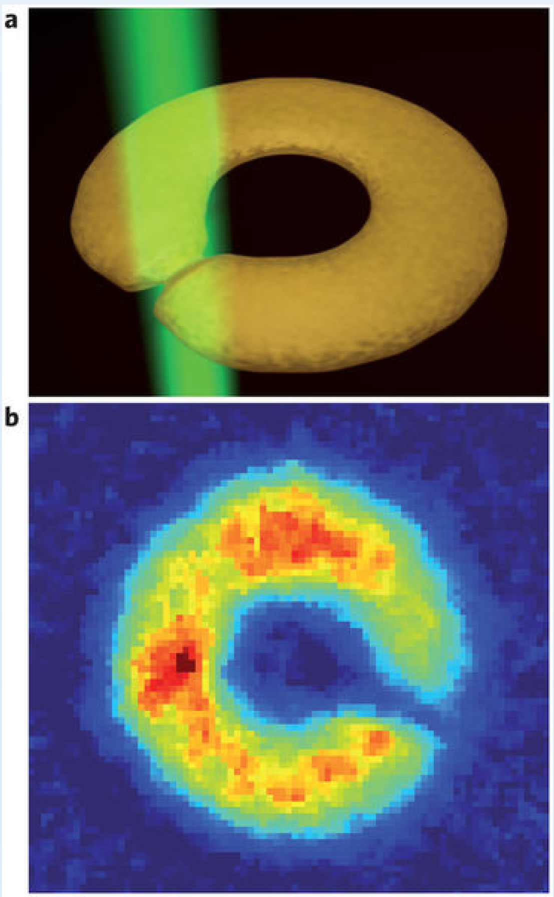
Adiabatic processes

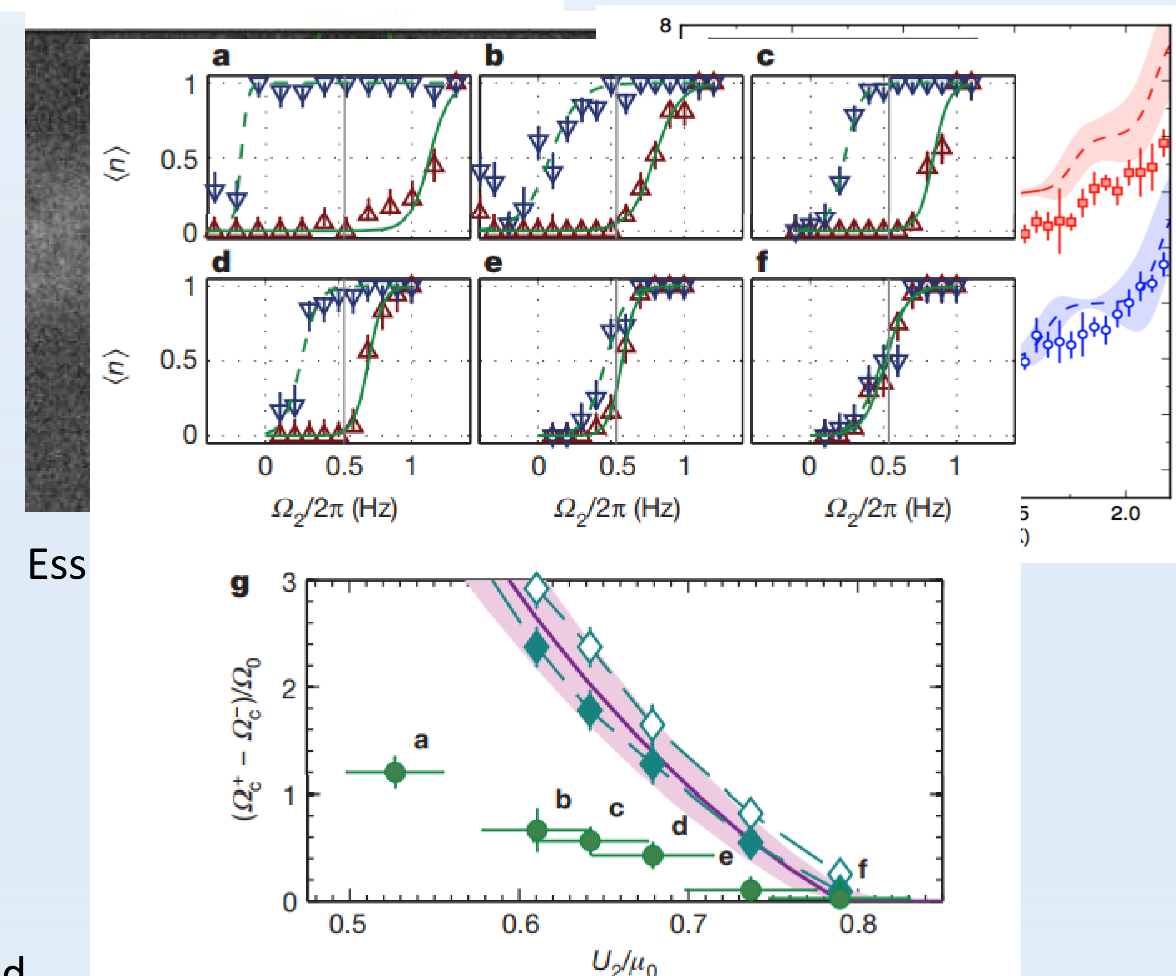
CM meets AMO

CONDENSED MATTER SEMINAR:
"OHM'S LAW AND BEYOND FOR ATOM CIRCUITS"

Chris Lobb, Maryland
1 pm Friday



Campbell group, NIST/Maryland



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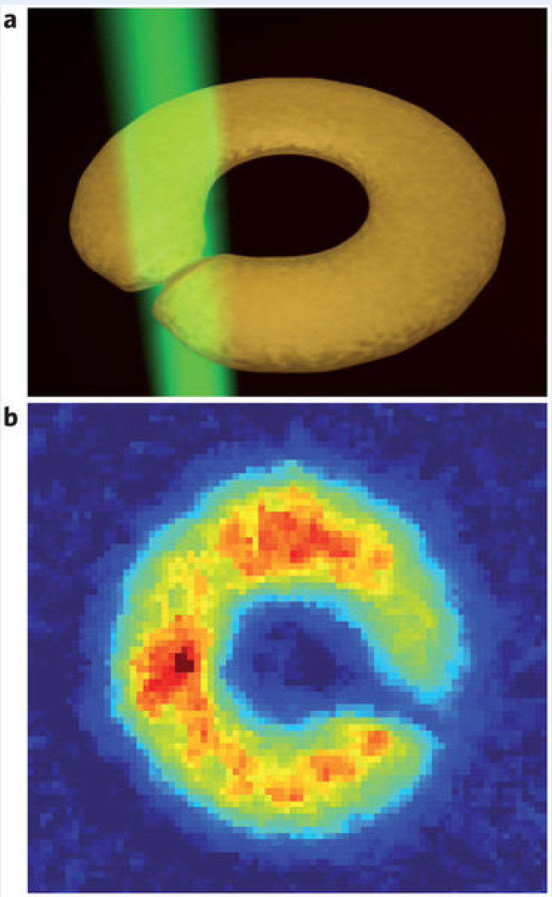

