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Bootstrap current in quasi-symmetric stellarators A.S. WARE, University of Montana, D.A. SPONG, L.A. BERRY, S.P. HIRSHMAN, J.F. LYON, Oak Ridge National Laboratory — This work examines bootstrap current in quasi-symmetric stellarators with a focus on the Quasi- Poloidal Stellarator (QPS). In the design of QPS, a code was used to predict the bootstrap current based on a calculation in an asymptotically collisionless limit. This calculation is believed to be a good approximation of the bootstrap current for low density, high electron temperature ($n \sim 3 \times 10^{19}$ m^{-3}, $T_e \sim 1$ keV, $T_i \sim 0.2$ keV), ECH heated plasmas in QPS but is expected to be much higher than the actual bootstrap current for more collisional ($n \sim 8 \times 10^{19}$ m^{-3}, $T_e \sim 0.4$ keV, $T_i \sim 0.4$ keV), ICH heated plasmas in QPS. Recently, a fluid moments approach has been developed to self-consistently calculate viscosities and neoclassical transport coefficients which can be used to calculate the bootstrap current (in addition to neoclassical flows) for arbitrary collisionality and arbitrary magnetic geometry [1]. The predictions from the asymptotic collisionless formula agree qualitatively with the bootstrap current predicted by the fluid moments calculation for the low density, ECH plasmas in QPS. For the high density, ICH heated plasmas, the shape of the predicted profiles are similar but the asymptotic collisionless formula predicts a magnitude of current $4 \sim 5$ times larger than the prediction from the fluid moments code. Bootstrap currents in NCSX and HSX plasmas are also calculated.
[1] D. A. Spong, Phys. Plasmas 12, 056114 (2005).

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