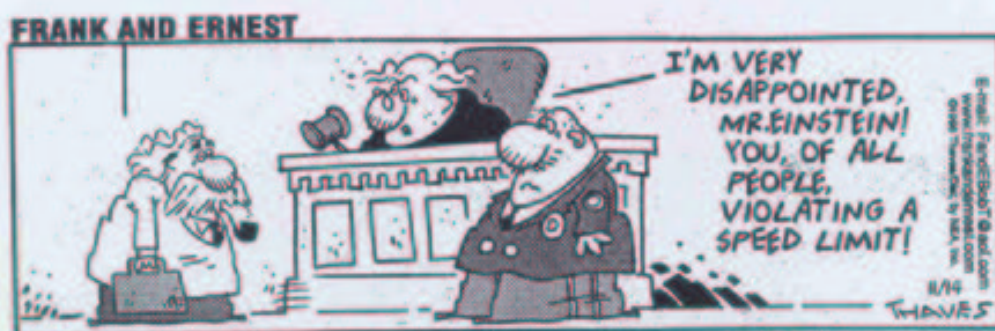


x

TAMING LIGHT WITH COLD ATOMS:
LIGHT AT BICYCLE SPEED...
AND SLOWER YET!



Harvard/Rowland Slow Light Team:

Zachary Dutton

Chien Liu

Cyrus Behroozi

Michael Budde

Christopher Slowe

Lene Vestergaard Hau

Collaborator:

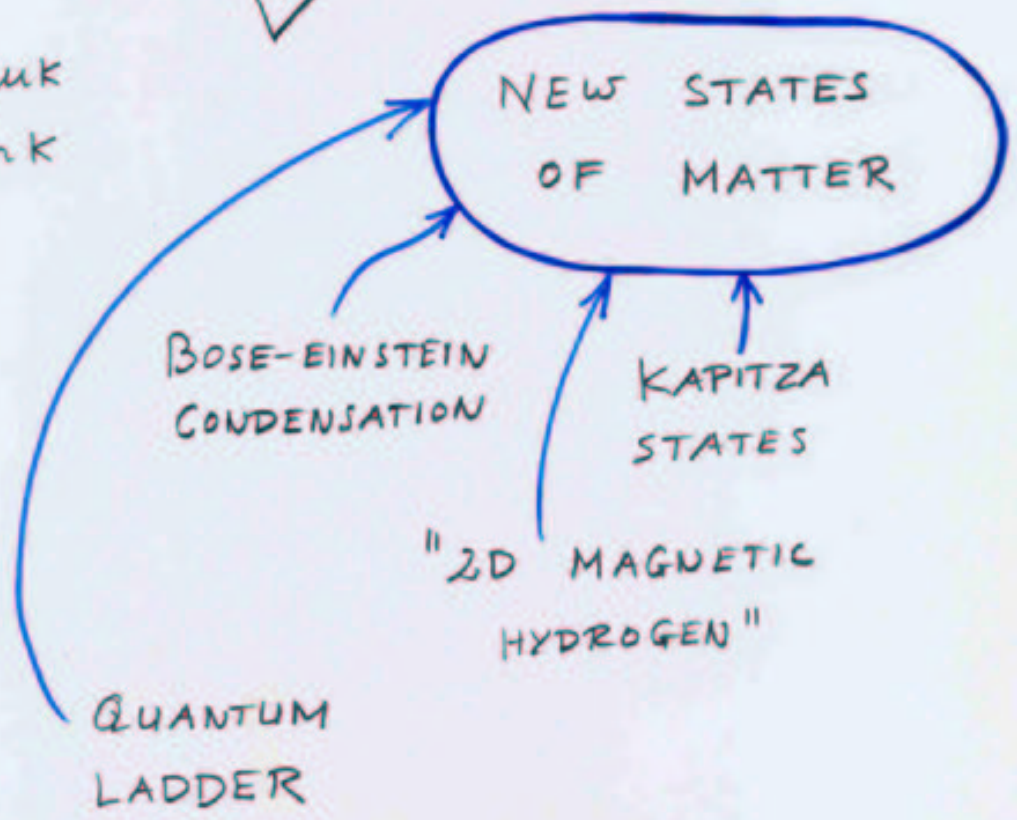
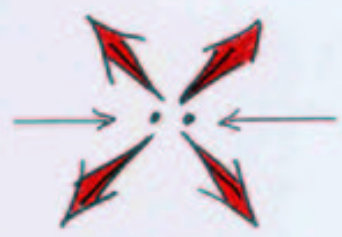
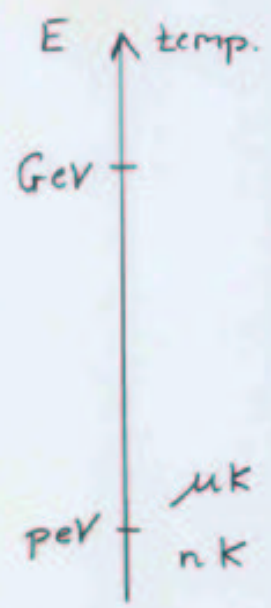
Steve Harris,

