

Abstract Submitted  
for the DAMOP19 Meeting of  
The American Physical Society

**All-optical production of lithium-6 molecular Bose-Einstein condensates in excited hyperfine levels**<sup>1</sup> FENG XIONG, YUN LONG, VINOD GAIRE, CAMERON CALIGAN, COLIN PARKER, Georgia Institute of Technology, PARKER LAB TEAM — We demonstrate the achievement of molecular BECs of lithium-6 in its lowest and second lowest hyperfine state pairs at 0.05 microkelvin by an all-optical method. At such temperature, the mixture of the lowest two states has a condensate fraction of 36% with  $9\text{E}+4$  atoms while mixture of the second lowest two states has a condensate fraction of 28% with  $3.2\text{E}+4$  atoms. Our method, although being mostly standard, introduces several unique features. For example, we add a few refinements to the Bitter-type magnetic bias coils. Utilizing a high-vacuum chamber, our design preserves a lot of optical access for future experiments and minimizes the use of active elements. By using a single tapered amplifier, we realize slowing and Doppler-cooling. We also implement a phase contrast imaging system to investigate the imbalances between hyperfine states in lithium.

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Date submitted: 31 Jan 2019

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