Quantum Information with Solid-State Devices

VO 141.246

Dr. Johannes Majer

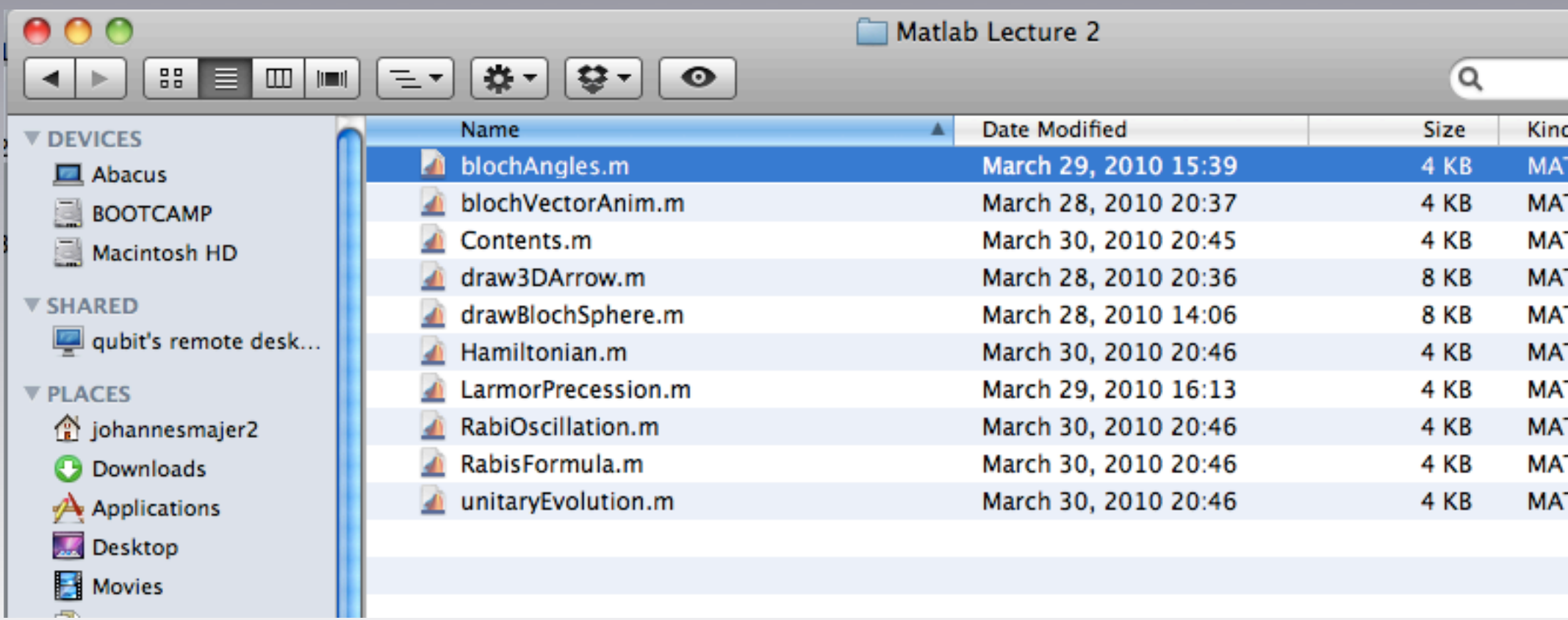
Lecture Notes

15 March 2010 - Lecture 1 Introduction

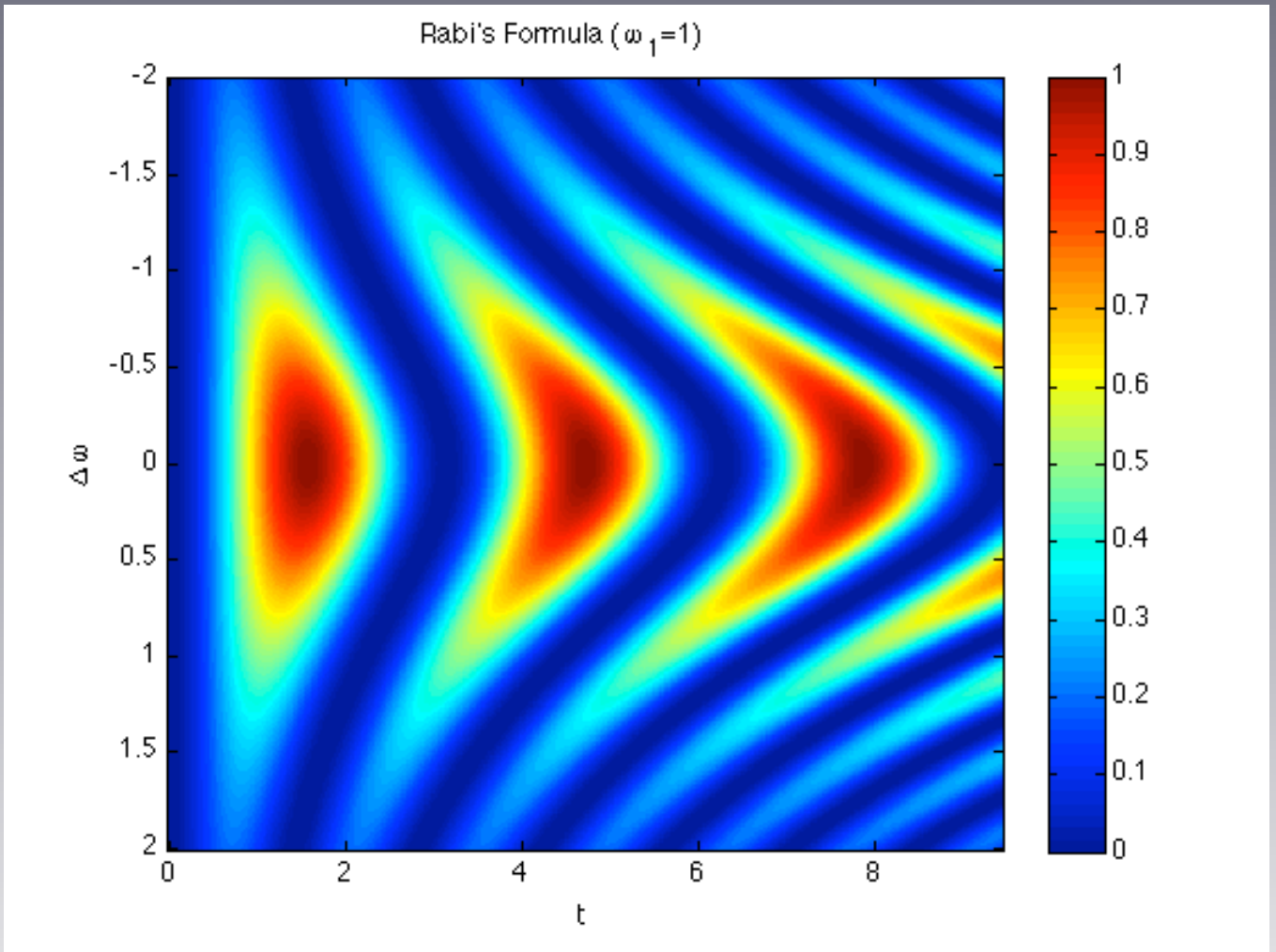
QISS Lecture Notes 1.pdf

22 March 2010 - Lecture 2

QISS Lecture 2 Notes.pdf
QISS Lecture 2 Slides.pdf
Matlab Lecture 2.zip



Rabi's Formula



