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**Resistive Axisymmetric X-Point (RAXP) Modes:**

**an informal discussion**

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The magnetic field line going through to the X-point of a magnetic divertor separatrix is resonant to axisymmetric MHD perturbation with toroidal mode number n=0 and any poloidal mode number [1]. For this reason, the magnetic X-point region may be strongly influenced by axisymmetric MHD perturbations. Yet, it appears that a detailed theoretical study of resistive axisymmetric X-point modes has not been carried out. In this seminar, I will discuss the analytical and numerical difficulties that may have prevented so far a detailed theoretical study of this problem.

Indeed, theoretical and experimental considerations [2] suggest that axisymmetric perturbations that are resonant at the X-point(s) of a magnetic divertor separatrix may play a role for the understanding of ELMs and their active control via “vertical kicks” [3] in tokamaks.

From a theoretical point of view, radially localized low-m, n=0 perturbations can cause a compression of the plasma in the X-point region, resulting in transient current spikes localized near the X-point, possibly associated with the generation of energetic electrons. The correct theoretical treatment of these modes requires considerations of the full two-dimensional nature of the X-point divertor equilibrium and of the oscillating external currents associated with the control of the vertical instability.

The first step in the development of an analytic model for RAXP modes, i.e., finding an adequate, but at the same time relatively simple analytic MHD equilibrium for a plasma column with noncircular cross section bounded by a magnetic separatrix, is also presented [4].

***Please note:*** *Since the development of a model for RAXP modes is still underway, the discussion will be kept at a very informal level.*

[1] F. Porcelli 1996 JET Report IR(96)09.

[2] J. Lingertat et al 1997 J. Nucl. Mat. **241**, 402; E. R. Solano et al 2008 Nucl. Fusion **48**, 065005.

[3] E. de la Luna et al 2016 Nucl. Fusion **56,** 026001.

[4] F. Porcelli and Adil Yolbarsop, *Phys. Plasmas* **26** (2019) 054501.