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Investigations of lithium pellet injections in the HL-2A and HL-3 tokamak

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Lithium Pellet Injection has proved to be an effective technique to control the Edge Localized Modes (ELMs) in tokamaks. The ELMs are inevitable during H-mode discharges and may lead to plasma disruption. Lithium pellet injections during H-mode discharges are capable of triggering small ELMs before the formation of large Type-I ELMs. Consequently, the plasma disruptions can be avoided and the high-confinement, long-pulse discharges are achieved.

Our recent studies[1,2] show that the lithium pellet is capable of penetrating ~ 20 cm into the HL-2A plasma when injected horizontally from the low-field-side midplane with the initial velocity of 100 m/s. The lithium ablation profiles obtained from both the modeling and experiment fit the Gaussian distribution approximately. The plasma pressure in the pedestal region increased ~ 25% due to the lithium pellet ablation and ionization. Figure 1 illustrates the evolution of Li^{3+} density and temperature profile.

Here, we briefly summarize our previous investigations[3,4] and present our modeling predictions for the lithium injections in the HL-2A and HL-3 tokamak. The NDS-BOUT++ package is used with the combination of different injection parameters to discover the favorable lithium injection conditions. The evolution of lithium ions (as shown in Fig. 1) and background plasma profiles are tracked with the BOUT++ transport and turbulence module to assess the effects of ELM control with the lithium pellet injection in the HL-2A and HL-3 tokamak.

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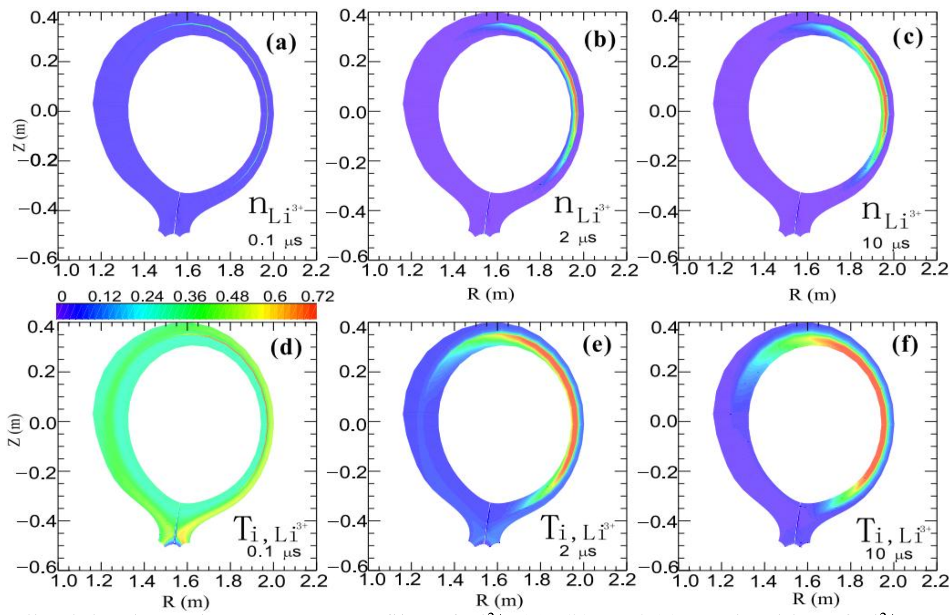

Figure 1 Normalized density and temperature profiles of Li^{3+}. (a), (b), and (c) are densities of Li^{3+} at t = 0.1μs, 2 μs, and 10 μs, respectively. (d), (e), and (f) are temperatures of Li^{3+} at t = 0.1 μs, 2 μs, and 10 μs, respectively.