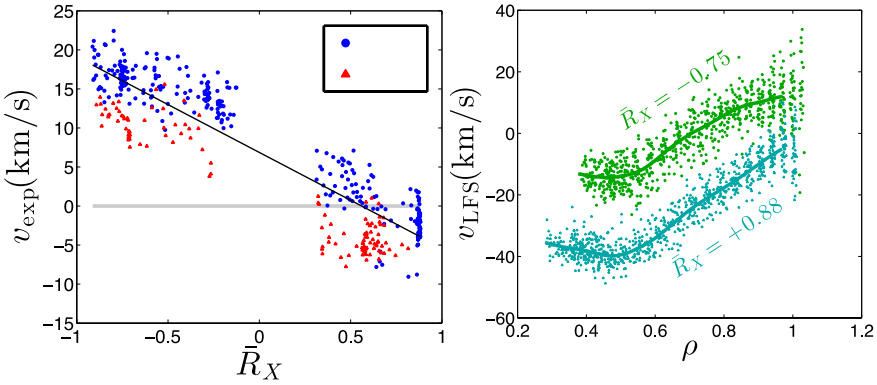

Fig.2. (a, left) Experimentally measured edge toroidal velocity as a function of major-radial X-point position (R_X), verifying theoretically predicted dependence. (b, right) Radial profiles of measured toroidal velocity for an inboard (green) and outboard (cyan) X-point, showing a large, nearly rigid shift.

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