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Vibrational Cooling of Photoassociated Homonuclear Cold Molecules HENRY PASSAGEM, PAULO VENTURA, JONATHAN TALLANT, LUIS MARCASSA, University of Sao Paulo — In this work, we produce vibrationally cold homonuclear Rb molecules using spontaneous optical pumping. The vibrationally cooled molecules are produced in three steps. In the first step, we use a photoassociation laser to produce molecules in high vibrational levels of the singlet ground state. Then in a second step, a 50 W broadband laser at 1071 nm, which bandwidth is about 2 nm, is used to transfer the molecules to lower vibrational levels via optical pumping through the excited state. This process transfers the molecules from vibrational levels around $\nu \simeq 113$ to a distribution of levels below $\nu = 35$. The molecules can be further cooled using a broadband light source near 685 nm. In order to obtain such broadband source, we have used a 5mW superluminescent diode, which is amplified in a tapered amplifier using a double pass configuration. After the amplification, the spectrum is properly shaped and we end up with about 90 mW distributed in the 682 -689 nm range. The final vibrational distribution is probed using resonance-enhanced multiphoton ionization with a pulsed dye laser near 670 nm operating at 4KHz. The results are presented and compared with theoretical simulations. This work was supported by Fapesp and INCT-IQ.

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