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Towards Measurement of Bootstrap and Pfirsch-Schlüter Currents in Stellarators using an Alkali Diagnostic Beam[1] P.J. FIMOGNARI, T.P. CROWLEY, D.R. DEMERS, Xantho Technologies, LLC — The bootstrap and Pfirsch-Schlüter currents change the magnetic topology of a stellarator in ways that affect neo-classical transport, stability, and divertor properties. These current profiles are typically inferred using codes that solve for the equilibrium as constrained by magnetic and temperature profile measurements. Our new technique enhances this solution by measuring a component of the magnetic vector potential at select locations in the plasma as an additional constraint. A beam of alkali atoms is injected into a device and undergoes collisions with plasma particles, creating a spray of secondary ions whose Larmor radii are sufficiently large to transport them out of the plasma. In stellarators, the momentum of these particles depends on the local magnetic vector potential both at the point of ionization and along the particles' path. We are studying beam particle simulations through the magnetic equilibrium of the HSX stellarator to determine the relative apportionment of the local and path contributions and thus determine the feasibility, in quasi-symmetric magnetic fields, of a diagnostic based on this principle. We have also developed a prototype detector for deployment on the HSX stellarator to study particle and radiative noise signals that may impact diagnostic measurements.

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