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Short Range Photoassociation of Rb_2 by a high power fiber laser[1]

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— Photoassociation has been studied using cold trapped atomic samples for the last 20 years. Due to poor Franck-Condon overlap, a free-to-bound transition followed by spontaneous decay results in a small production of electronic ground state molecules. If the photoassociation is done at short range, deeply bound ground state molecules can be formed [1]. Optical pumping schemes can be used to populate a single state [2]. In our experiment, we have performed trap loss spectroscopy on trapped ^{85}Rb atoms in a MOT using a high power fiber laser. Our single mode fiber laser (linewidth < 1 MHz) produces about 50 W, which can be tuned in the 1060-1070 nm range. Two vibrational bound states of the 0_u^+ potential were observed ($\nu = 137$ and 138). The frequency positions as well as the rotational constants of these states are in good agreement with theoretical predictions. We have also measured the lifetime of a crossed optical dipole trap using such fiber laser. The lifetime on resonance is shorter than off resonance as expected. A simple theoretical model indicates that the molecules decay to deeply bound vibrational levels in the ground state. [1] C. Menegatti et all, Phys. Rev. A 87, 053404 (2013). [2] M. Viteau et all, Science 321, 232 (2008).

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