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Origin of Harmonics of Drift Tearing Mode in ADITYA tokamak

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Tearing modes play pivotal role in determining two of the most critical parameters for tokamak operation, namely plasma confinement and disruption. They have been extensively studied both theoretically and experimentally, as controlling them is foremost priority for every tokamak, including ITER and future large size tokamaks. Coupling of tearing modes with drift wave is a common phenomenon observed in all tokamaks, resulting in drift tearing modes. Multiple drift tearing modes have also been observed in a bunch of experiments. However, these modes have been identified as different modes with different poloidal (m) and toroidal (n) mode numbers. In ADITYA as well as ADITYA Upgrade tokamak, the frequency spectra of Mirnov signal show multiple frequency bands corresponding to drift tearing modes. Interestingly, the higher frequencies have been precisely found to be integral multiples of the fundamental frequency. Further analysis reveals that these frequencies don't belong to different modes but harmonics of a single mode. These harmonic frequencies also reflect significantly in the density as well as impurity radiation. We have also found that the occurrence of these harmonics is strongly correlated with the presence of runaways in the plasma. The origin of these harmonics and their operational regime will be explained in this paper. The role of runaway electrons in manifestation of these harmonics is also proposed.

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