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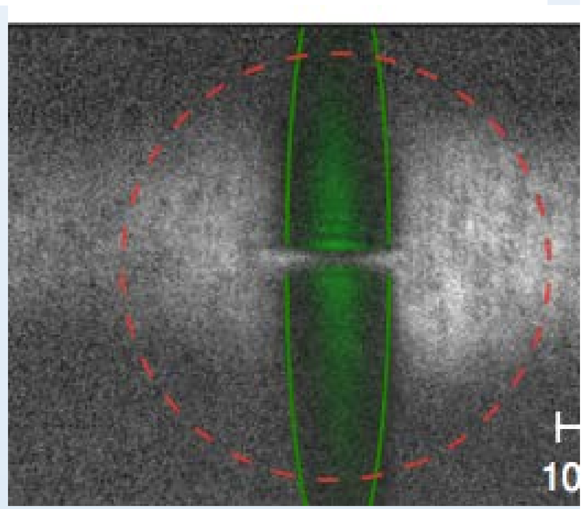
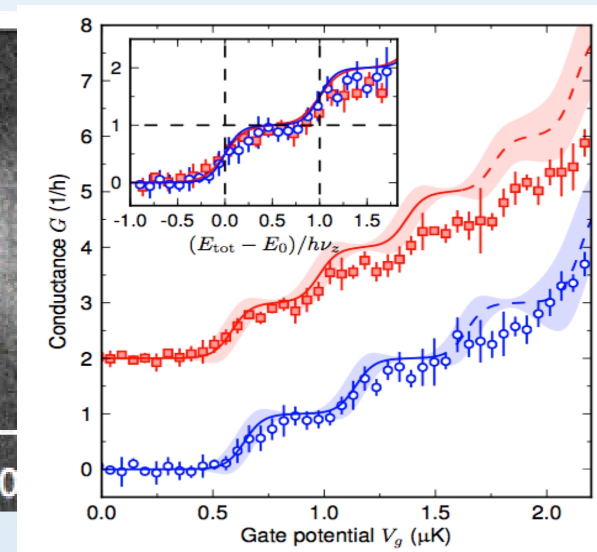

Esslinger group, ETH Zurich



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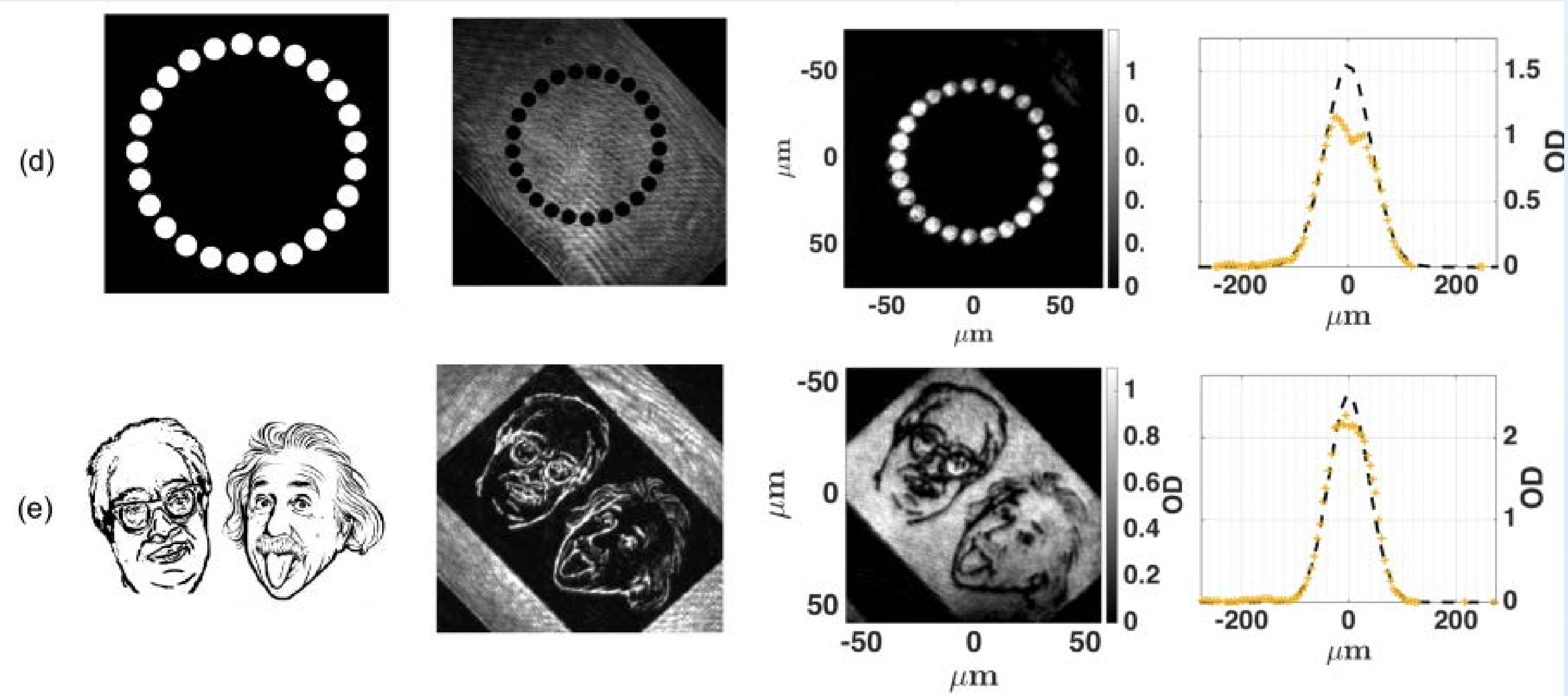


Neely group, Univ. of Queensland

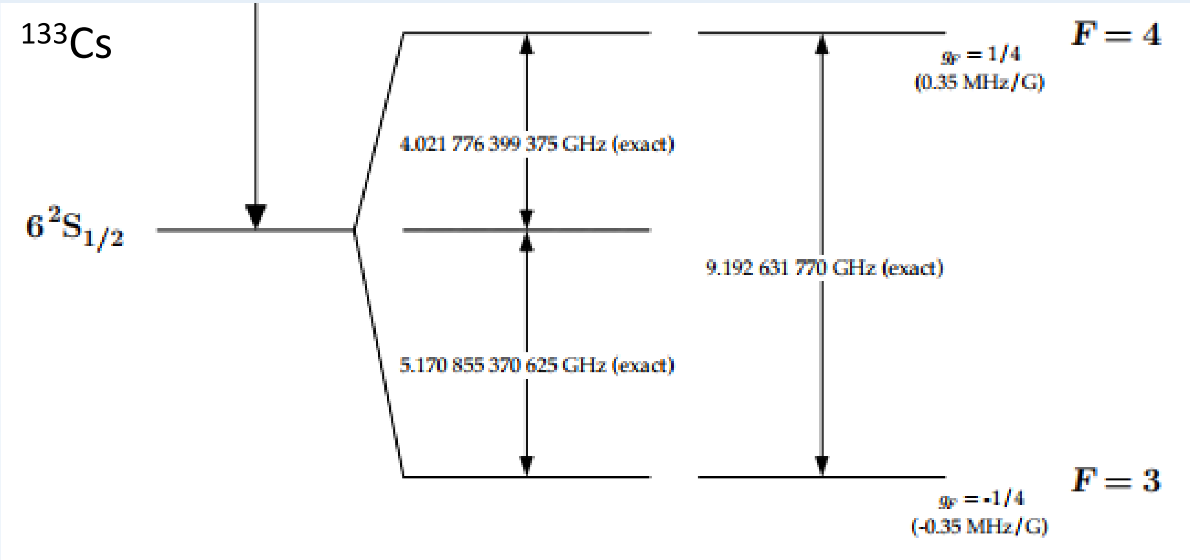
~arbitrary structures possible

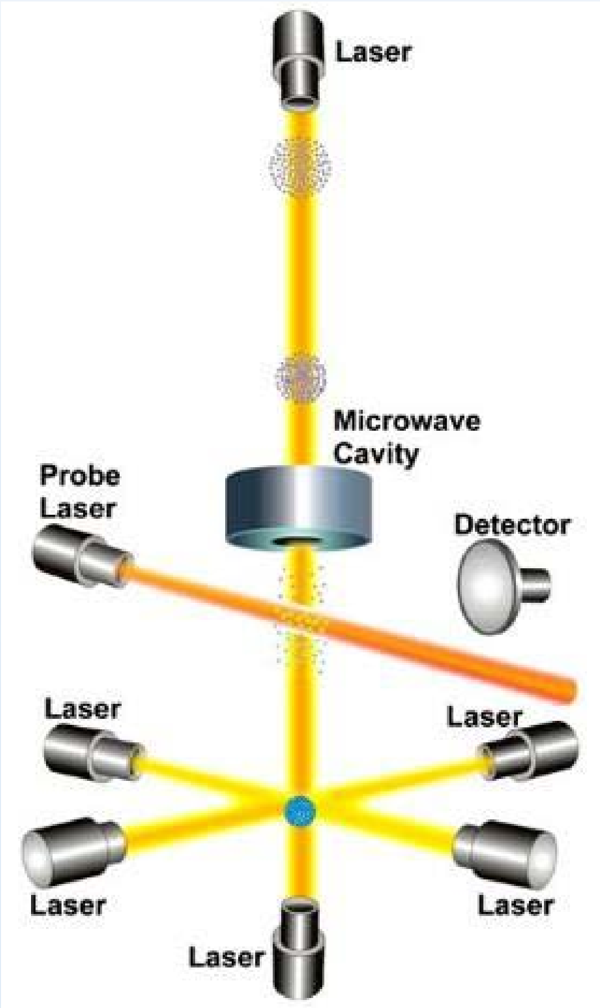
From last time…

the cesium fountain clock

ΔE determines the SI second (and meter)

