Abstract Submitted
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**Probing a scattering resonance with Rydberg molecules inside a Bose-Einstein condensate**[1] J. PEREZ-RIOS, Department of Physics and Astronomy, Purdue University, West Lafayette, IN 47907, M. SCHLAGMÜLLER, T. C. LIEBISCH, H. NGUYEN, G. LOCHEAD, F. ENGEL, F. BÖOTTCHER, K. M. WESTPHAL, K. S. KLEINBACH, R. LÖW, S. HOFFERBERTH, T. PFAU, 5. Physikalisches Institut and Center for Integrated Quantum Science and Technology, Universität Stuttgart, Pfaffenwaldring 57, 70569 Stuttgart, C. H. GREENE, Department of Physics and Astronomy, Purdue University, West Lafayette, IN 47907 — The spectroscopy of a single Rydberg atom within a Bose-Einstein condensate is studied, and as a result a line shape dependence on the principal Rydberg quantum number n is observed, apart from the expected density shift due to the large number of neutrals inside the Rydberg orbit [1]. The observed line broadening depends on the Rydberg electron-neutral interaction, in particular, it manifests the influence of the e-Rb(5S) p-wave scattering shape resonance, which dramatically affects the potential energy landscape for the neutrals embedded within the Rydberg orbit. The observed spectroscopic line shapes are reproduced with an overall good agreement by means of a microscopic model, in which the atoms overlapped with the Rydberg orbit are treated as zero-velocity point-like particles, with binding energies associated with the ion-neutral distance [1] E. Amaldi and E. Segrè, Nature **133**, 141 (1934). [2] M. Schlagmüller et al. arXiv:1510.07003v1 (accepted in PRL)

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