The construction of the low energy Li^+ source and the preliminary spectroscopy for the 1s2s ^3S - 1s2p ^3P transitions

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As the simplest system, Li^+ has significant application in verifying the quantum electrodynamics (QED) theory and determination of the fine-structure constant α, because the spectrum of Li^+ ion can be calculated accurately in theory [1-4]. We constructed a low energy Li^+ source by electron bombardment, and energy of the $^7Li^+$ ions is 500 eV (Fig. 1). The 1s2s ^3S -1s2s ^3P transitions of $^7Li^+$ are investigated by laser saturation spectroscopy on a low-energy Li^+ ion beam which radial Doppler broadening is optimized to 200 MHz, and the transition frequency is identified by Lamb dip (Linewidth ~ 40 MHz) (Fig. 2). Meanwhile, the laser frequency is measured by an optical frequency comb (FC8004, Menlo Systems GmbH). Hyperfine and fine structure splits can be derived from these transitions, in which most of the systematic frequency shifts are canceled. We are optimizing the stability of the laser and ion beam. The uncertainty of the hyperfine and fine structure splits is promising to less than 100 kHz.

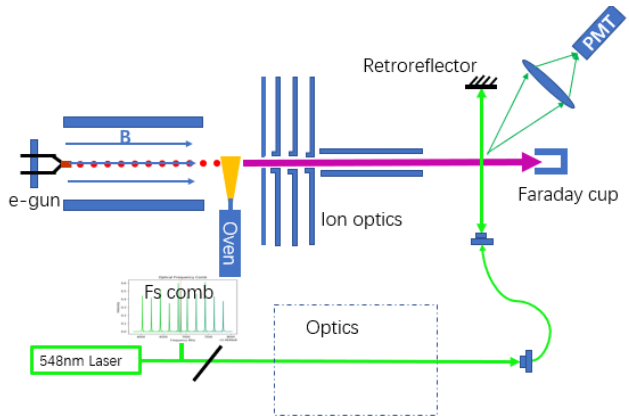

Figure1： the low energy Li^+ source and the schematic of the saturation spectroscopy

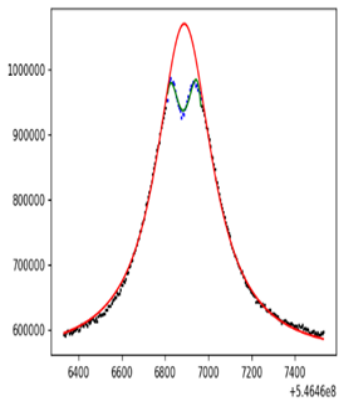

Figure2：Lamb dip of saturation spectroscopy

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