$\Delta E \propto 1/\Delta t$



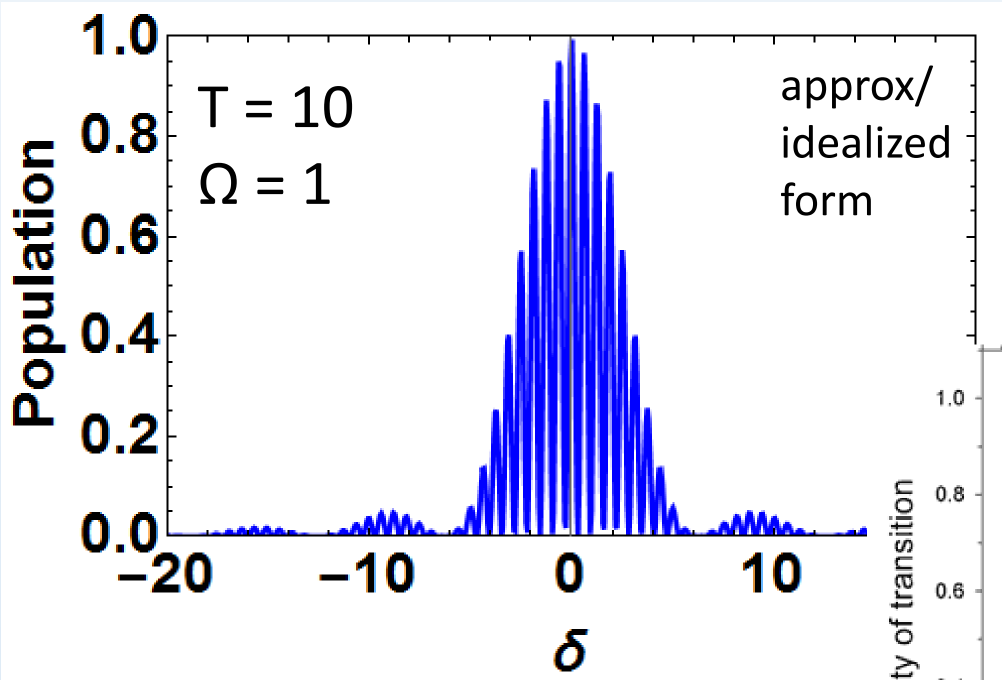


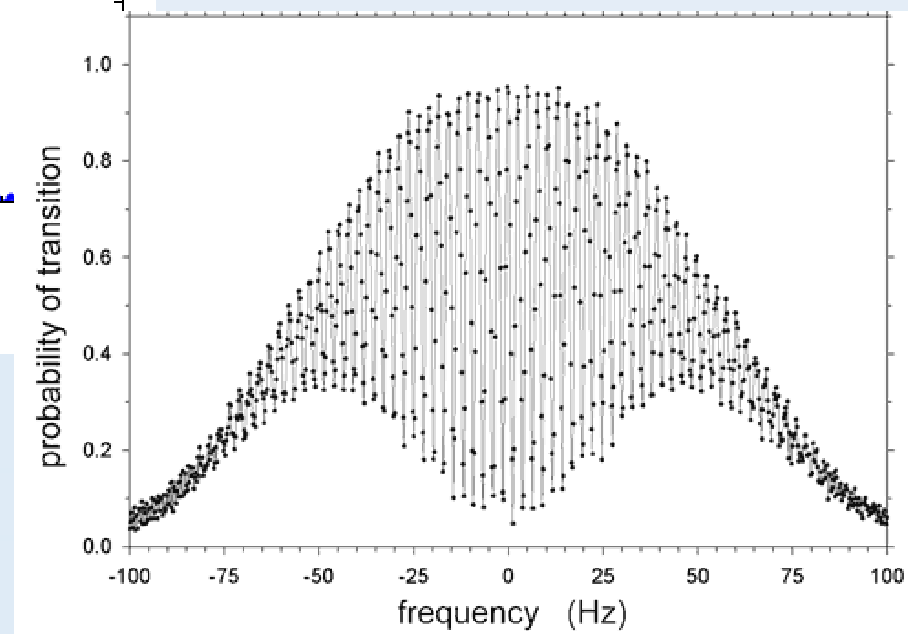
For many experiments,
long interaction time = large region of space

Hard to keep microwaves/laser (Ω) and external fields constant over large region of space

From last time…

Ramsey signal





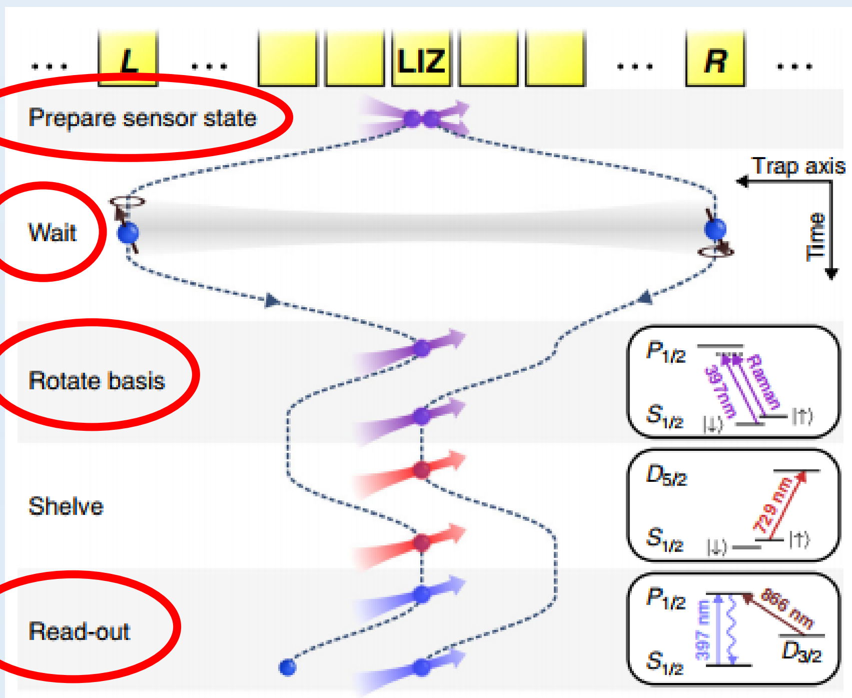
Phase accumulation in Ramsey interferometry

PHYSICAL REVIEW X **7**, 031050 (2017)

Entanglement-Based dc Magnetometry with Separated Ions*

T. Ruster, H. Kaufmann, M. A. Luda,† V. Kaushal, C. T. Schmiegelow,‡ F. Schmidt-Kaler, and U. G. Poschinger

Institut für Physik, Universität Mainz,
(Received 6 April 2017; revised manuscript rec



