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Instabilities and coherent structures in long-legged divertors

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Lawrence Livermore National Laboratory — In some versions of tokamak divertor designs the distance between the strike point and the X-point is large, approaching and even exceeding the tokamak minor radius (e.g., R.W. Conn et al, Nucl. Fusion Suppl., v. 3, p. 203, 1977; P.M. Valanju et al, Phys. Plasmas, 16, 056110, 2009). In such a situation, the plasma propagates from the vicinity of the X-point to the divertor plate along a narrow channel (“divertor leg”). The presence of a large geometrical factor, the length-to-thickness ratio, enhances the role of particle drifts and leads to the appearance of significant parallel currents, thereby enhancing the role of the divertor-plate boundary conditions. The divertor modes associated with the finite-beta effects (R.H. Cohen, D.D Ryutov. PPCF, 47, 1187, 2005) become more virulent and may lead to formation of a specific type of finite-beta blobs. The characteristics of these blobs are evaluated and possible damage to the vacuum chamber in the divertor legs is discussed. Prepared by LLNL under Contract DE-AC52-07NA27344.

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