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Theory of Advanced Magnetic Divertors[1] MICHAEL KOTSCHENREUTHER, PRASHANT VALANJU, SWADESH MAHAJAN, BRENT COVELE, Institute for Fusion Studies, UT Austin — The magnetic field structure in the SOL is the most important determinant of divertor physics. A comprehensive analytical and numerical methodology is developed to investigate SOL magnetic fields in the backdrop of two advanced divertor geometries- the X-divertor (XD) proposed and discussed in 2004, and the snowflake divertor (SFD) of 2007-2010. The analysis shows that XD and SFD represent very distinct and readily distinguishable magnetic geometries, epitomized through a differentiating metric, the Divertor Index (DI). In terms of this simple metric, the XD (DI $>$ 1) and the SFD (DI $<$ 1) fall on opposite sides of the standard divertor SD (DI=1). Amongst other things, DI signifies the rate of convergence (divergence) of the flux surfaces near the divertor plate; the flux surfaces of SFD are more convergent contracting) than the SD while the XD flux surfaces are less convergent, in fact, divergent (flaring). These different SOL magnetics imply different physics, particularly with respect to detachment dynamics. It is also shown that some experiments on NSTX and DIII-D match both the prescription and the predictions of the 2004 XD paper.

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