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# Comparison of ELM-Filament Mitigation between Supersonic Molecular Beam Injection and Pellet Injection in the HL-2A Tokamak

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It is widely accepted that the transient heat flux carried by edge localized mode-filaments (ELM-filaments) can dramatically erode divertor materials, increase impurities and recycling. Thus, it is an extremely challenge to decompose heat flux originating from core plasma. In this paper, the statistical characteristics of ELM-filament within mitigation by the Supersonic Molecular Beam Injection (SMBI) and Pellet Injection (PI) have been studied.

In these experiments, we use four-tip probe to measure the temporal evolution of floating potential, electron temperature and density. The injection depths are about 1~2 cm and 15~18cm inside LCFS by the SMBI and the PI, respectively. It is found that ELM amplitude reduces and its frequency increases after SMBI/PI. We extract ELM filament structure on the basis of threshold $\delta ne/\sigma$, where $\sigma$ is the standard deviation of $\delta ne$. In both mitigations, larger amplitude filament burst rate decrease significantly, implies that the larger amplitude filaments are suppressed. The divertor ion-electron collisionality, and the long-range correlation are also calculated, respectively. In both ELM-mitigations, we observe that the ion-electron collisionality increases after SMBI/PI, while the long-range correlation decreases significantly. This phenomenon is in good agreement with the theory prediction that collisionality affects the parallel correlation.

The particle and heat fluxes are estimated, respectively. Taking the heat fluxes for example, it is found that the transient heat fluxes decrease 50%-60% after SMBI and 40%-50% after PI. This is a direct evidence for the transient heat flux suppression. The average heat flux decreases from 1.2kW/m2 to 0.4kW/m2 after SMBI, meanwhile the thermal radiation increase, implies that there is another energy loss channel by thermal radiation, in addition to the energy loss carried by filaments. But after PI, the thermal radiation does not increase, the average heat flux only change from 1.2kW/m2 to 1.1kW/m2, almost retaining.

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