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Cloud shape of a molecular Bose-Einstein condensate in a disordered trap: a case study of the dirty boson problem[1] MILAN RADONJIC, BENJAMIN NAGLER, SIAN BARBOSA, JENNIFER KOCH, AXEL PELSTER, ARTUR WIDERA, Department of Physics and Research Center OPTIMAS, Technical University of Kaiserslautern, Germany — We study, both experimentally and theoretically, the ground state static geometric properties of a harmonically trapped Bose-Einstein condensate of lithium-6 molecules in laser speckle potentials by determining the average transverse column density profiles and the corresponding cloud widths [1]. To this end, we use the cumulant expansion method [2] to develop a theory that is non-perturbative with respect to the disorder strength and includes quantum fluctuations. For small disorder strengths we find quantitative agreement with the perturbative approach of Huang and Meng [3]. For strong disorder our theory perfectly reproduces the geometric mean of the measured transverse widths. However, we also observe a systematic deviation of the individual measured widths from the theoretically predicted ones. Moreover, the measured cloud aspect ratio monotonously decreases with increasing disorder strength, while the theory yields a constant ratio. We discuss this discrepancy in light of more exact numerical simulations that support our theoretical findings. [1] B. Nagler et al., arXiv:1911.02626 [2] R. Kubo, J. Phys. Soc. Jpn. 17, 1100 (1962) [3] K. Huang and H. F. Meng, Phys. Rev. Lett. 69, 644 (1992)

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