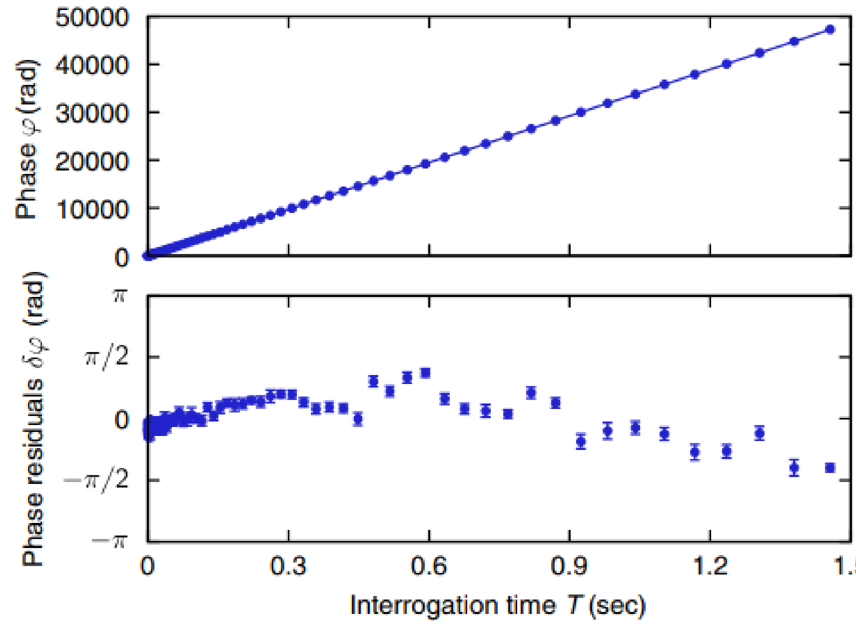
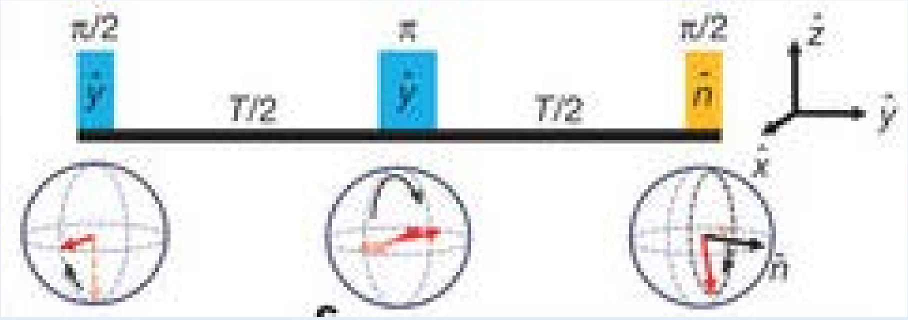


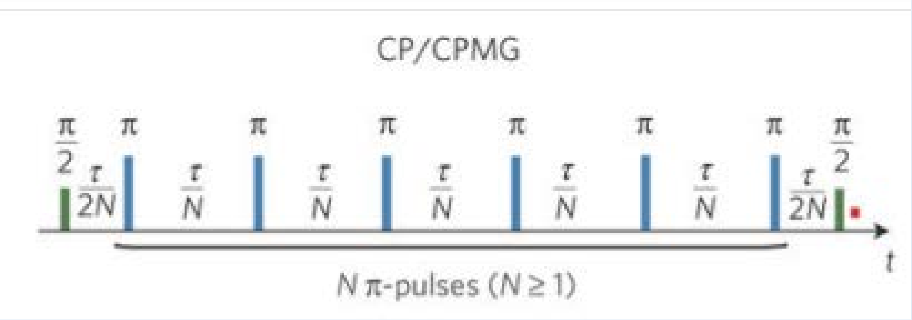
FIG. 2. Incremental measurement of the phase accumulation rate $\Delta\omega$ at an ion distance of $d = 6.2$ mm. A linear fit to measurements of the accumulated phase φ at predefined interrogation times (top part), and the fit residuals $\delta\varphi$ for each phase measurement are shown (bottom part). For each point, measurements of both operators have been repeated 50 times.

From last time…

More complex pulse sequences

Spin-echo (refocusing pulses)





From last time…

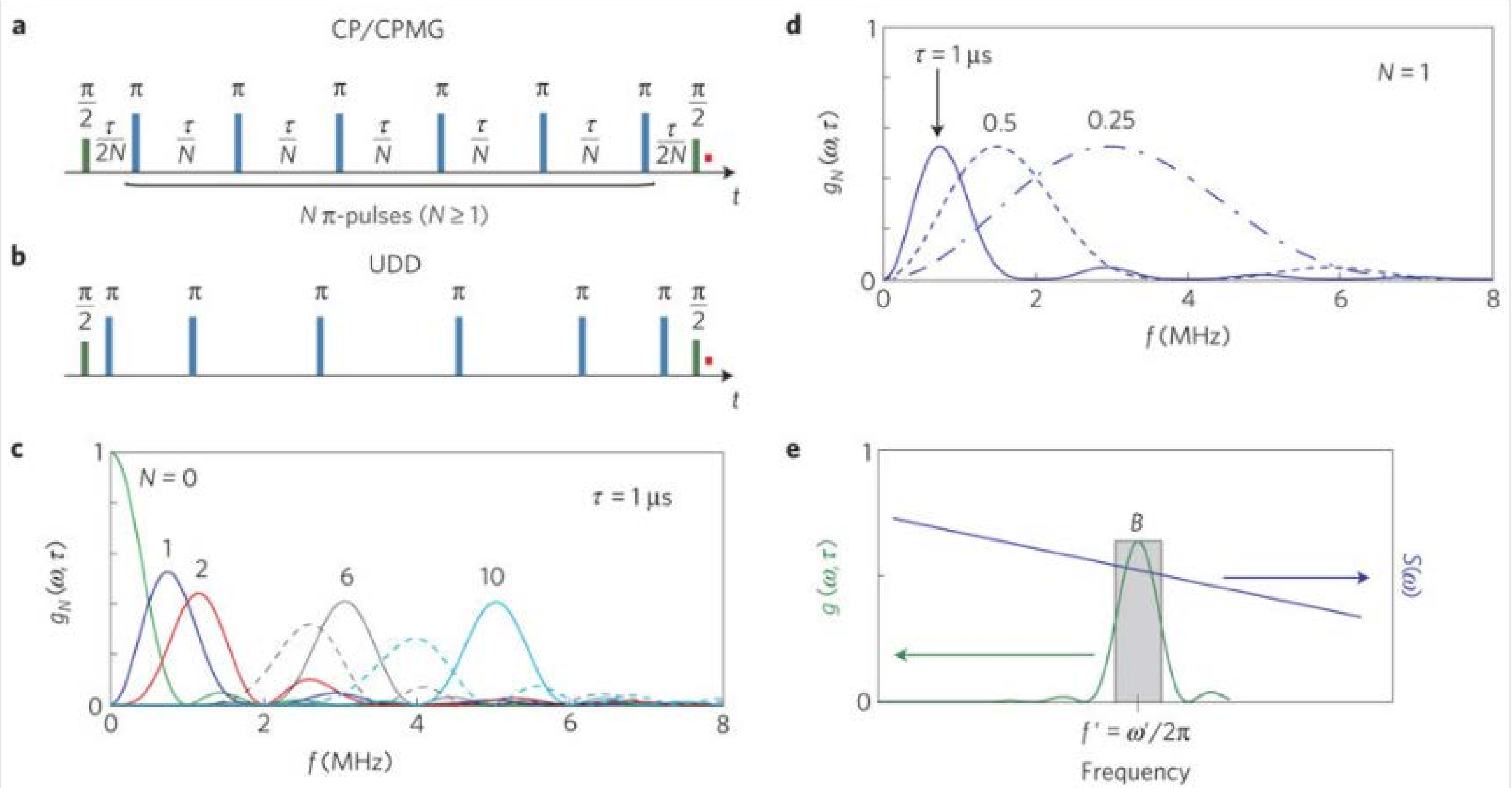
More complex pulse sequences

From

Noise spectroscopy through dynamical decoupling with a superconducting flux qubit