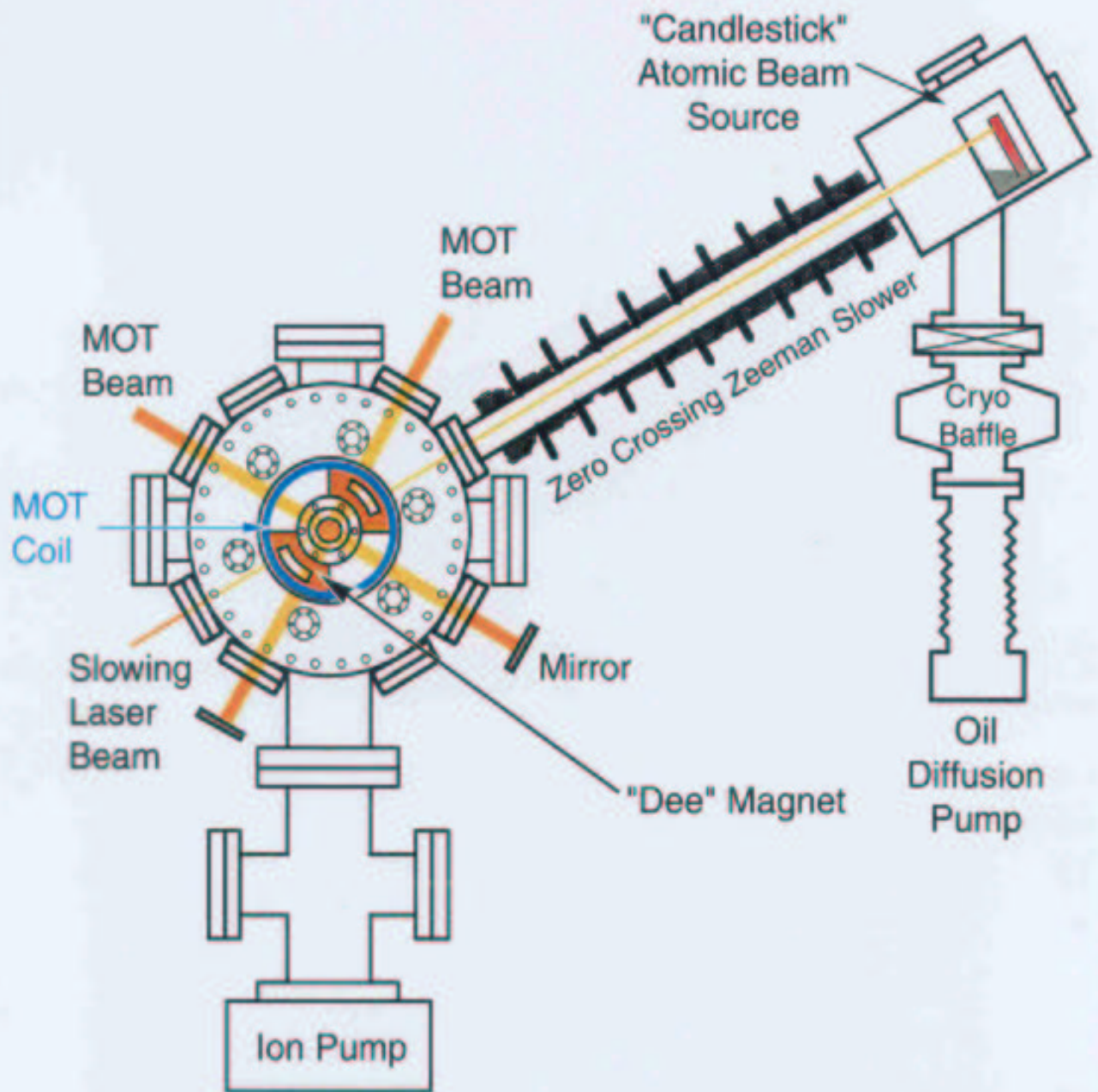
Stanford

ATOM COOLING

μK nK

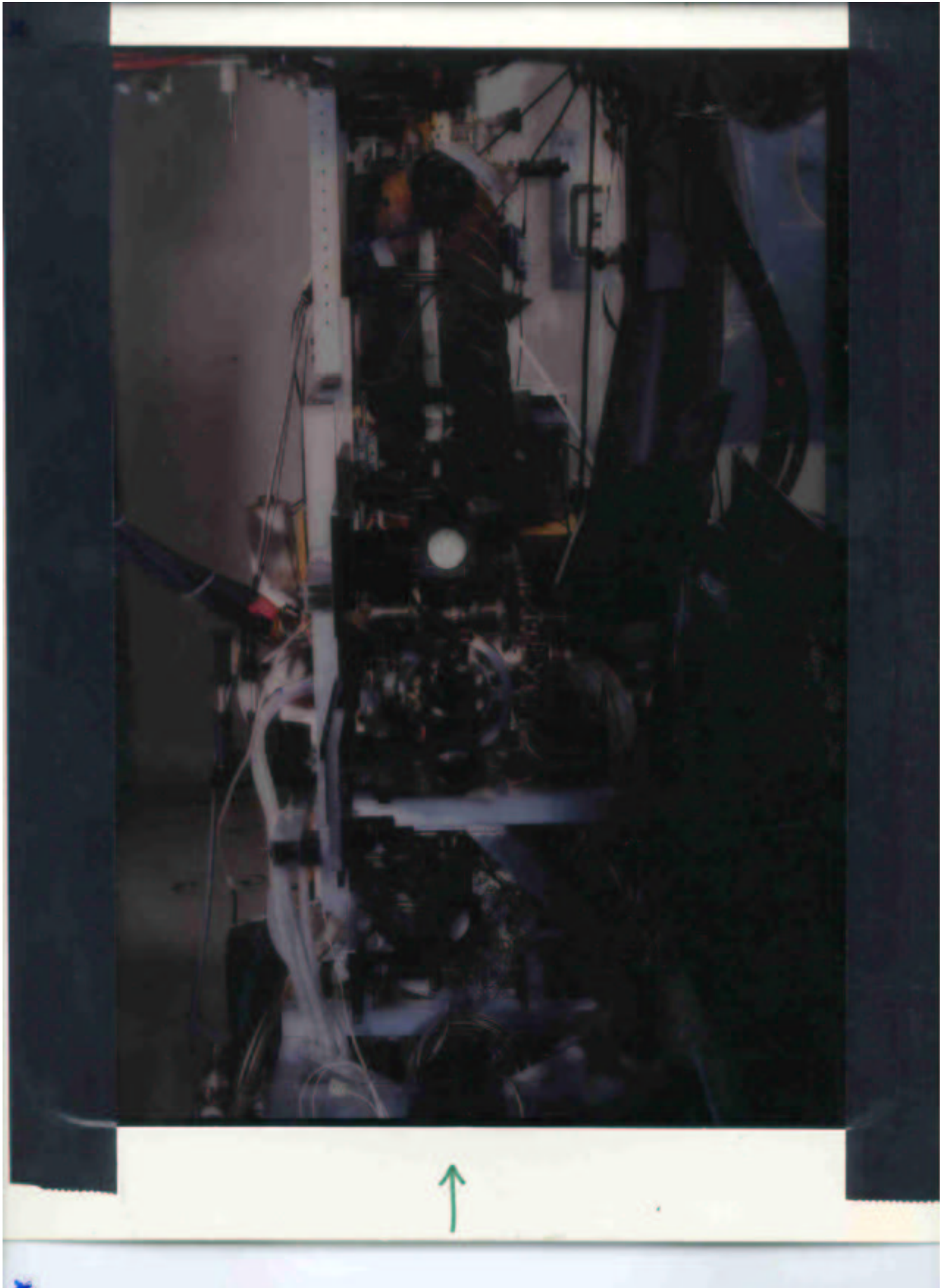
WHY ???



