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Laser spectroscopy of LiHe, a van der Waals molecule NAIMA TARIQ, NADA AL TAISAN, VIJAY SINGH, JONATHAN WEINSTEIN, University of Nevada Reno — Van der Waals molecules are extremely long-range, extremely weakly-bound molecules [1]. Lithium helium (LiHe) is an interesting van der Waals molecule due to theoretical interest in its molecular structure and properties. We report the first observation of ground state LiHe molecules. We use cryogenic helium buffer gas cooling to produce high densities of atomic lithium at temperatures ranging from 1-5 Kelvin [2]. LiHe molecules are formed by three body recombination: $\text{Li} + \text{He} + \text{He} \leftrightarrow \text{Li}\text{He} + \text{He}$ (1) The Li density is continuously monitored via laser absorption spectroscopy. LiHe is detected spectroscopically using both laser induced fluorescence and laser absorption spectroscopy. The LiHe spectrum shows good agreement with a theoretical model of the molecular structure, with only a single bound rovibrational state. Our data shows good agreement with the model which describes the expected density of product (LiHe) varies with temperature and reactants' densities [3] and we also use it to determine the binding energy of the LiHe ground state. The measured binding energy is consistent with the calculated value [4]. References [1] B.L Balney and G.E.Ewing, Annual Review of Physical Chemistry 27, 553(1976). [2] Naima Tariq, Nada Al Taisan, Vijay Singh, and Jonathan D.Weinstein.Phys. Rev.Lett., 110, 153201, 2013. [3] N.Brahms, T.V. Tscherbul, P. Zhang, J. Klos, H.R. Sadeghpour, A. Dalgarno, J. M. Doyle, and T.G. Walker, Phys Rev. Lett. **105**, 033001 (2010). [4] U. Kleinekathöfer, M. Lewerenz, and M. Mladenović , Phys. Rev. Lett., 83, 4717-4720, 1999.

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