Jonas Bylander, Simon Gustavsson, Fei Yan, Fumiki Yoshihara, Khalil Harrabi, George Fitch, David G. Cory, Yasunobu Nakamura, Jaw-Shen Tsai & William D. Oliver

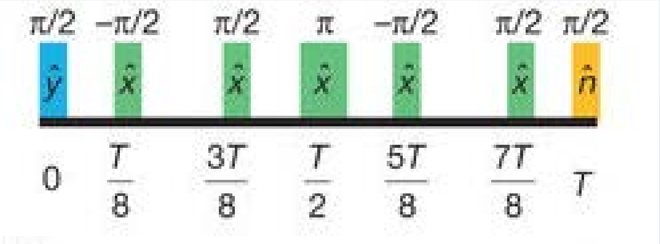
Nature Physics 7, 565–570 (2011) | doi:10.1038/nphys1994
Received 25 February 2011 | Accepted 04 April 2011 | Published online 08 May 2011



From last time…

More complex procedures

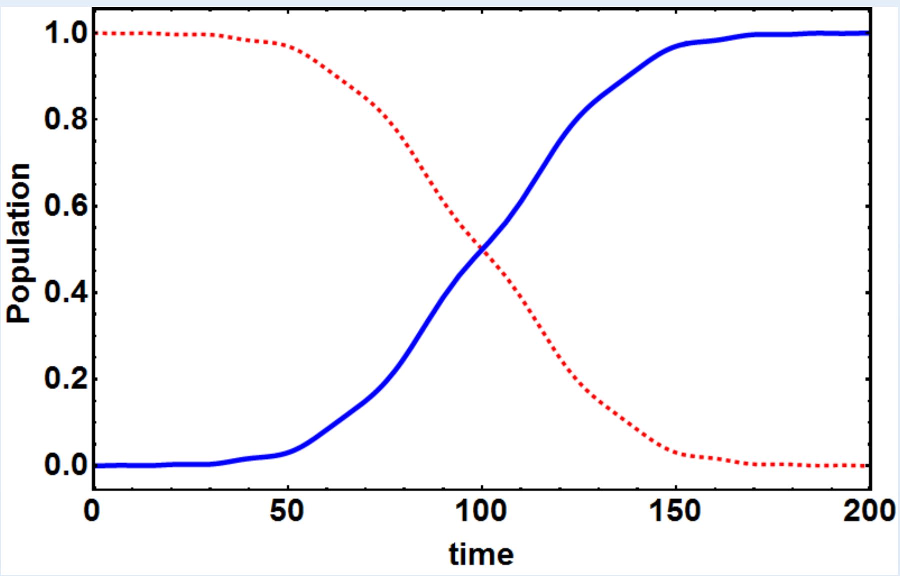
WAHUHA

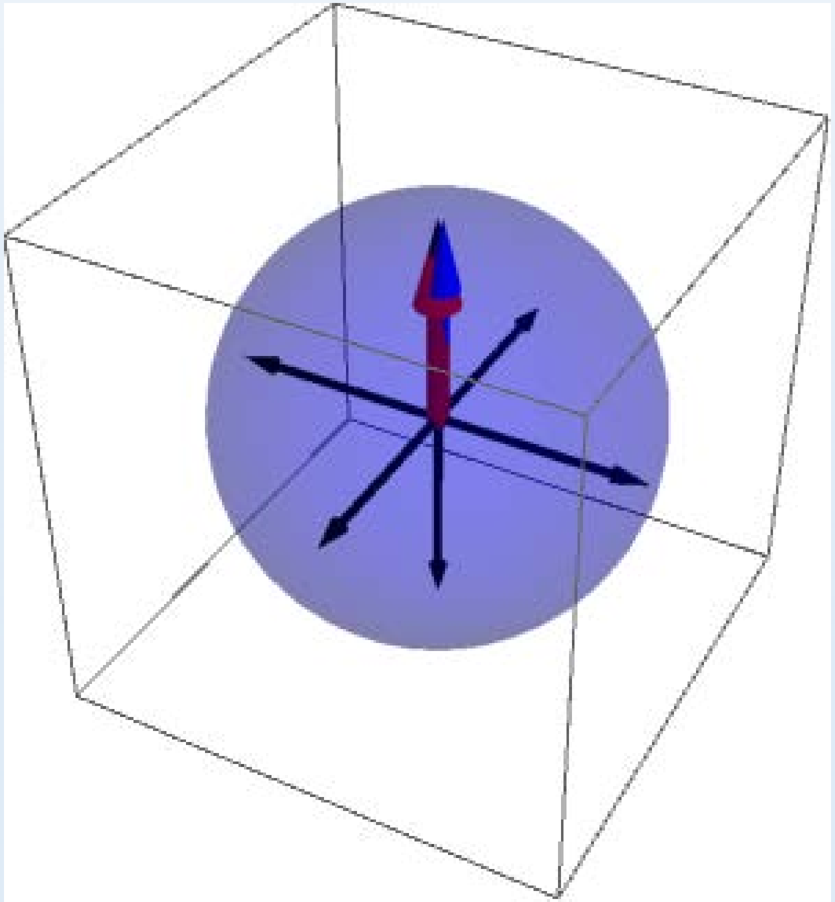


Adiabatic processes

Adiabatic rapid passage (ARP)