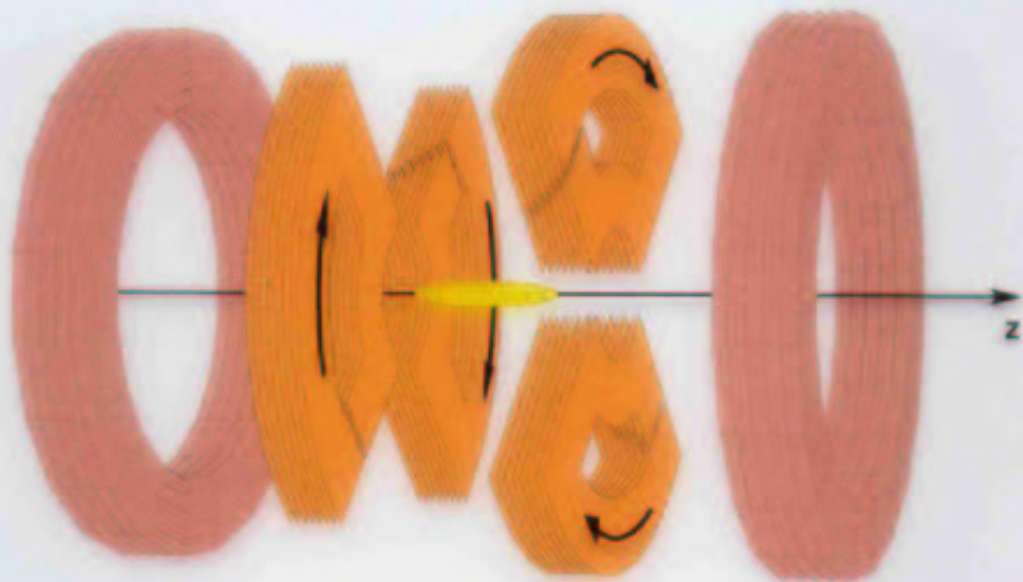


NATIONAL GEOGRAPHIC, October 2001





"4D" MAGNET



Collision rate \uparrow :

TIGHT TRAP : ~ 1000 A \nearrow 1ms

asymmetric harmonic oscillator :

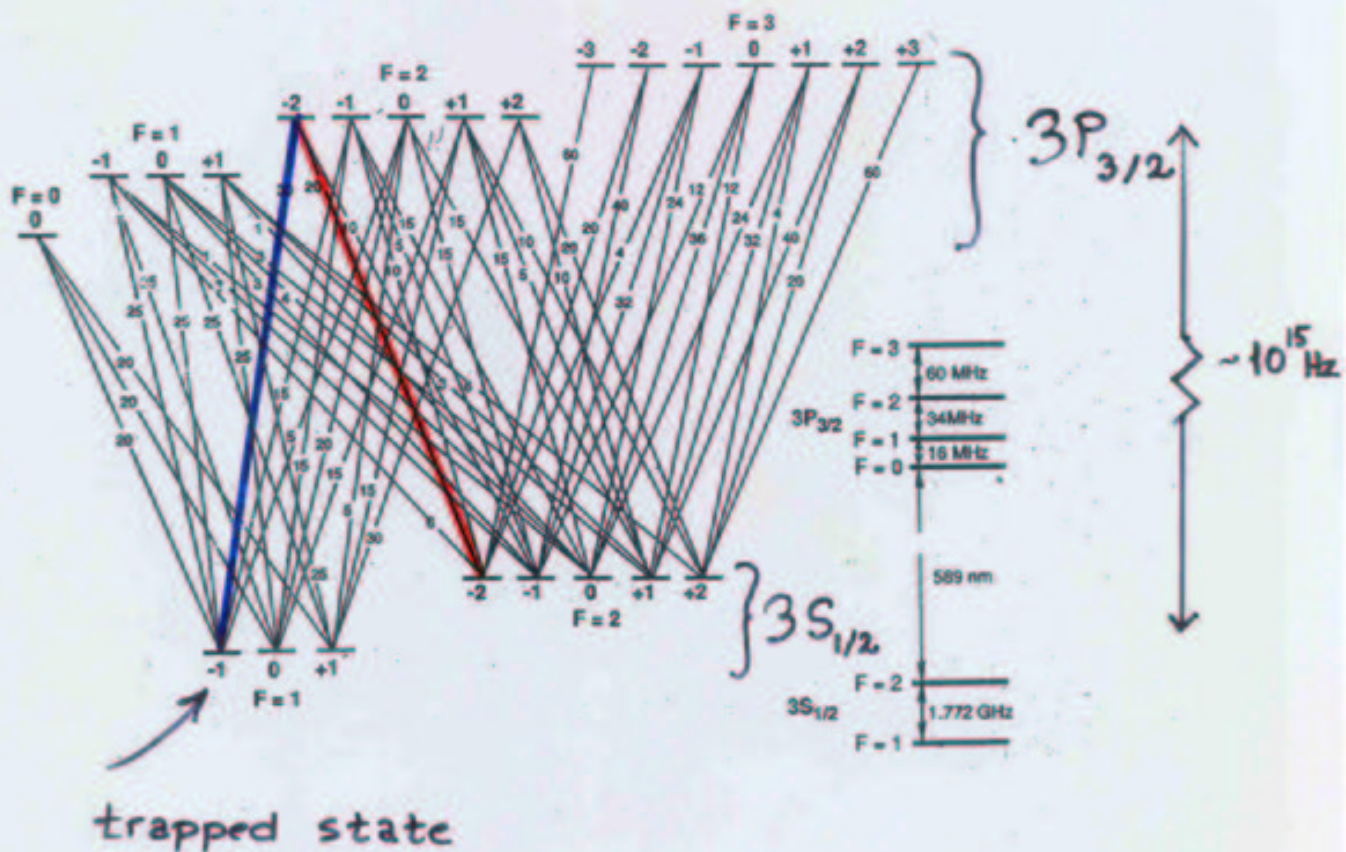
$$\omega_x = \omega_y = 12 \omega_z = 2040 \text{ rad/s}$$

