Overview of EAST and HT-7 experiments

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EAST device (Experimental Advanced Superconducting Tokamak) is aimed to achieve steady-state high-performance plasma sustained by intensive use of radio frequency heating and current drive, and to study related physics and technologies. The initial three campaigns were addressed the feasibility of the full superconducting magnets and control algorithm with new features to explore some critical issues relating to steady-state operation with shaped plasma configurations. Since the third campaign last year, many new techniques have been employed to upgrade DN divertor plasma performance, including modification of in-vessel structures and PFCs, iso-flux real-time feedback control, full graphite wall with active water cooling, internal cryo-pump and new diagnostics, as shown in Fig.1, many significant progress have been achieved [1, 2]. In recent fourth campaign, repeatable divertor plasma discharge with 0.25MA and more than 1 minute, 0.25MA/8s fully non-inductive current drive plasma under 1MW LHCD have been demonstrated. RF wave coupling with plasma, LHCD current drive and heating, divertor plasma behavior, plasma initiation under LHCD assistant have been carried out and studied, as illustrated in Fig.2 and Fig.3.

Fig.1 EAST in-vessel components and diagnostics

Fig.2 EAST long pulse discharge (0.25MA/63s)  Fig.3 Different SOL states in detached DN- plasma
In the meanwhile, HT-7 superconducting device, focused on high RF power heating, synergetic effects between LHCD and ICRF or IBW, MHD instabilities and turbulence study, different scenarios of AC operation, wall conditioning, new diagnostics etc., has become a test-stand to support the EAST project scientifically and technically, and to train Master and PhD students. In recent HT-7 experimental campaign, some interesting phenomena were observed during fluctuation study based on three channels’ Co2 collective scattering system [3]. As shown in Fig.4, ohmic normalized fluctuation levels as a function of low hybrid wave power is of opposite tendency at different plasma current, which implies that fluctuation variation may come from a negative magnetic shear in the LHCD plasma. Results from LHCD power scanning experiments shown in Fig.5 indicates clearly there is a power threshold for the TEM fluctuation stabilization.

Fig.4 Ohmic normalized fluctuation levels versus LHW power

Fig.5 LHW Power threshold for density fluctuation

References:
[1] Overview of EAST experiments and Research Plan in next Two Years, Baonian Wan, 3rd EAST IAC meeting, Hefei, China, May 14-15, 2009

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