$$H = \delta(t)\hat{\sigma}_z + \Omega(t)\hat{\sigma}_x$$

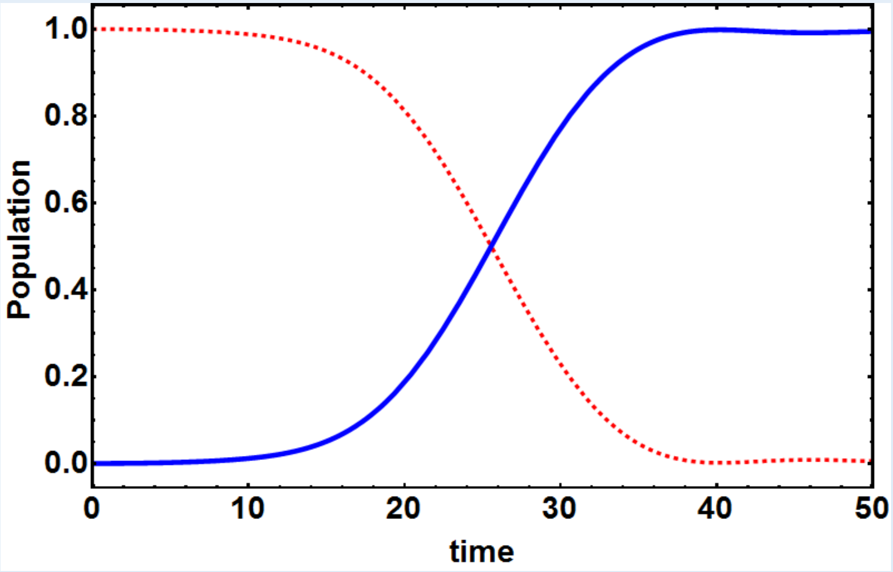


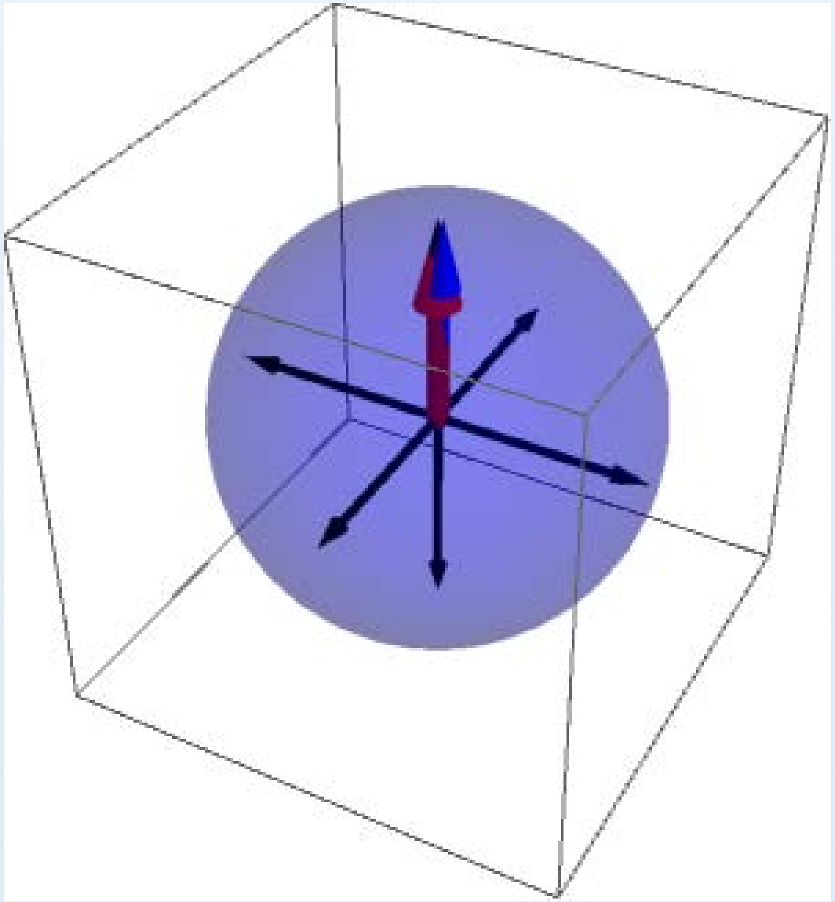


Adiabatic rapid passage (ARP)

$$H = \delta(t)\hat{\sigma}_z + \Omega(t)\hat{\sigma}_x$$

faster by factor of 4

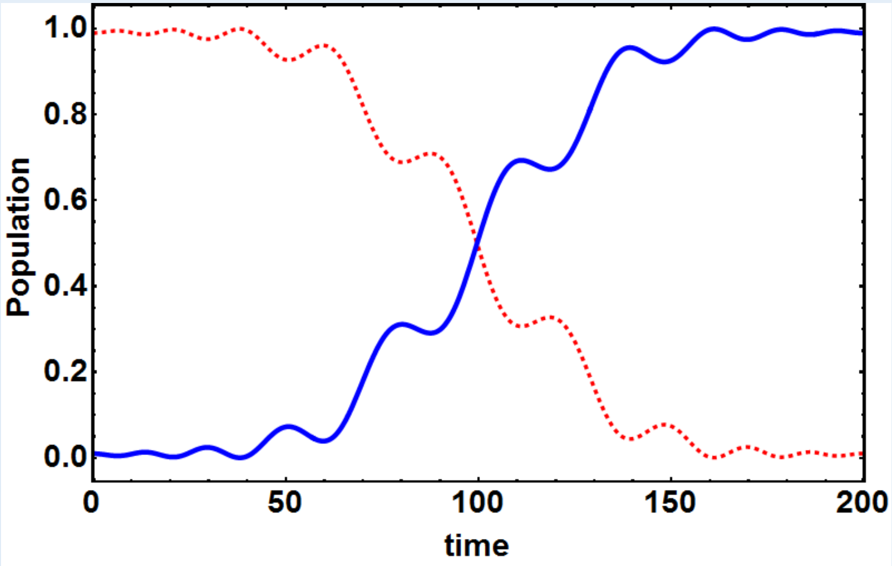


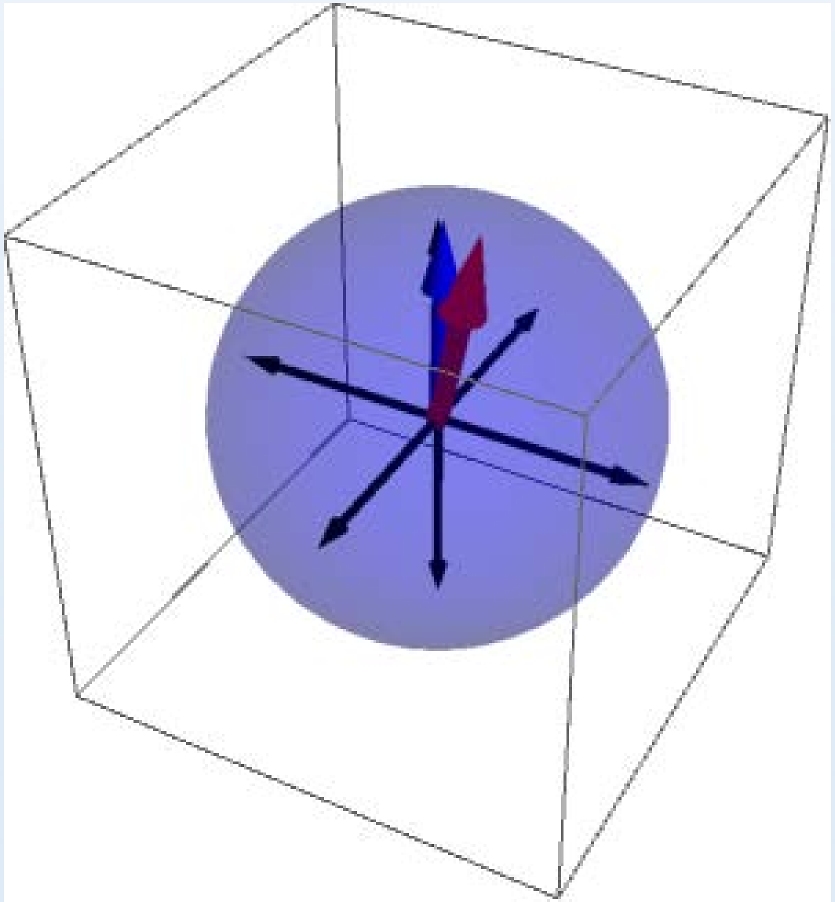


Adiabatic rapid passage (ARP)