38 secs evaporation

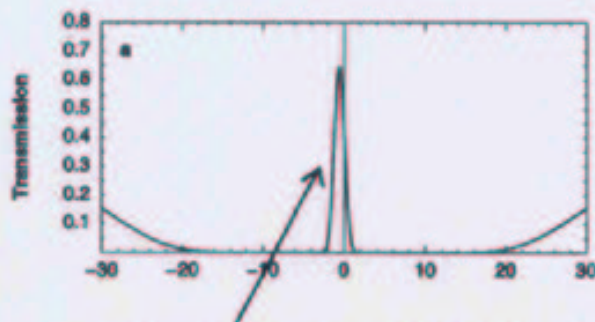
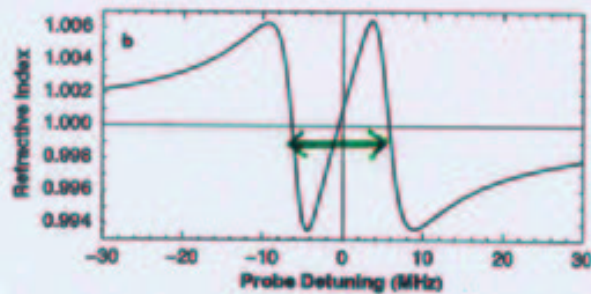
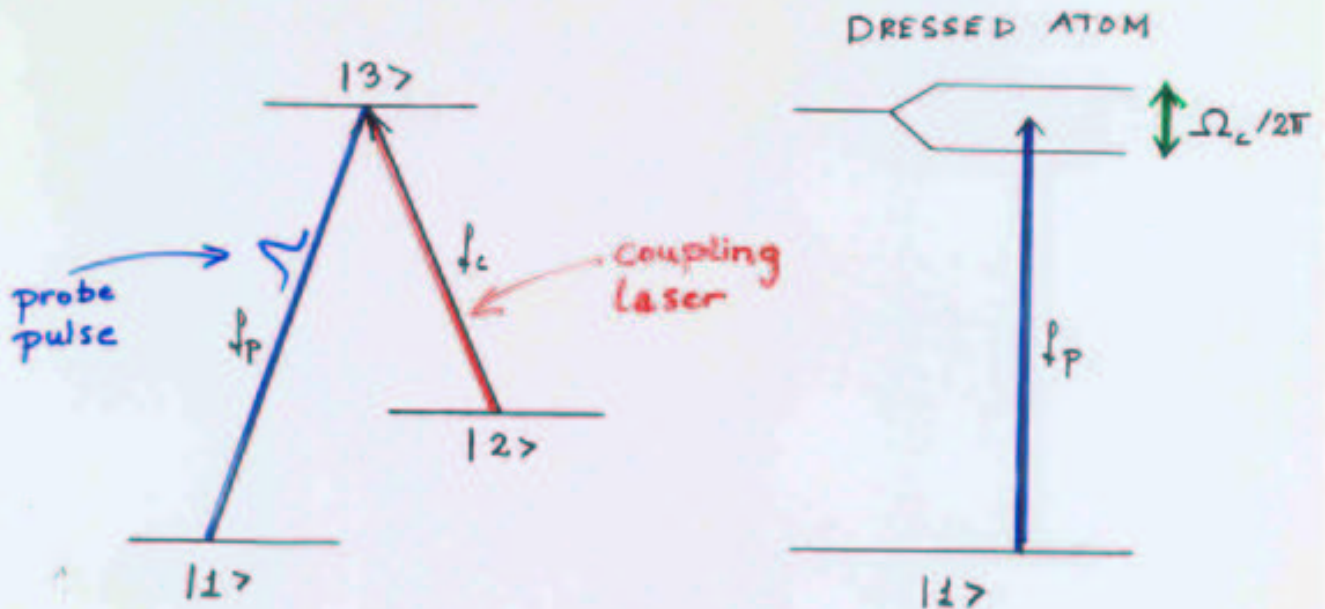
RF : 32 MHz \longrightarrow ≈ 1.2 MHz