$$P_1(t) = \frac{\omega_1^2}{\omega_1^2 + \Delta\omega^2} \sin(\sqrt{\omega_1^2 + \Delta\omega^2 t})^2$$

Supplement

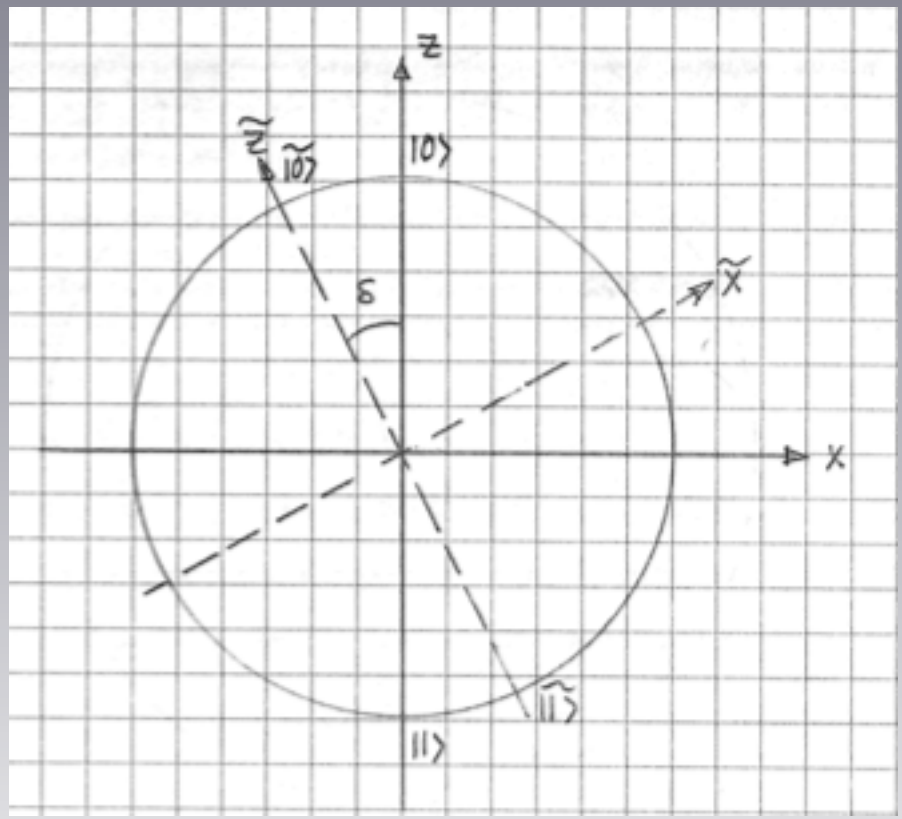
$$H = \alpha \sigma_z + \beta \sigma_x = \begin{pmatrix} \alpha & \beta \\ \beta & -\alpha \end{pmatrix}$$

$$\tilde{H} = \begin{pmatrix} \sqrt{\alpha^2+\beta^2} & 0 \\ 0 & -\sqrt{\alpha^2+\beta^2} \end{pmatrix}$$

