

Abstract Submitted
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Sub-attoneutron force detection in three dimensions with a single atom sensor¹ ERIK STREED, VALDIS BLUMS, Griffith University, MARCIN PIOTROWSKI, Griffith University, CSIRO Pullenvale, IRTIZA HUSSAIN, BENJAMIN NORTON, STEVEN CONNELL, Griffith University, STEPHEN GENSEMER, Griffith University, CSIRO Pullenvale, MIRKO LOBINO, Griffith University — Ultra-sensitive force measurements are a crucial tool for investigating fundamental physical limits. Here we demonstrate a sub-attoneutron force sensor based on a single trapped ion that can resolve all three dimensions components of an applied force through super-resolution imaging. The force is detected by measuring the ion displacement with nanometer precision with a sensitivity of 372 ± 9 zN/ $\sqrt{\text{Hz}}$ in one direction, and $(335, 359) \pm 14$ zN/ $\sqrt{\text{Hz}}$ and $(779, 836) \pm 42$ zN/ $\sqrt{\text{Hz}}$ for the other two axes. After characterizing our system in all three dimensions, we demonstrated its accuracy by measuring a light pressure force on the ion of 95 zN.

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