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Hyperfine structures of the 2 $^3\Pi(\Omega$ =1), 2 $^1\Pi(\Omega$ =1), and 3 $^3\Sigma^+(\Omega$ =1) states of ultracold ^{85}Rb^{133}Cs via short range photoassociation JIN-TAE KIM, Chosun University, Korea/Yale University, USA, TOSHIHIKO SHIMASAKI, DAVID DEMILLE, Yale University, USA — We have observed new short-range photoassociation (PA) to the 2 $^3\Pi(\Omega$ =1), 2 $^1\Pi(\Omega$ =1), and 3 $^3\Sigma^+$ (Ω =1) states of ultracold ^{85}Rb^{133}Cs molecule, starting with ^{85}Rb and ^{133}Cs atoms trapped in their $|F_{Rb}$ =2>and $|F_{Cs}$ =3>hyperfine states in dark SPOT MOTs We have completed vibrational and electronic assignments of those PA states in the perturbed region where assignments were difficult due to strong mixing between electronic states through spin-orbit interaction [1] Further, high-resolution (˜10 MHz) PA spectroscopy has revealed rich hyperfine structures in the low J, which we can understand using various coupling schemes (Hund's case $b_{\beta S}$ or Hund's case $b_{\beta J}$) mainly considering Fermi contact interaction. Similarly, we have also observed PA lines in the strongly perturbed singlet (1 $^1\Pi$) and triplet (2 $^3\Sigma^+$) states, which also show similar hyperfine structures. Further, we have observed production of RbCs molecules in the rovibronic ground state through these PA lines via one-photon decay, which opens up the possibility of using these new PA lines as an efficient direct path to the rovibronic ground state. [1] Y. Lee *et al.* J. Phys. Chem. A **112**, 7214 (2008)

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