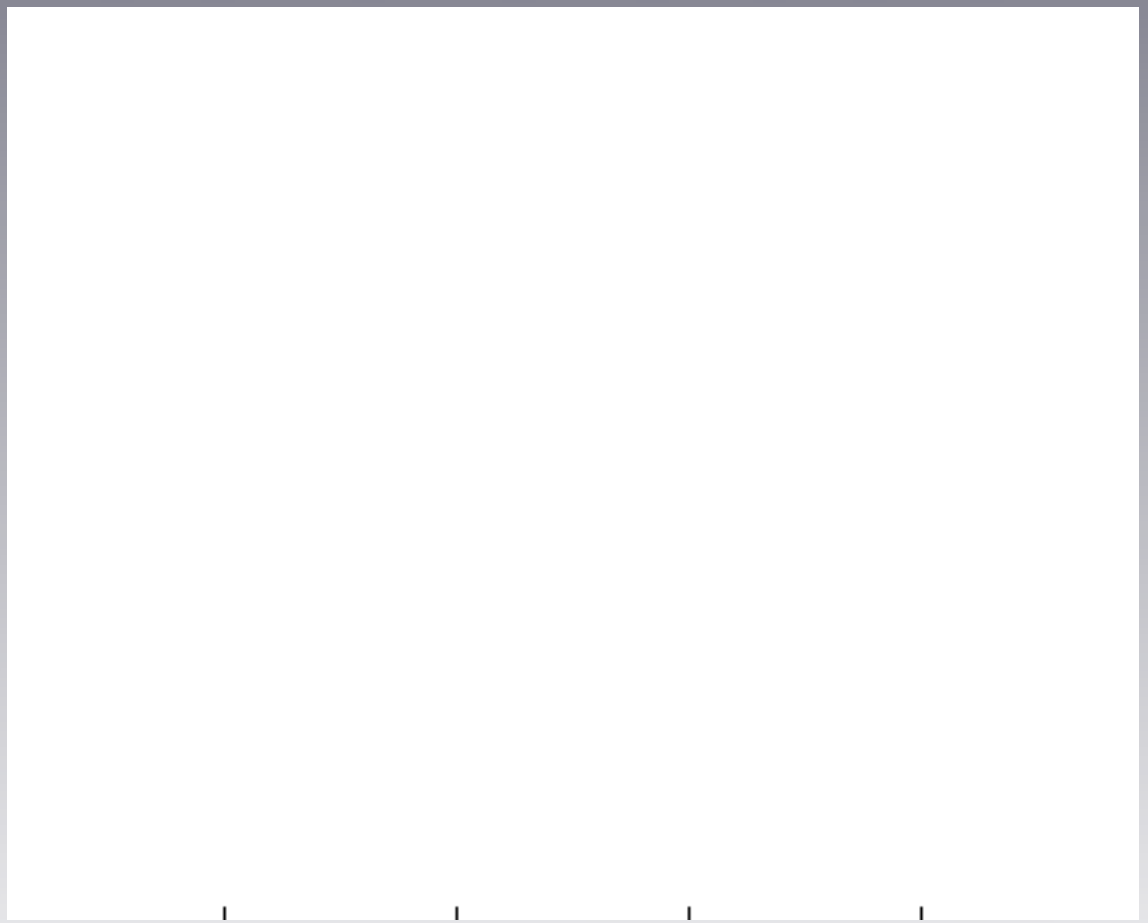
$$U = \begin{pmatrix} \cos(\delta/2) & \sin(\delta/2) \\ -\sin(\delta/2) & \cos(\delta/2) \end{pmatrix}$$

$$\tan(\delta) = \frac{\beta}{\alpha}$$

$$H = U^{-1} \tilde{H} U$$



Relaxation



Motivation

Solid-state qubit
+environment

open quantum system

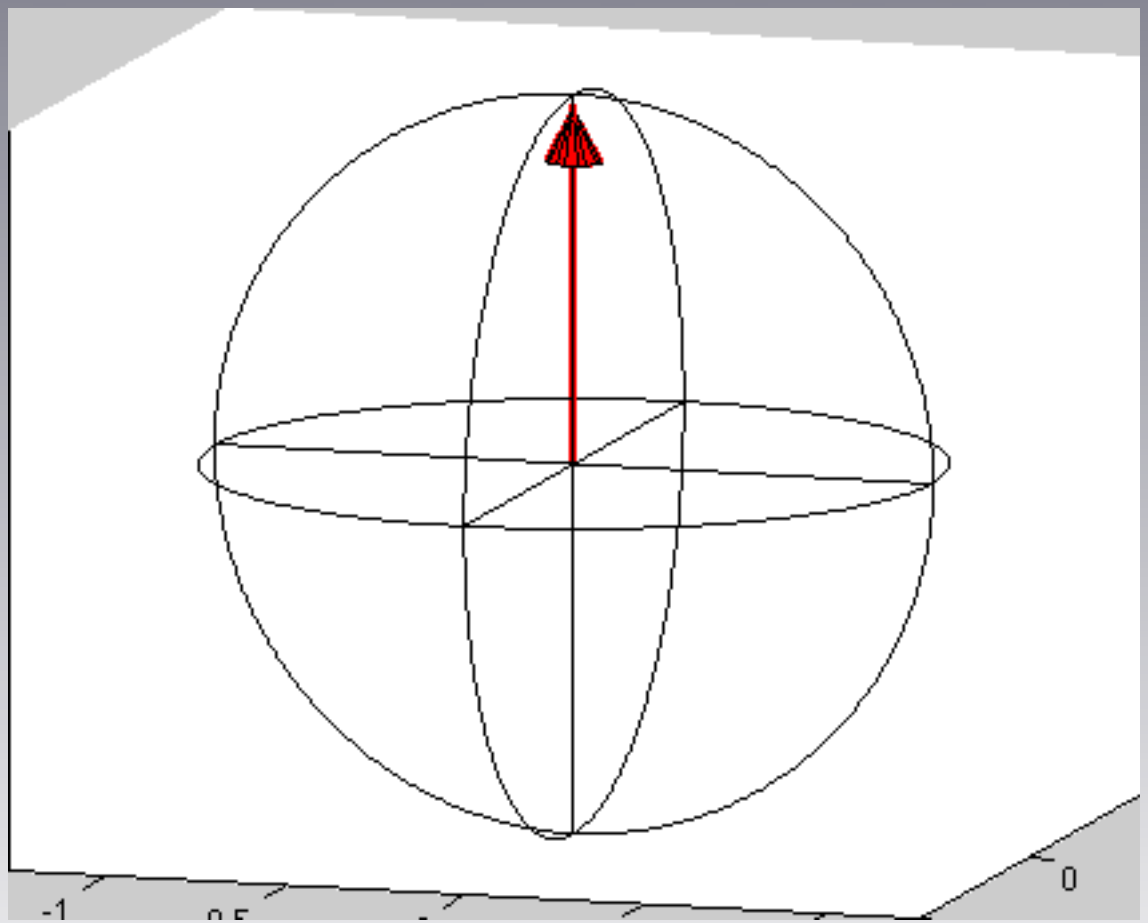
can we describe the qubit with few parameters?

