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Error Field in Ideal Magnetically Symmetric Tokamaks Generated through Asymmetric Shadows Cast by Neutral Beams on Divertor Floor[1] HIRONORI TAKAHASHI, ERIC FREDRICKSON, STEFAN GERHARDT, Princeton Plasma Physics Laboratory — The neutral beam intersects open field lines as it traverses the Scrape-Off-Layer (SOL), and casts its "shadows" on the divertor floor, where beam particles and heat lost in transit are deposited. These shadows are toroidally asymmetric in shape, reflecting the localized nature of the beam geometry and, unlike in the main plasma, a lack of symmetrizing field-line property (irrational surfaces) in the SOL. Thermoelectrically driven Scrape-Off-Layer Current (SOLC) due to a Te difference between these shadows is also toroidally asymmetric, and, when considered on a single flux-surface basis, generates an error field in an otherwise ideal magnetically symmetric tokamak. Spreading of the SOLC over flux surfaces has a symmetrizing effect on magnetic field produced due to field-line shear, except around a "sweet spot" midway between primary and secondary separatrices, necessitating calculations along the entire SOL beam path for a reliable field estimate. This study explores the possibility that error field due to a SOLC in the beam shadows may contribute to strong plasma rotation braking often observed when the SOL magnetic structure rapidly evolves in an early discharge phase. Similar considerations may apply to pellet paths, gas puff clouds, and other operational asymmetries.

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