Abstract Submitted
for the DAMOP16 Meeting of
The American Physical Society

Matter-wave diffraction at the natural limit CHRISTIAN BRAND, University of Vienna, Austria, MICHELE SCLAFANI, Institut de Ciences Fotoniques, Spain, CHRISTIAN KNOBLOCH, University of Vienna, Austria, YIGAL LILACH, Tel Aviv University, Israel, THOMAS JUFFMANN, Stanford University, USA, JANI KOTAKOSKI, CLEMENS MANGLER, University of Vienna, Austria, ANDREAS WINTER, ANDREY TURCHANIN, University of Jena, Germany, JANNIK MEYER, University of Vienna, Austria, ORI CHESHNOVSKY, Tel Aviv University, Israel, MARKUS ARNDT, University of Vienna, Austria — The high sensitivity of matter-wave interferometry experiments to forces and perturbations makes them an essential tool for precision measurements and tests of quantum physics. While mostly grating made of laser-light are used, material gratings have the advantage that they are independent of the particle's internal properties. This makes them universally applicable. However, the molecules will experience substantial van der Waals shifts while passing the grating slits, which suggests limiting this perturbation by reducing the material thickness. In a comprehensive study we compared the van der Waals interactions for free-standing gratings made from single and double layer graphene to masks commonly used in atom interferometry [1]. From the population of high fringe orders we deduce a surprisingly strong electrical interaction between the polarizable molecules and the nanomasks. As even for these thinnest diffraction elements which-path information is not shared with the environment, we interpret this as an experimental affirmation of Bohr's arguments in his famous debate with Einstein.
C. Brand et al., Nat. Nanotechnol. 10 (2015)

Christian Brand
University of Vienna, Austria

Date submitted: 19 Jan 2016 Electronic form version 1.4