Abstract Submitted
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Quantum-limited evanescent single molecule sensing.[1] WARWICK BOWEN, NICOLAS MAURANYAPIN, LARS MADSEN, Australian Centre for Engineered Quantum Systems, University of Queensland, MICHAEL TAYLOR, University of Queensland, MUHAMMAD WALEED, Australian Centre for Engineered Quantum Systems, University of Queensland — Sensors that are able to detect and track single unlabeled biomolecules are an important tool both to understand biomolecular dynamics and interactions, and for medical diagnostics operating at their ultimate detection limits. Recently, exceptional sensitivity has been achieved using the strongly enhanced evanescent fields provided by optical microcavities and plasmonic resonators[1]. However, at high field intensities photodamage to the biological specimen becomes increasingly problematic[2]. Here, we introduce a new approach that combines dark field illumination and heterodyne detection in an optical nanofibre[3]. This allows operation at the fundamental precision limit introduced by quantisation of light. We achieve state-of-the-art sensitivity with a four order-of-magnitude reduction in optical intensity. This enables quantum noise limited tracking of single biomolecules as small as 3.5 nm and surface-molecule interactions to be montored over extended periods. By achieving quantum noise limited precision, our approach provides a pathway towards quantum-enhanced single-molecule biosensors. [1] Baaske et al, Nat. Nano. **9** 933 (2014); Pang and Gordon, Nano Letters **12** 402 (2012). [2] E.g. Mirsaidov et al., Phys. Rev. E. **78** 021910 (2008). [3] Mauranyapin et al. arxiv:1609.05979 (2016).

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