Colder : smaller + denser cloud

D2 hyperfine lines



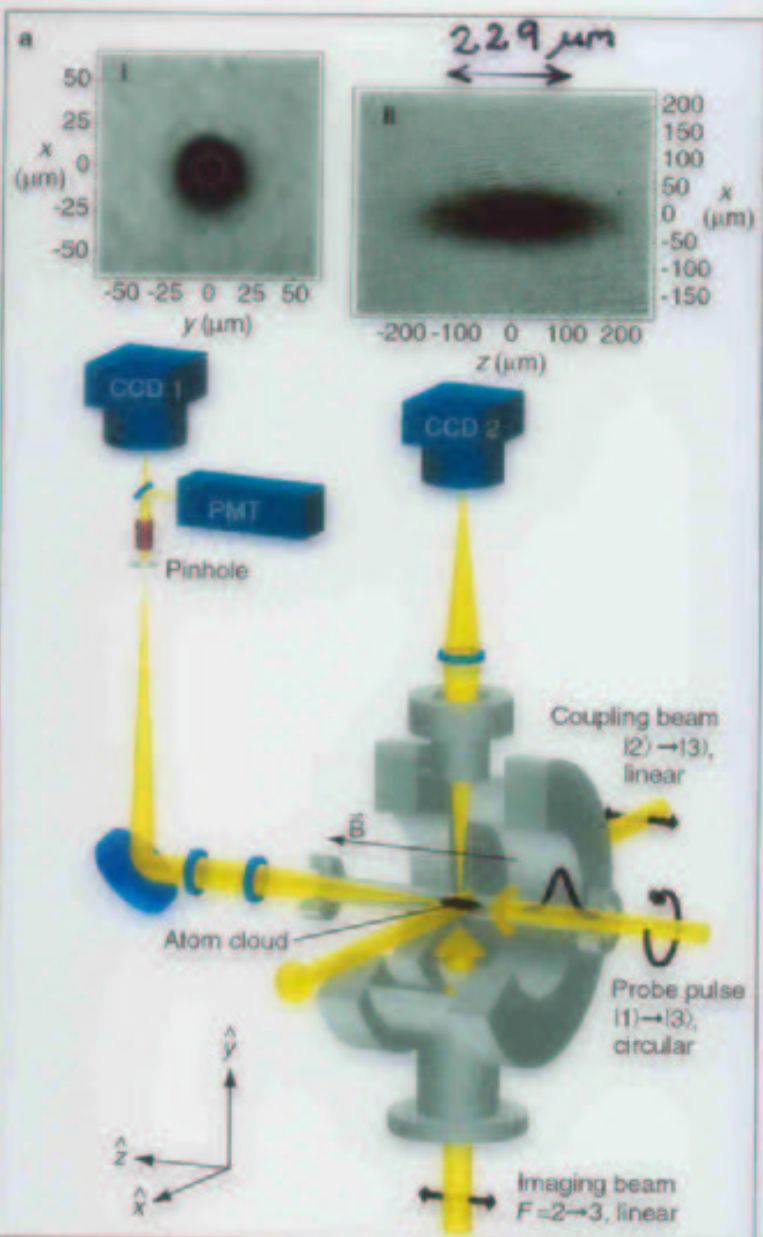
• Electromagnetically Induced Transparency



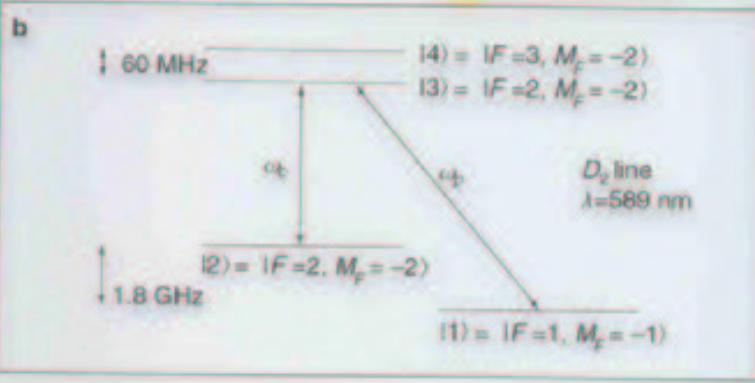
Electromagnetically Induced Transparency

