13.11. *Quantum Rabi Oscillation: A Direct Test of Field Quantization in a Cavity.* M. Brune, F. Schmidt-Kaler, A. Maali, J. Dreyer, E. Hagley, J. M. Raimond, and S. Haroche. *Phys. Rev. Lett.* **76**, 1800 (1996)

Presenter (10 min):
Sketch the key results. 3 slides at maximum!
Bibliometrics: what do you know about the authors and impact of the paper?
Based on the bibliometrics, do you think the paper is a milestone?
Take a look at C. Gerry, P. Knight "Introductory Quantum Optics," Chapter 10.

Intro:

1. *„However, the most generally admitted evidence of field quantization, the discrete nature of the photodetection current, is perfectly explained by a classical description of the field, provided that the linear detector is a quantum system„*

   How is this statement in line with the last paper?

2. Why is it so difficult to observe the discreteness of the energy of the radiation stored in a cavity mode?
3. What are Rabi Oscillations? Write down the semi-classical light–matter interaction Hamiltonian
4. What is the Jaynes-Cummings Hamiltonian? Write it down.
5. Sketch P(n) for thermal, coherent fields and Fock states.
6. Why is $P_{eg}(t)$ for coherent states and Fock states with large n identical. What is with thermal fields?
7. What is the prime claim of the paper?

Setup:

8. Why is cooling to 0.8 K required? How can you reach such low temperatures?
9. What are the relevant properties of the atom source?
10. What is described by the cavity Q factor? How does it link to T_{cav}?
11. Why is the atom field coupling determined by the size of atom and cavity?
12. Why is the atom–cavity interaction time essential? How is it controlled?

Results:

13. Why is a sinusoidal oscillation visible in Fig. 2A and not in 2 B-D?
14. Why do different frequencies show up in 2a-d?
15. Why does the semi-classical expectation (coherent state + Rabi oscillations) give wrong results for small injected fields?
16. Sketch the Jaynes-Cumming ladder!