dephasing rate, relaxation time, ...

how to measure them?

relaxation measurement, Ramsey, Hahnecho

Relaxation



VOLUME 90, NUMBER 2 PHYSICAL REVIEW LETTERS week ending 17 JANUARY 2003

Measurement of the Excited-State Lifetime of a Microelectronic Circuit

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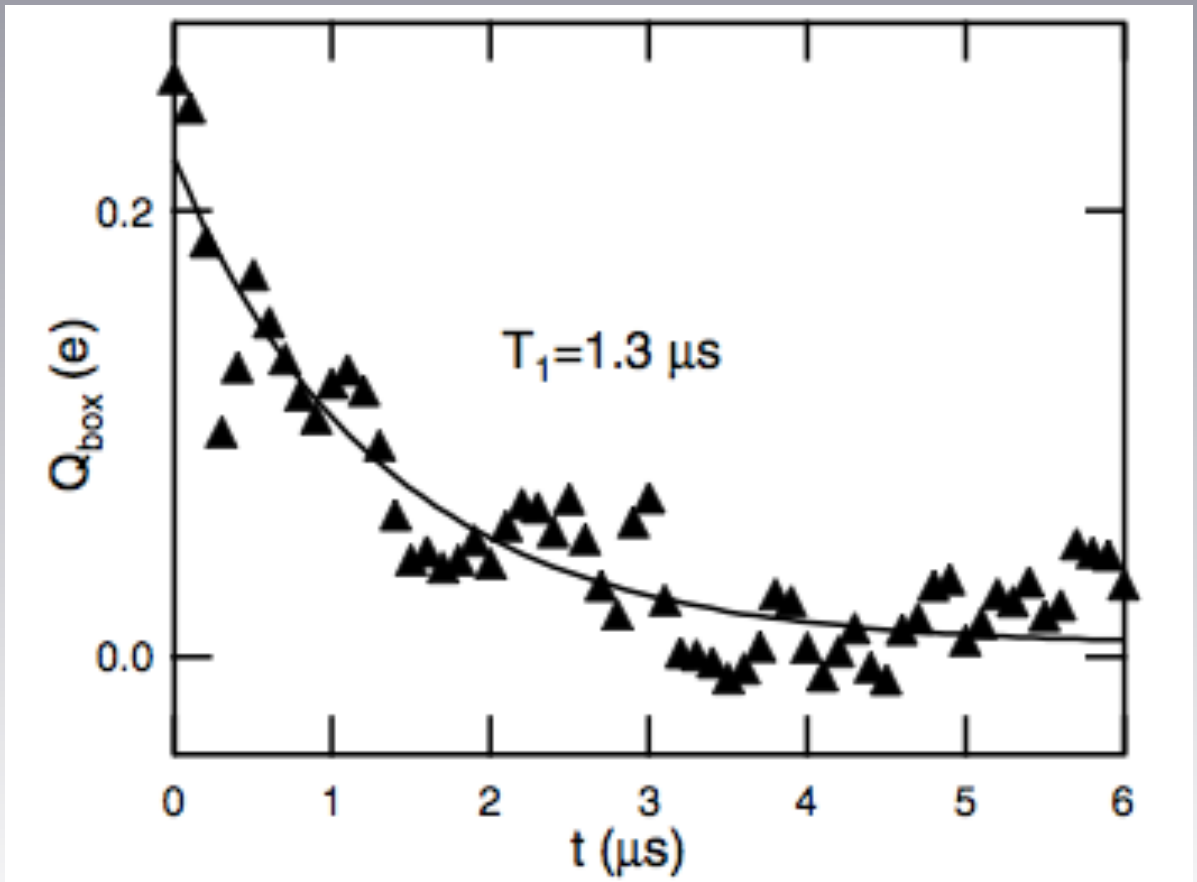
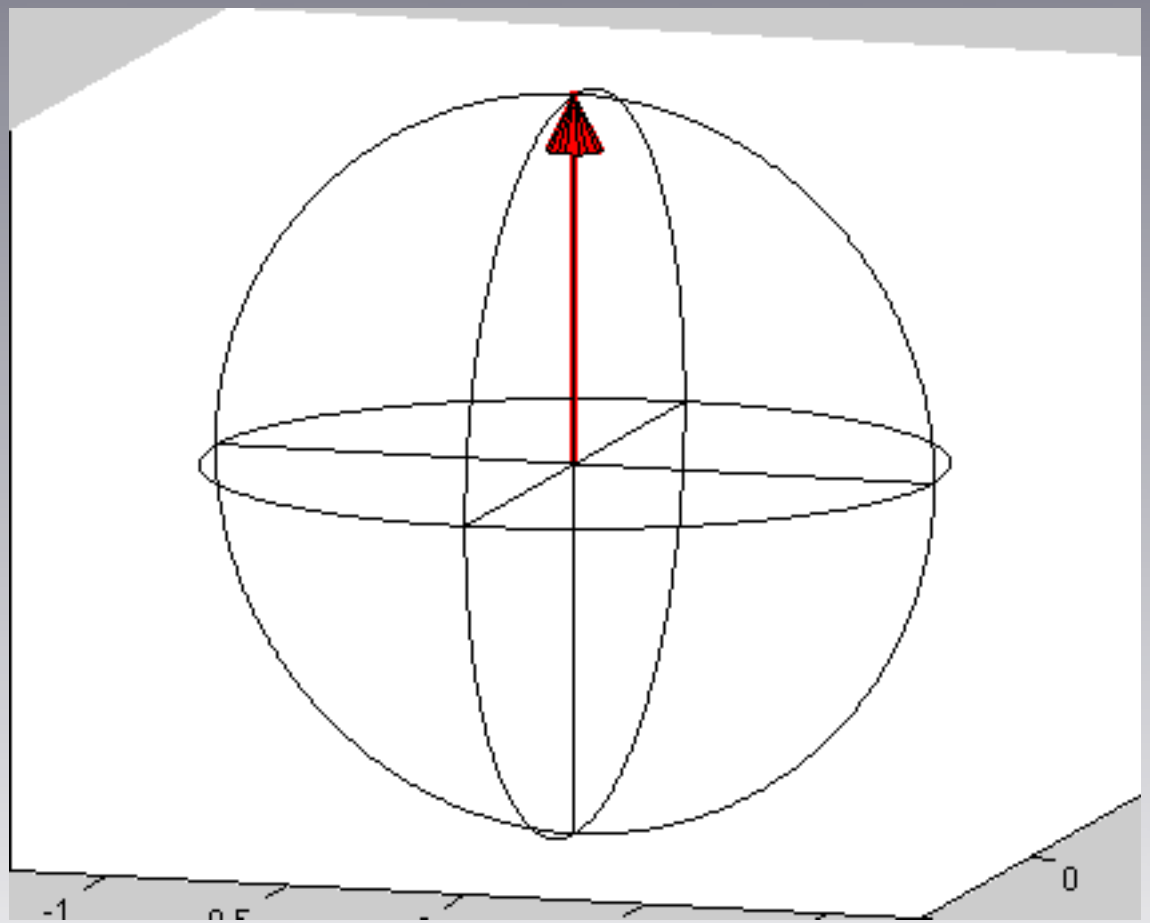
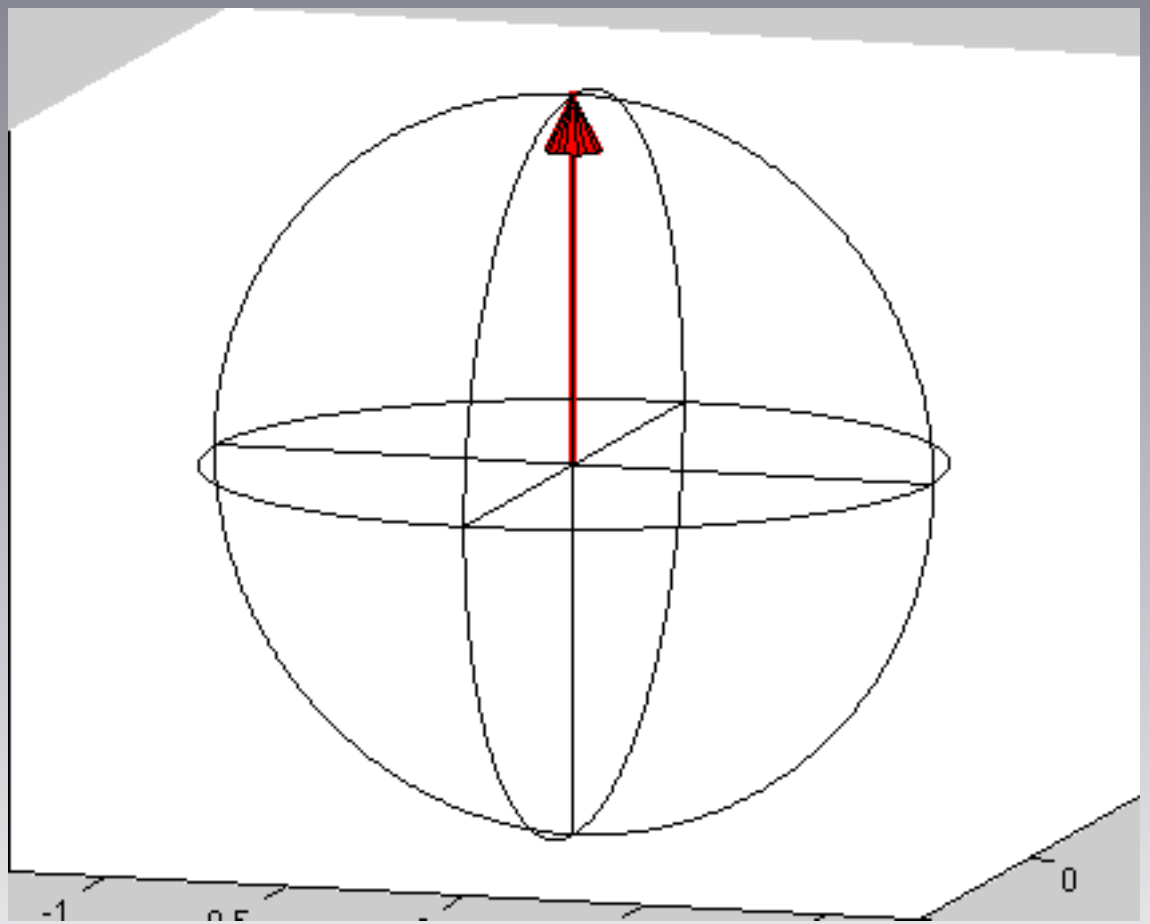