• Destructive interference of induced dipole moments

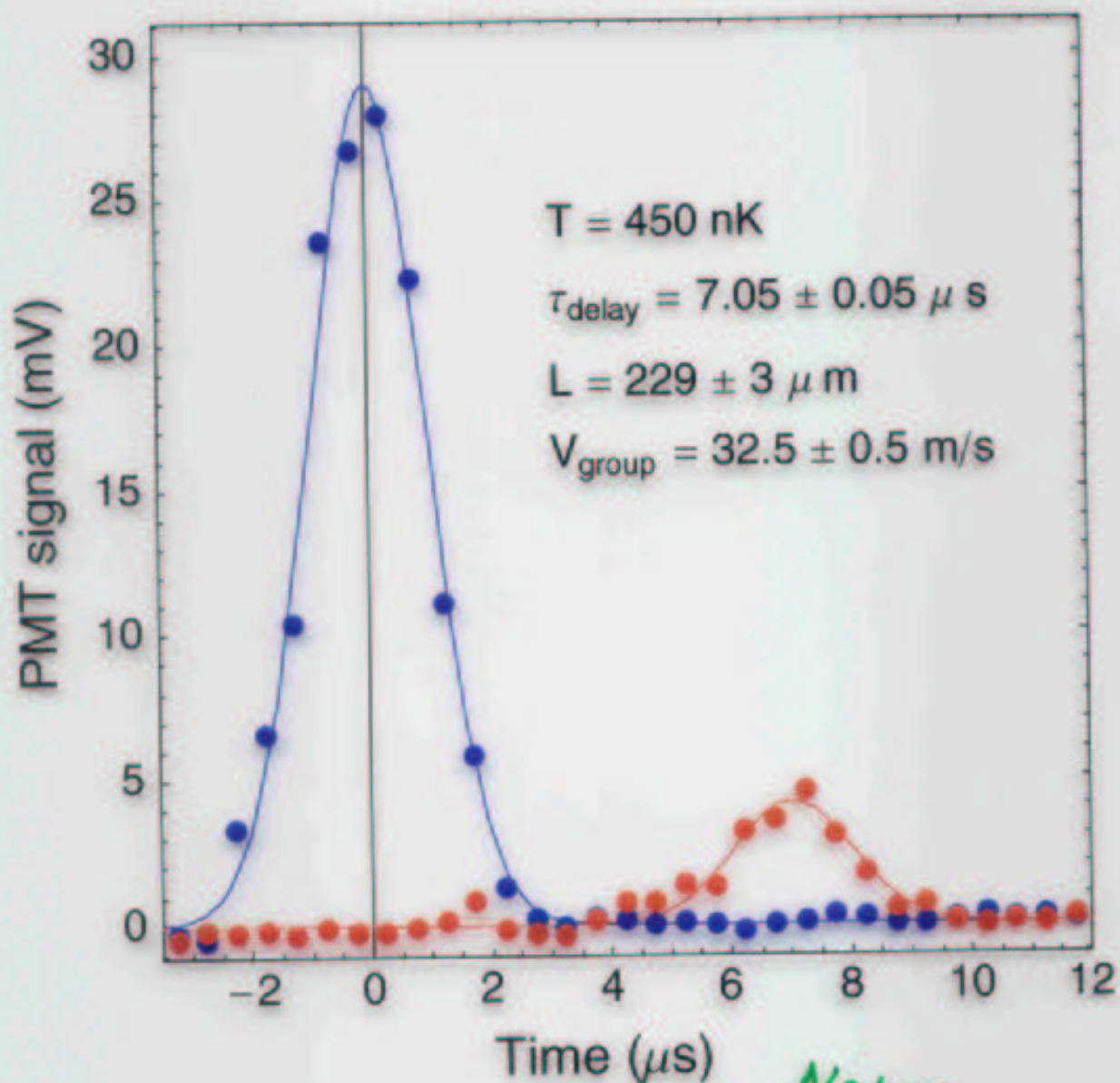
• no coupling to vacuum modes



$T = 450 \text{ nK}$
 $T_c = 435 \text{ nK}$
 $N = 3.8 \cdot 10^6$
 $\eta_0 = 3.3 \cdot 10^{12} / \text{cm}^3$



PULSE DELAY MEASUREMENT



Nature
Feb. 18 1999

18 February 1999

International weekly journal of science

nature

0028-280X(19990218)381:1:1-0
1999 Nature Publishing Group
0028-280X(19990218)381:1:1-0
1999 Nature Publishing Group
0028-280X(19990218)381:1:1-0
1999 Nature Publishing Group

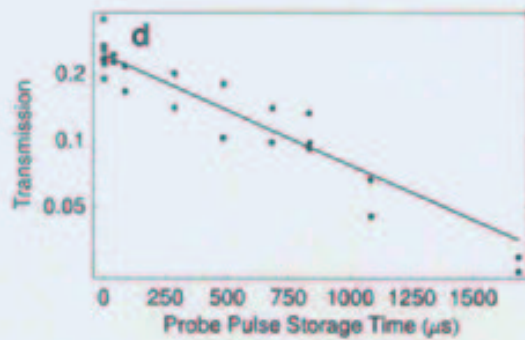
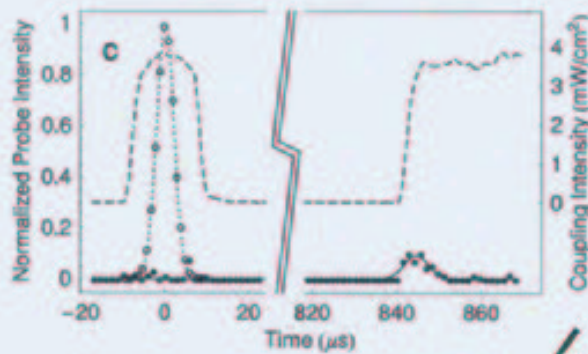
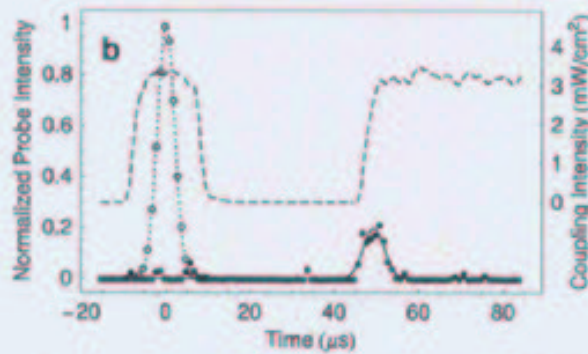
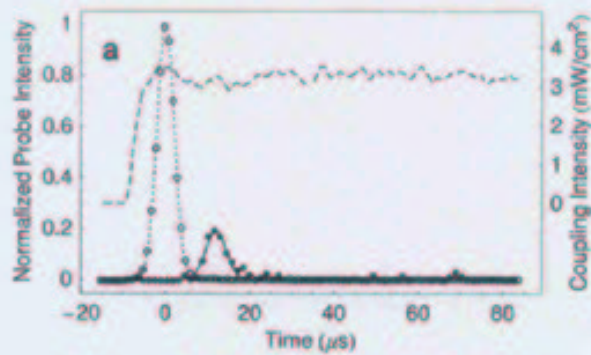
Cycling at the speed of light?

