# Atom-light interaction in the strong focusing regime

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Understanding the interaction between atoms or individual emitters and photons at the single photon level is important for implementing elementary quantum gates that use optical photons to transfer information between different microscopic systems in a quantum network. To arrive at a sizable interaction of individual photons with atoms or atom-like systems, the most common technique to increase the electrical field at the location of an atom is to employ optical cavities or other resonant structures with a small effective mode volume for the electromagnetic field.

A complementary method to arrive at a small effective mode volume of an electromagnetic field is to use strong focusing. This localizes the electromagnetic filed in a small region of space, and permits significant interaction between a single atom and single photons. In this presentation, we report on recent progress in our group on increasing this interaction in a propagating field configuration using large numerical aperture lenses [1], an electric field geometry borrowed from 4-Pi microscopy, where single-atom extinction over 36% has been observed [2], and the electrical field in a near-concentric resonator geometry [3], which may permit very high interaction strengths [4].

## References

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