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Insights on disruption physics in MAST using high speed visible camera data

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Disruption prediction requires an understanding of the routes that a plasma may take from being in a healthy state to a disruption, such as the analysis carried out on JET [1]. Of particular concern are those routes that give very little warning of an imminent disruption because they give little potential to either take avoiding or mitigating action. We will use the MAST high speed visible camera data to provide insights into disruptions and their precursors. MAST (Mega Amp Spherical Tokamak) operated from 2001 to 2013 at UKAEA. MAST had a very open internal structure without a close fitting first wall which allowed particularly full views of the plasma. A high-speed video camera, taking data at around 100kHz, was deployed for a series of shots in the later MAST campaigns. We have produced spectrograms from these data which show the presence of various MHD instabilities such as ballooning filaments [2], the LLM [3] and NTM [4]. We further use techniques such as EVM (Eulerian Video Magnification) [5,6], which can highlight oscillations in camera data, to look at the structure of these instabilities. We use this and other available data to look at disruption precursors and the disruptions themselves in both LSN and DND MAST plasmas and discuss implications for disruption prediction.

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[5] Hao-Yu Wu, Michael Rubinstein, Eugene Shih, John Guttag, Fredo Durand, and William T. Freeman 'Eulerian Video Magnification for Revealing Subtle Changes in the World'(2012) ACM Transactions on Graphics (Proc. SIGGRAPH 2012) 31 (4)

[6] D Ryan 'Amplification of Plasma Edge Phenomena with Eulerian Video Magnification'(2014) University of York MSc thesis

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