$$H = \delta(t)\hat{\sigma}_z + \Omega(t)\hat{\sigma}_x$$

slightly rotated initial state





Superadiabatic (counterdiabatic) protocols

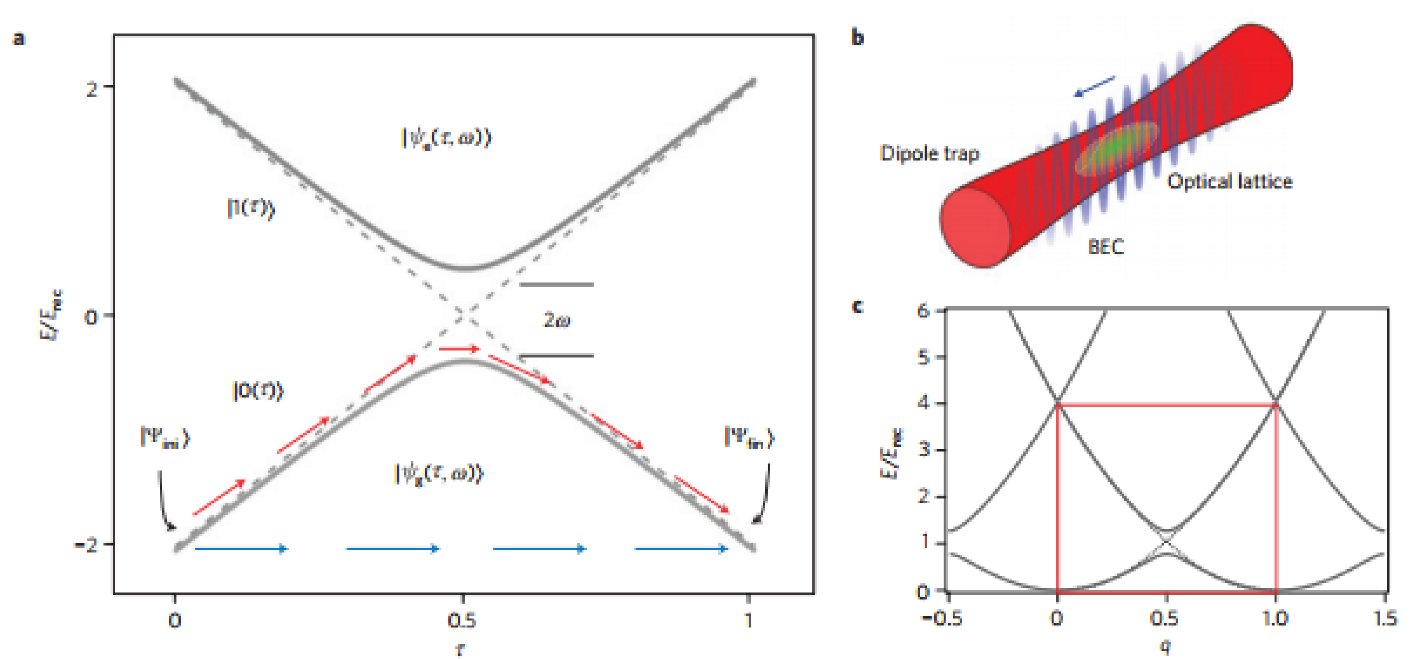
nature physics

ARTICLES

PUBLISHED ONLINE: 18 DECEMBER 2011 | DOI: 10.1038/NPHYS2170

High-fidelity quantum driving

Mark G. Bason[1], Matthieu Viteau[1], Nicola Malossi[2], Paul Huillery[1,3], Ennio Arimondo[1,2,4], Donatella Ciampini[1,2,4], Rosario Fazio[5], Vittorio Giovannetti[5], Riccardo Mannella[4] and Oliver Morsch[1]*



Superadiabatic (counterdiabatic) protocols


nature physics
ART
PUBLISHED ONLINE: 18 DECEMBER 2011 | DOI: 10.10

High-fidelity quantum driving

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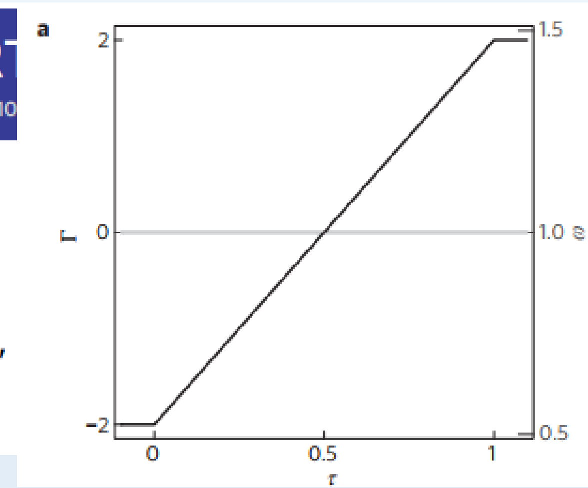
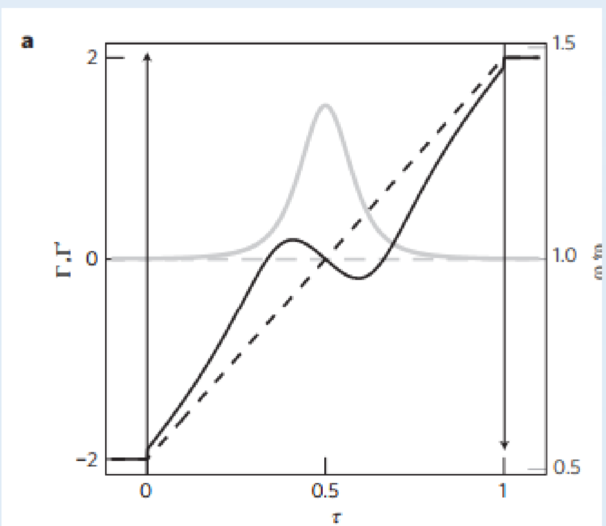
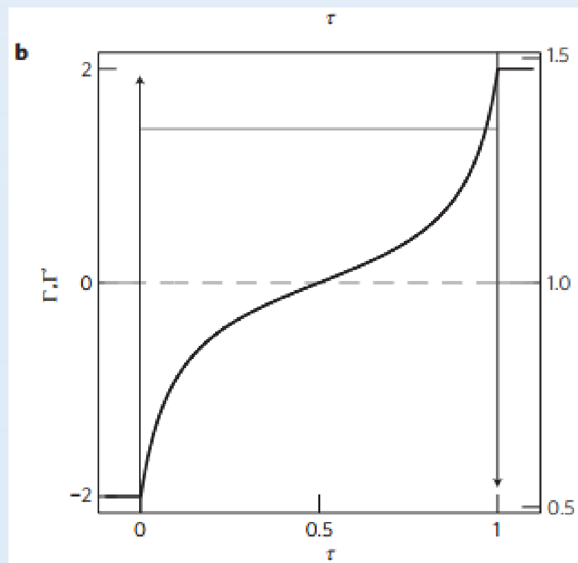
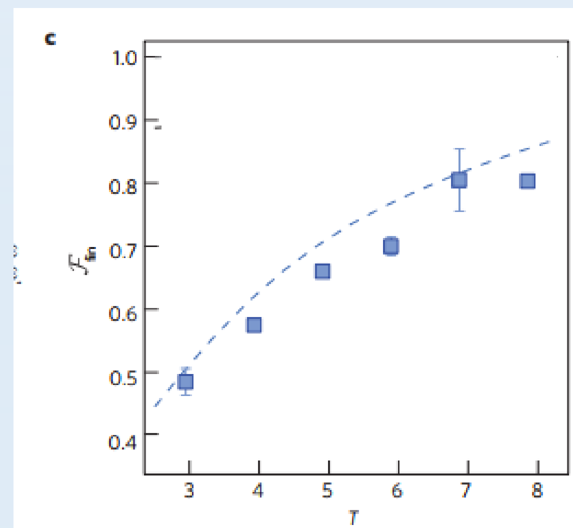




