Photoassociation of Laser Cooled Ytterbium Atoms

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We report photoassociation of laser-cooled ytterbium (Yb) atoms. By detecting the trap loss of $^{174}$Yb atoms in the FORT due to the photoassociation beam, we could observe more than 90 photoassociation resonances of vibrational levels in the $^1\Sigma_u^+$ state which connects asymptotically to the $^1S_0 + ^1P_1$ atomic state in the dissociation limit.

From the observed resonance frequencies we could precisely determine the atomic radiative lifetime of the $^1P_1$ state to $5.464 \pm 0.005$ ns. We have also observed linebroadening of photoassociation resonances, which is ascribed to the predissociation to the triplet states, and determined the transition probability to be 0.2. Furthermore, we have observed the decrease of the intensity of photoassociation signal at 435 GHz detuning from the $^1S_0 + ^1P_1$ asymptote, from which the scattering length is estimated to be equal to or less than 3 nm.

We will also discuss interesting possibilities of cold Yb molecules.