Palaeontology A primitive fossil fish

Mars Insights into surface processes

Gene expression A DNA demethylase

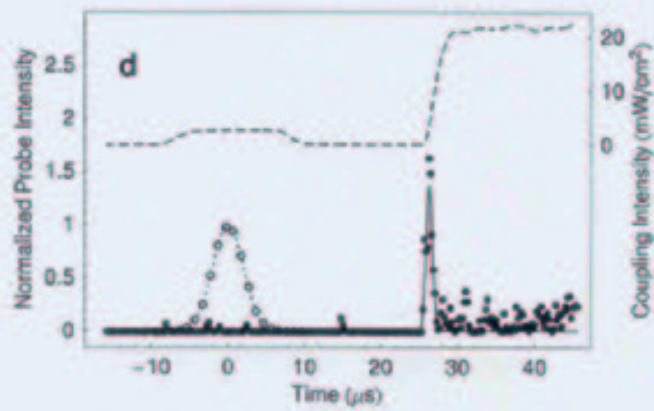
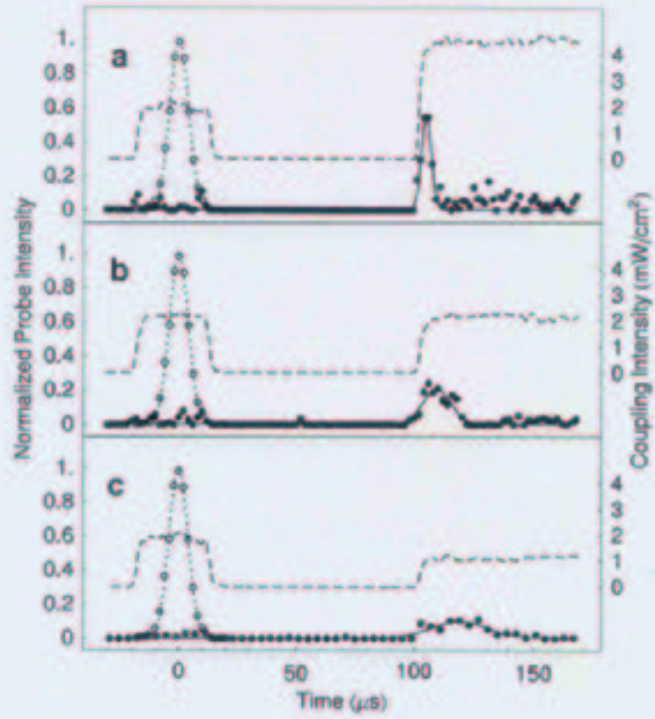
Now on the market
Software

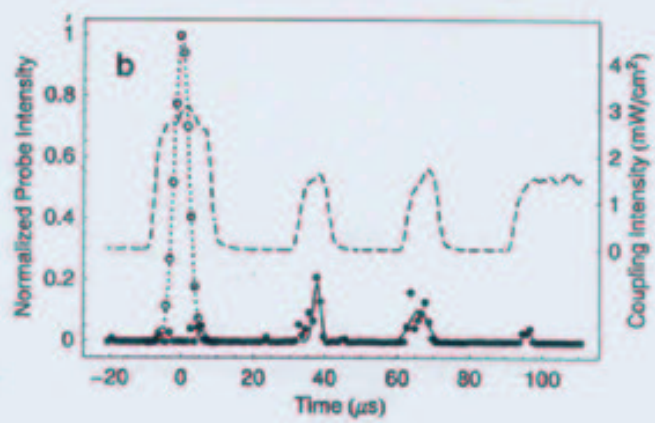
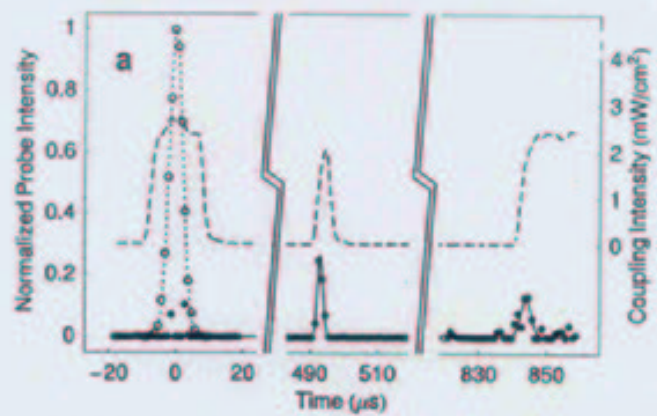