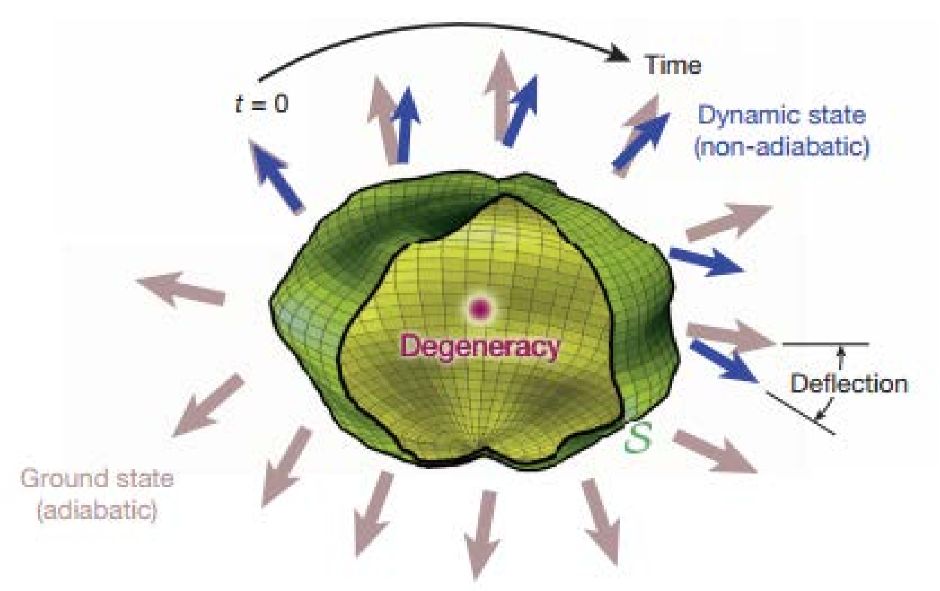




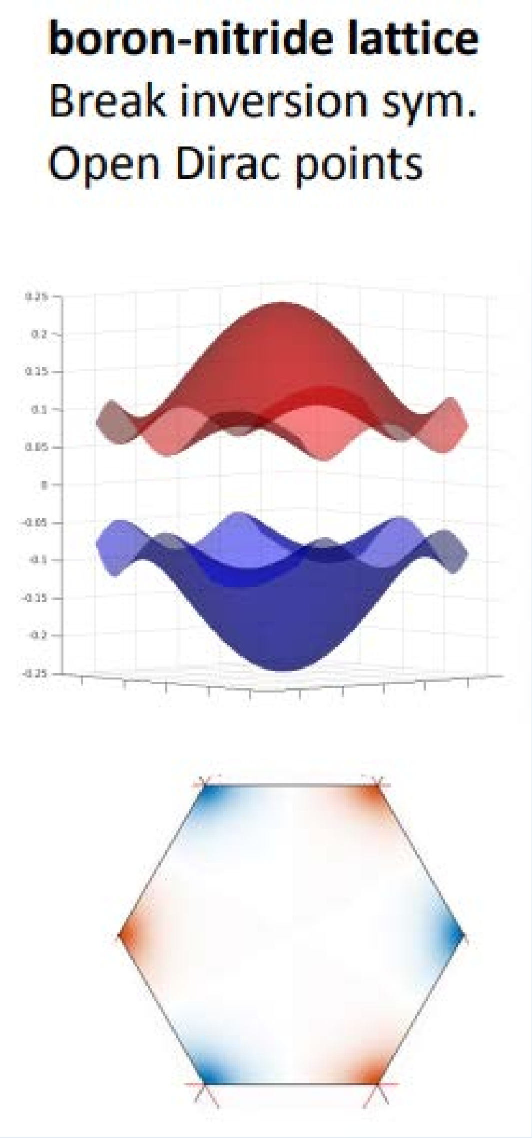
Non-adiabatic response

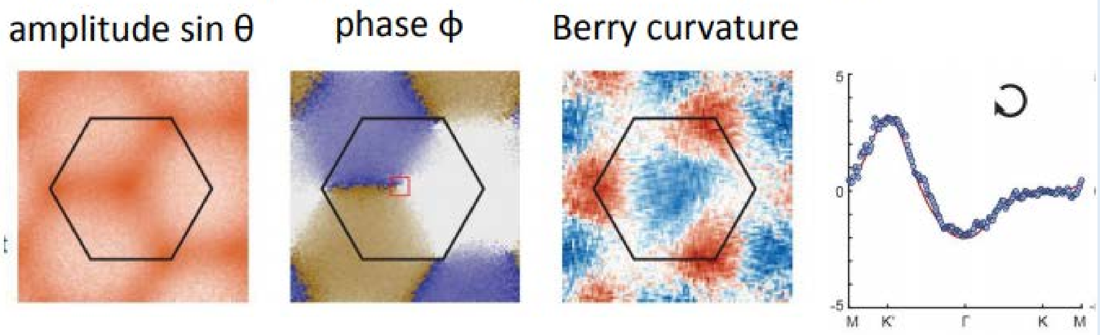
Observation of topological transitions in interacting quantum circuits

P. Roushan[1]†*, C. Neill[1]*, Yu Chen[1]†*, M. Kolodrubetz[2], C. Quintana[1], N. Leung[1], M. Fang[1], R. Barends[1]†, B. Campbell[1], Z. Chen[1], B. Chiaro[1], A. Dunsworth[1], E. Jeffrey[1]†, J. Kelly[1], A. Megrant[1], J. Mutus[1]†, P. J. J. O'Malley[1], D. Sank[1]†, A. Vainsencher[1], J. Wenner[1], T. White[1], A. Polkovnikov[2], A. N. Cleland[1] & J. M. Martinis[1,3]



Non-adiabatic response – berry curvature



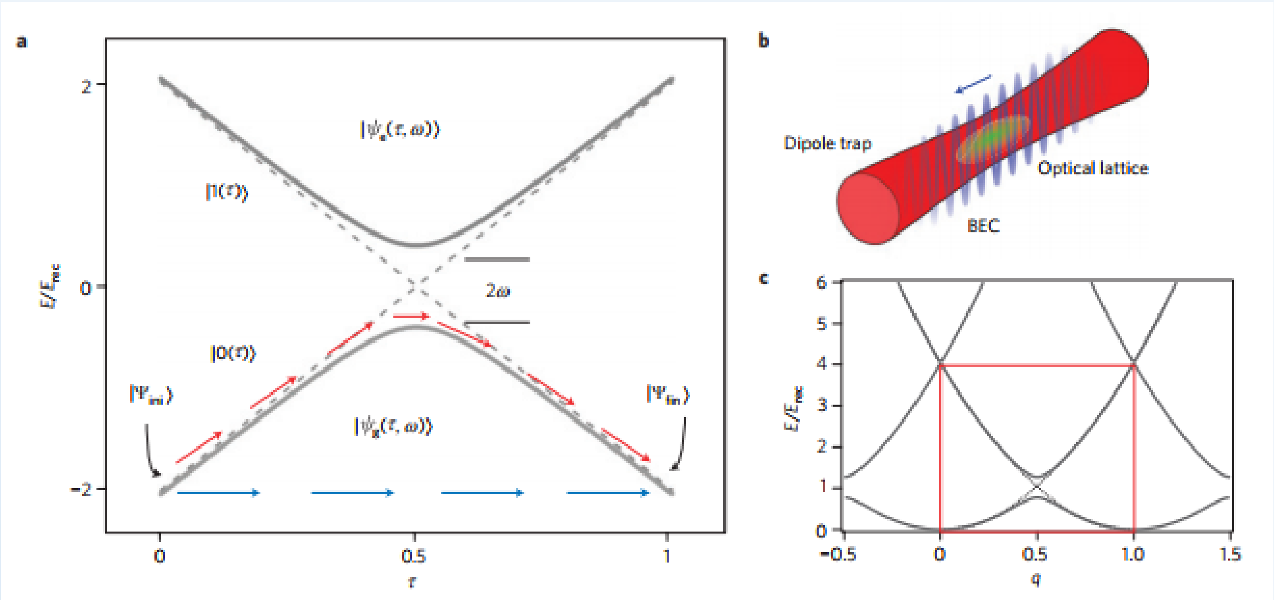


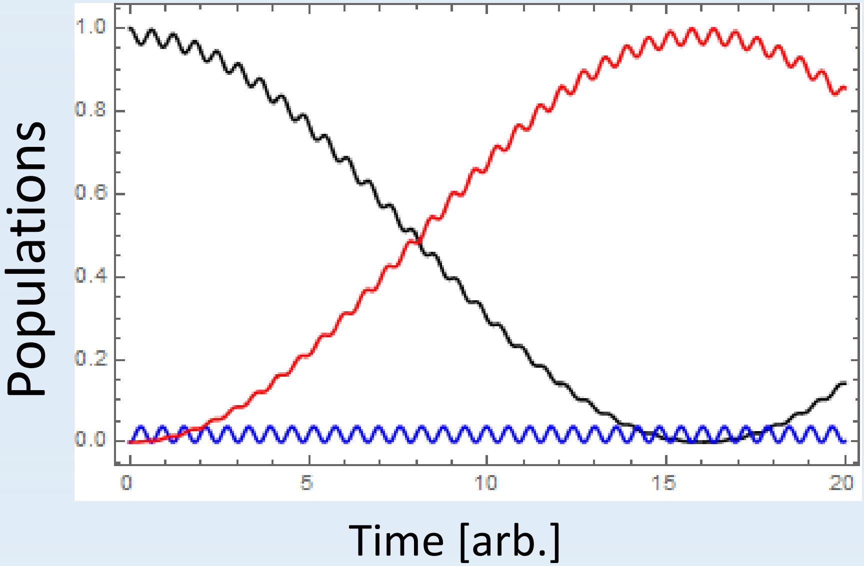
- State tomography from quench dynamics
- Quantization of the Chern number:

C=0.005(6) C=-0.016(8)

Weitenberg/Sengstock group, Hamburg

Three-level systems





STImulated Raman Adiabatic Passage