BLUE-DETUNED PHOTOASSOCIATION SPECTRUM IN Rb_2

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We report on the observation of blue-detuned photoassociation as proposed in [1] and references therein. "Blue-detuned" refers to the location of vibrational levels — energetically above the corresponding atomic asymptote. Ultracold ^{85}Rb atoms in a MOT were photoassociated to levels of the $1\,^3\Pi_g$ state a few hundred wavenumbers above the $5S + 5P_{3/2}$ limit. These transitions were found to be strong even though they occur at short internuclear separations (R_e=10 a_0). Levels of the $1\,^3\Pi_g$ state spontaneously decay to the $a\,^3\Sigma_u^+$ state, where they are detected by resonantly enhanced multiphoton ionization with time-of-flight spectroscopy. We have observed most vibrational levels of the $1\,^3\Pi_g$ state belonging to all of its spin-orbit components ($0_g^+, 0_g^-, 1_g, 2_g$). Recent unpublished *ab-initio* calculations [2] of these potentials show good agreement with the observed vibrational and rotational constants. This work is supported by the NSF, AFOSR, and UConn Research Foundation.

[1] M.-L. Almazor *et. al.*, *Eur. Phys. J. D* **15** 355 (2001)
[2] O. Dulieu, private communication