Ramsey Oscillations



Ramsey Oscillations



Manipulating the Quantum State of an Electrical Circuit

D. Vion,* A. Aassime, A. Cottet, P. Joyez, H. Pothier,
C. Urbina,† D. Esteve, M. H. Devoret‡

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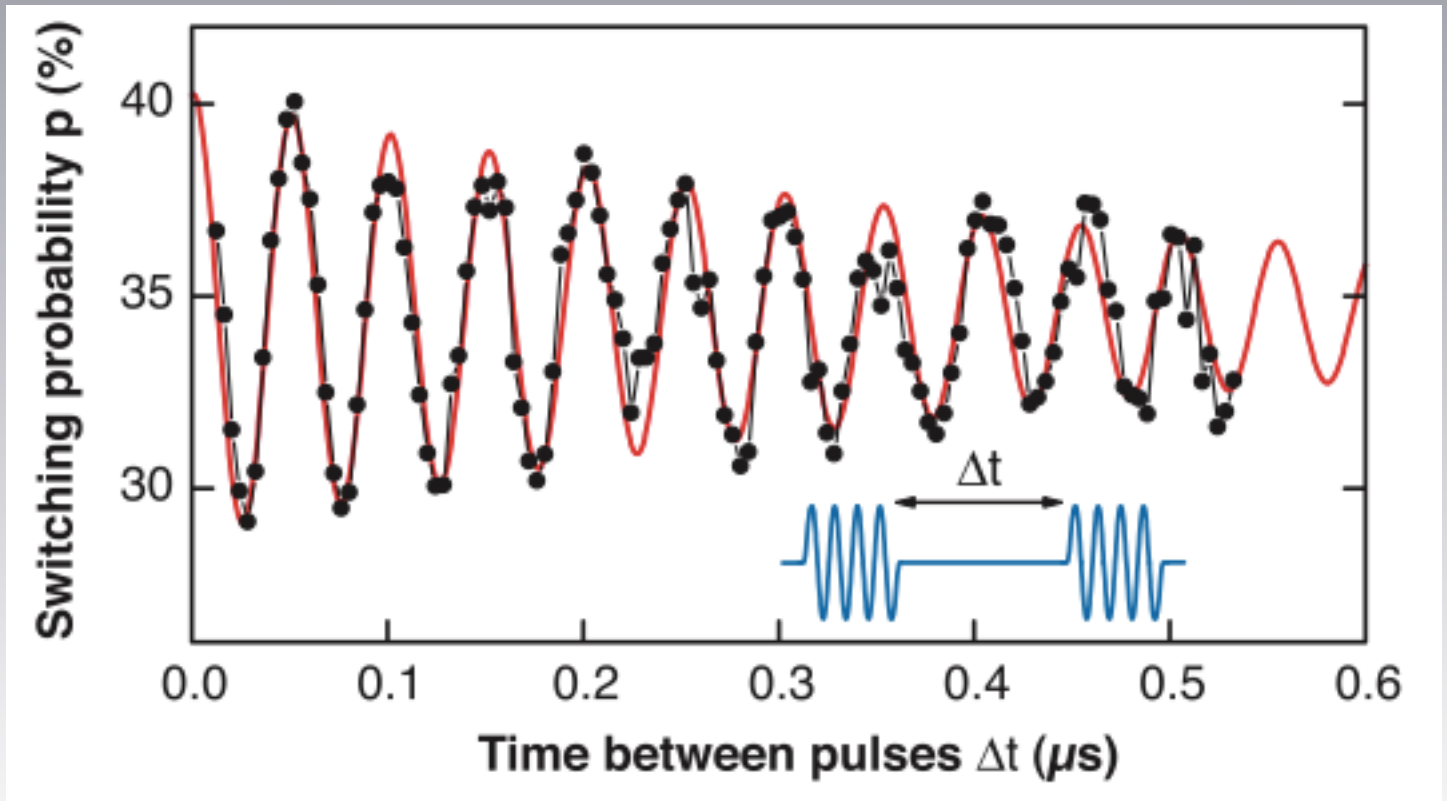
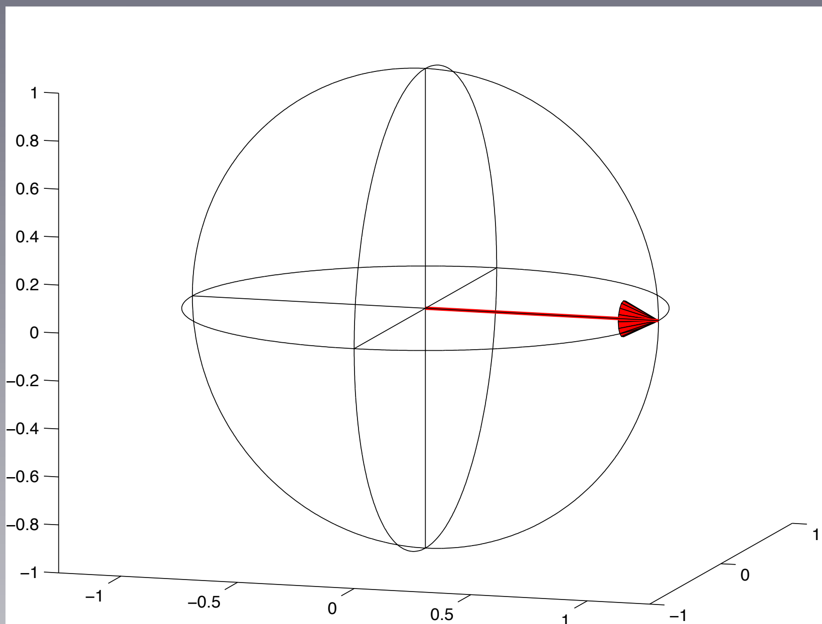


