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**Formation of Ultracold Ground-State RbCs via Photoassociated**

**$1^1\Pi$  State** H. WANG, G. IYANU, The Aerospace Corporation — Two electronic states,  $1^1\Pi$  and  $2^1\Sigma^+$ , of the Rb(5s) + Cs(6p) atomic asymptote can be used to directly populate the RbCs ground state  $X^1\Sigma^+$  at short range following heteronuclear photoassociation of laser-cooled Rb and Cs atoms. Our Franck-Condon factor calculation shows that the  $1^1\Pi$  state (dissociating to the Rb(5s) + Cs( $6p_{3/2}$ ) asymptote) is more favorable than the  $2^1\Sigma^+$  state (dissociating to the Rb(5s) + Cs( $6p_{1/2}$ ) atomic limit) for forming ultracold ground-state RbCs in low vibrational levels ( $v < 20$ ), which can be further efficiently transferred to the  $v = 0, J = 0$  lowest quantum state of the molecule through a simple one-photon optical pumping process. Experimentally we have observed ultracold RbCs molecules in a Rb-Cs dual MOT by two-photon ionization and time-of-flight mass spectroscopy. Efforts are underway on heteronuclear photoassociation to the  $1^1\Pi$  state ( $\Omega = 1$  state at long range) and formation of ultracold RbCs in the singlet ground  $X^1\Sigma^+$  state. In this paper we present our Franck-Condon calculation on the transition scheme of using photoassociated  $1^1\Pi$  rovibrational levels to make ground state RbCs and report our experimental results and progress in heteronuclear photoassociation, detection and trapping of ultracold RbCs molecules. This work was supported under The Aerospace Corporation's Independent Research and Development Program.

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