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The Investigation of Major Disruption Based on Plasma Current Beat-wave Excitation In IR-T1 Tokamak

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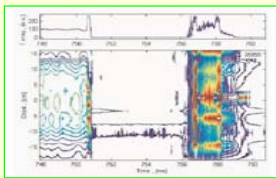
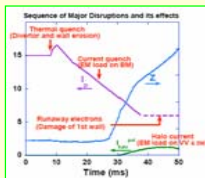
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Abstract

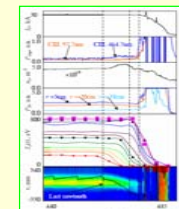
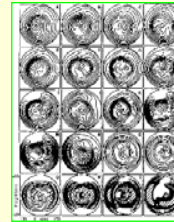
The major disruption phenomenon can be seen in small Tokamak (IR-T1) shots and can cause unwanted shutdown of plasma and it can clearly be seen in the abrupt vanishing of plasma current. By means of a magnetic and a soft x-ray diagnostics it was seen that in the very short interval of disruption the temporal current beat-wave in plasma current was excited. This beat-wave can be related to the standing TE resonant modes of Tokamak cavity (Torus). In the present paper it is shown that the excited current beat-wave is really originated from superposition of torus resonant modes and when this current beat-wave is modulated on plasma main current it can produce stimulated radiation and finally cool the plasma and shot it down. The stimulated radiation is also investigated and it was shown that the main part of this radiation is in microwave region.

Major disruption

- 1- High plasma density.
- 2- Locked mode development.
- 3- Impurity radiation.
- 4- MHD activity
- 5- ...



Time evolution of the x-ray intensity and x-ray contour plot measured during density limit disruption with the use of array of Si detectors with orthogonal view of the plasma column.



Evolutions during density limit disruption.

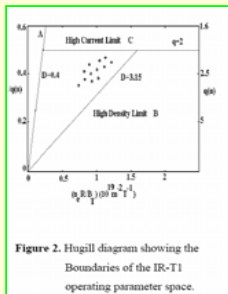
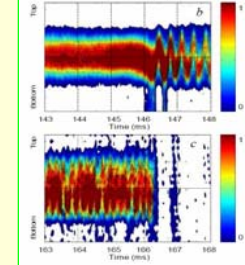
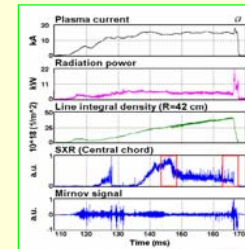
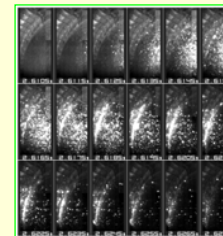


Figure 2. Hugill diagram showing the boundaries of the IR-T1 operating parameter space.

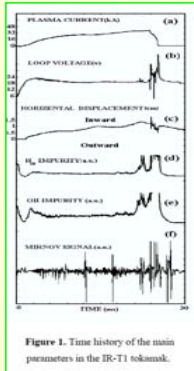
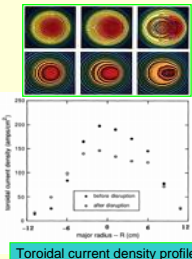
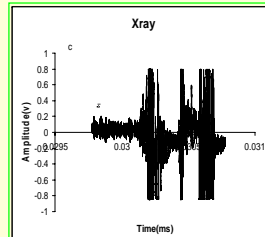
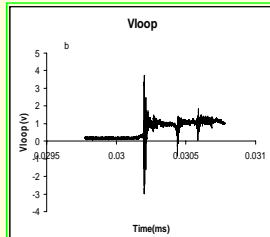
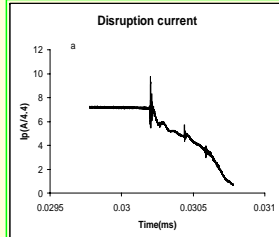
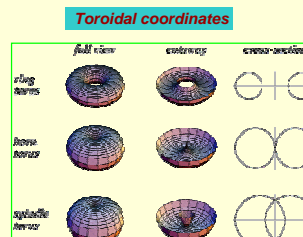


Figure 3. Time history of the main parameters in the IR-T1 tokamak.



Toroidal current density profile



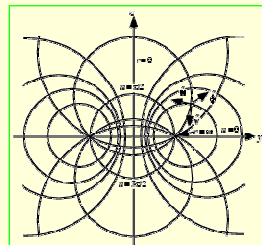
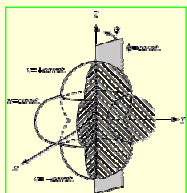
Toroidal coordinates

The most common definition of toroidal variables

$$x = a \frac{\sinh \tau}{\cosh \tau - \cos \sigma} \cos \phi$$

$$y = a \frac{\sinh \tau}{\cosh \tau - \cos \sigma} \sin \phi$$

$$z = a \frac{\sin \sigma}{\cosh \tau - \cos \sigma}$$



Crystals and plasma crystals