Hahn Echo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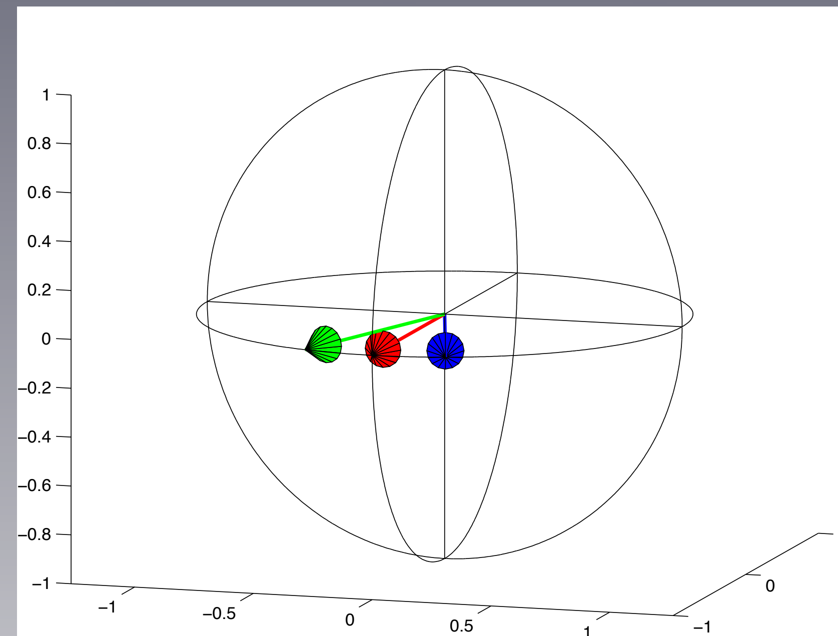
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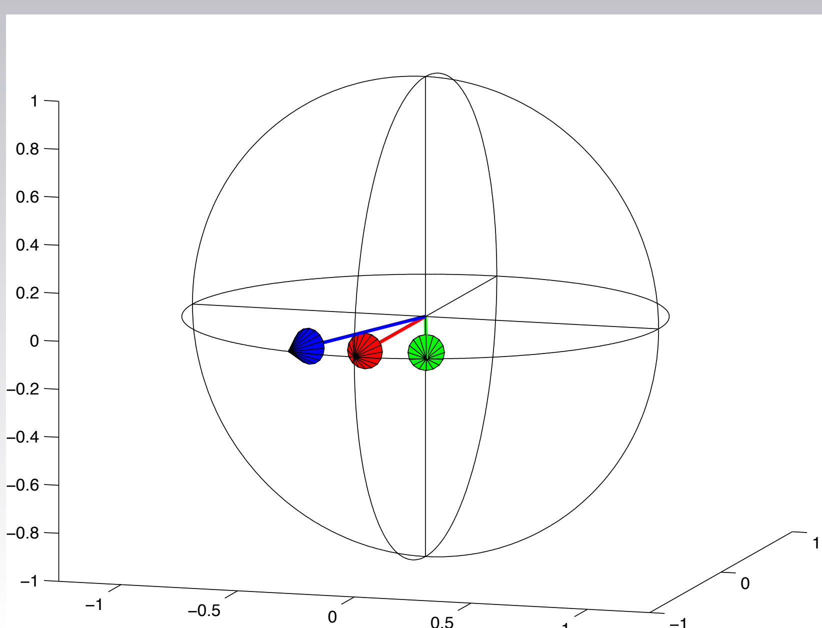
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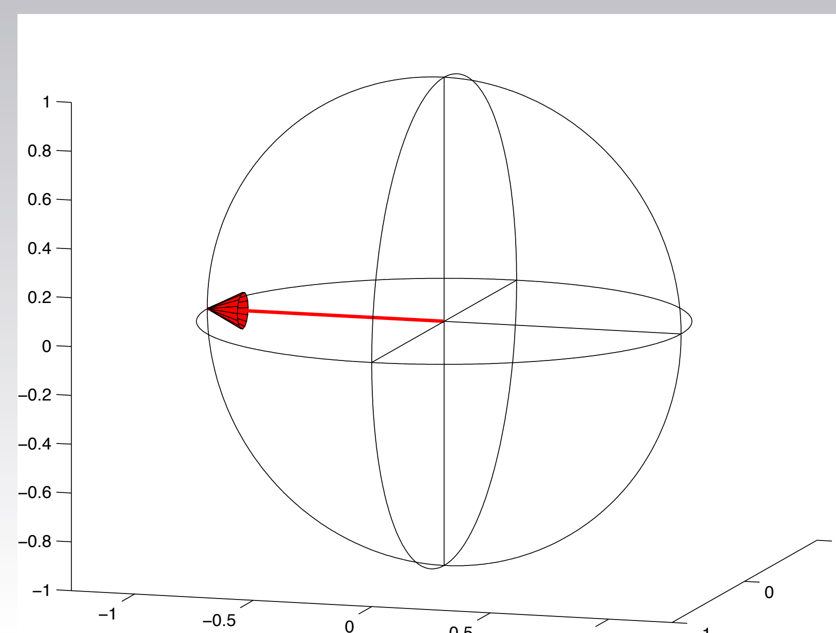
