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Recent Developments in Quasi-Poloidal Stellarator Physics[1] J.F. LYON, D.A. SPONG, J.H. HARRIS, Oak Ridge National Laboratory — The Quasi-Poloidal Stellarator (QPS) is a different type of compact stellarator with very low aspect ratio $R/a \sim 2.7$, 1/4–1/2 that of existing stellarators. QPS has little variation of |B| in the poloidal direction and larger variation in the toroidal direction, and is thus more like a linked magnetic mirror than a tokamak or other stellarators. The quasi-poloidal symmetry reduces anomalous transport by decreasing the poloidal viscosity by a large factor, thus strongly promoting self-generation of sheared flows that break up turbulent eddies. The magnitude, direction and variation within a flux surface of plasma flows in QPS that affect transport and stability differ from those in other stellarators (LHD, W 7-X, NCSX). The self-generated flow shearing is sufficient to impact temperature gradient modes. QPS is the only toroidal device stable to drift wave turbulence over a range of temperature and density gradients, which should reduce anomalous transport even in absence of flow shearing. The magnetic field structure has a large fraction of trapped particles in regions of low/favorable field line curvature while all other toroidal devices have a significant fraction of the trapped particles in regions with bad curvature. This strongly reduces the drive for a class of trapped-particle instabilities.

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