



Contribution ID: 257

Type: Poster

EX/P3-20: Observation of ELM-Free H-Mode in the HL-2A Tokamak

Wednesday, October 10, 2012 8:30 AM (4 hours)

For the first time, a high performance ELM-free H-mode was observed in the HL-2A tokamak. It was realized with Electron Cyclotron Resonance Heating (ECRH) and co-current Neutral Beam Injection (NBI) heating. The H98y2 factor increased by about 40-50% compared with the one before the transition. This regime is triggered by a minor disruption via the edge current change, where the temperature profile undergoes a sudden contraction. The mechanism leading to this regime is investigated. During the ELM-free phase, the edge particle transport barrier is formed with peaked central density, and the edge turbulence is significantly reduced. An EHO mode has been identified in the ELM-free H-mode plasmas. It propagates poloidally in the direction of the electron diamagnetic drift velocity and toroidally in the direction of the plasma current and NBI. The edge particle transport is enhanced with EHO which locates near the q95 surface. Interesting, the EHO/ELM transition during the plasma current ramp phase has been observed with a transient phase where the EHO and grassy ELM coexist. And each burst of the grassy ELM tends to stabilize the EHO. Thus the amplitude of the EHO becomes more fluctuant in the case of mixture of EHO and grassy ELM. During this phase, the EHO amplitude is decreasing and then it is completely disappeared, and ELMs appear with increasing density. It is likely that these transitions are governed by the edge current profile and the pedestal gradient.

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Session Classification: Poster: P3

Track Classification: EXC - Magnetic Confinement Experiments: Confinement