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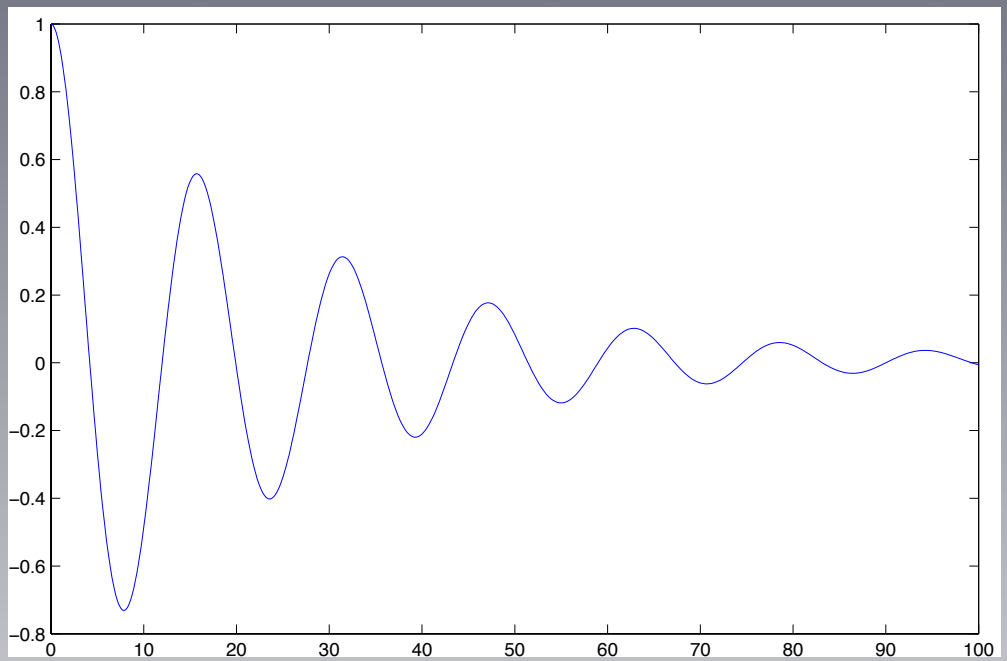
Rabi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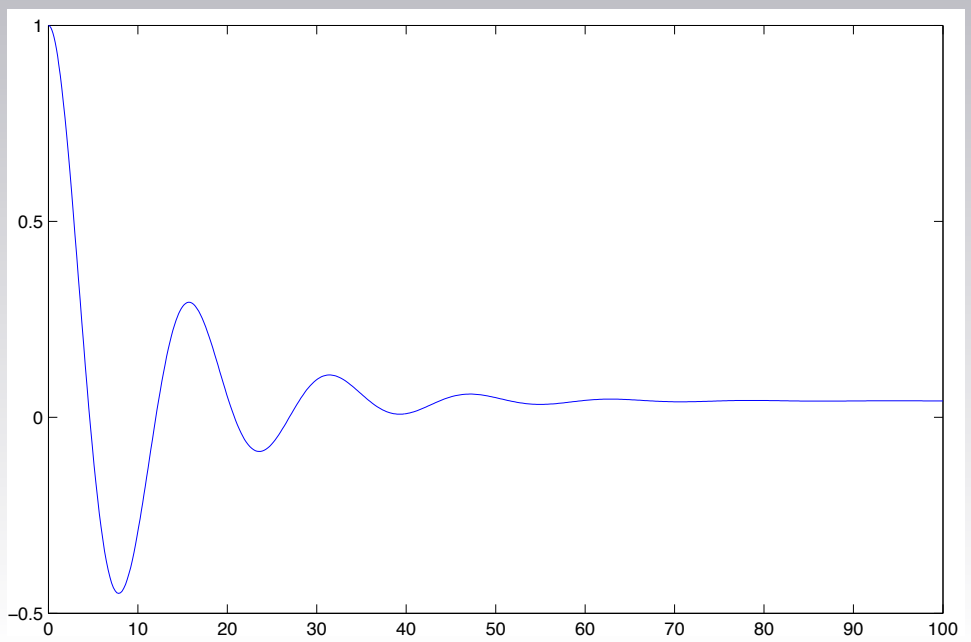
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