L.Y. Hau et al.:
<http://condon.colorado.edu/~chg/Talks/Hau>
 Feb. 10, 1999

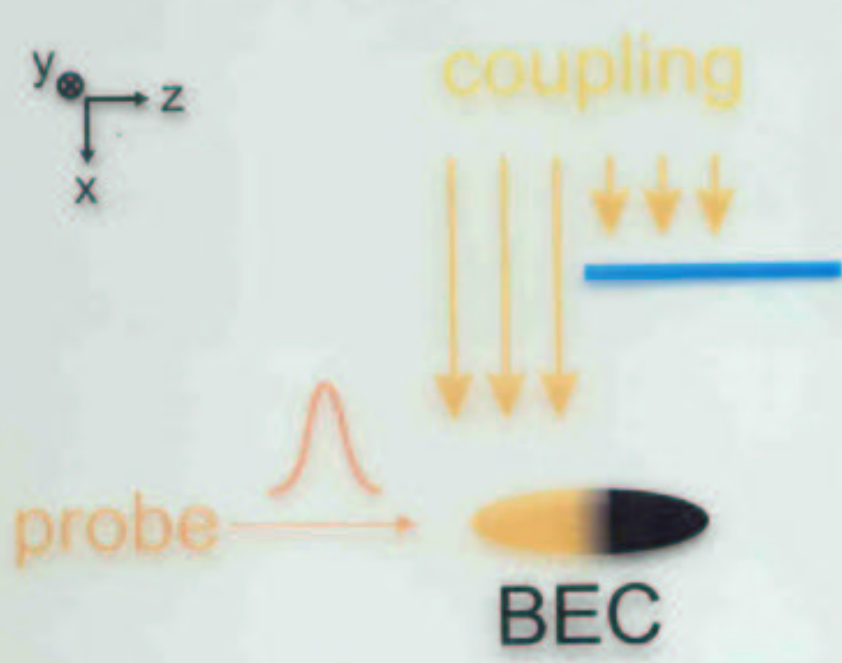
Nature

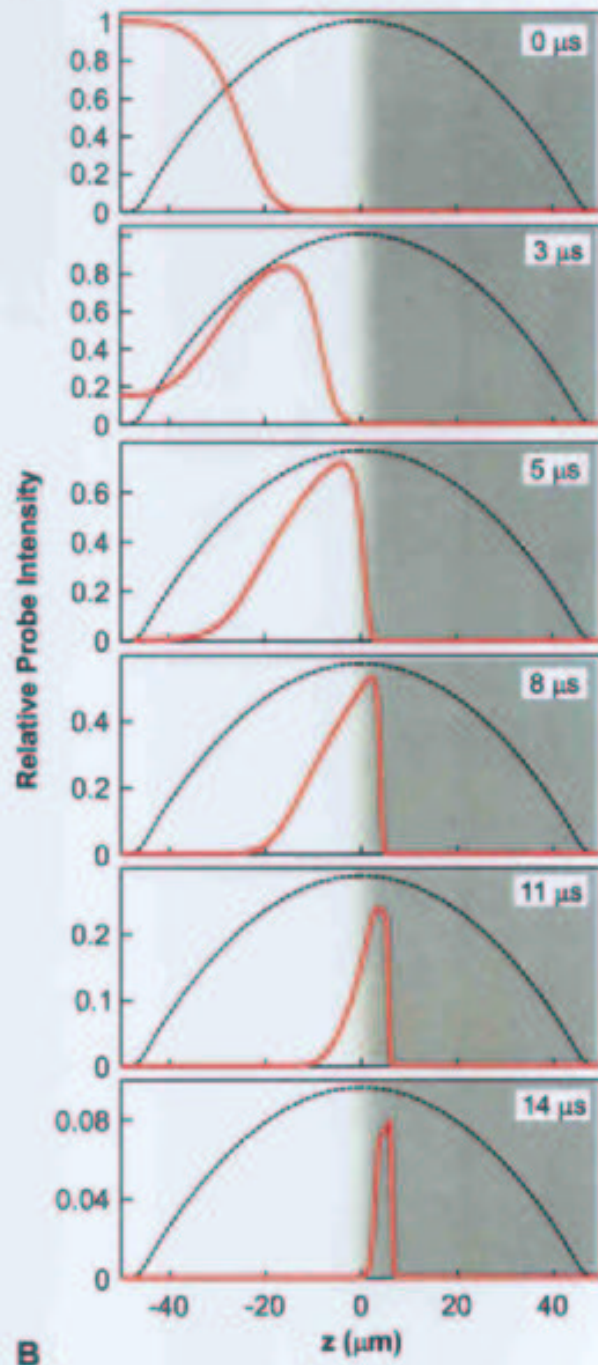
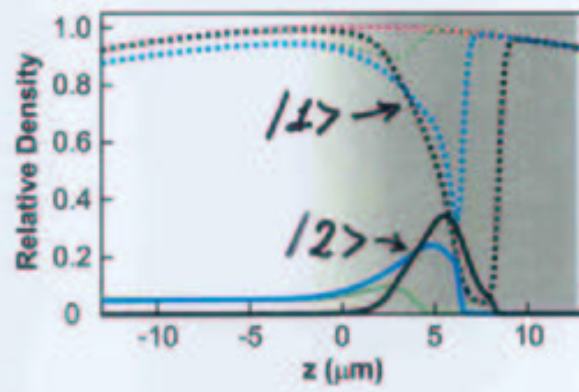
409 490 (2001)
 Jan. 25





LIGHT 'ROADBLOCK'



A**B**

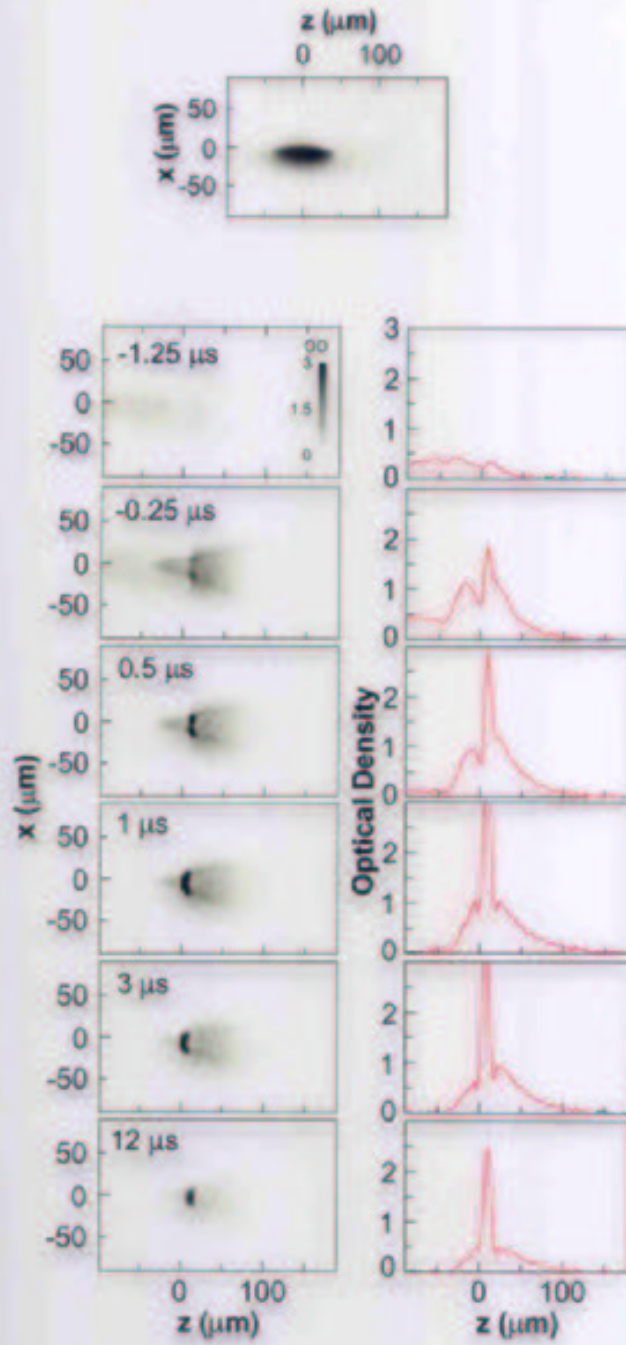
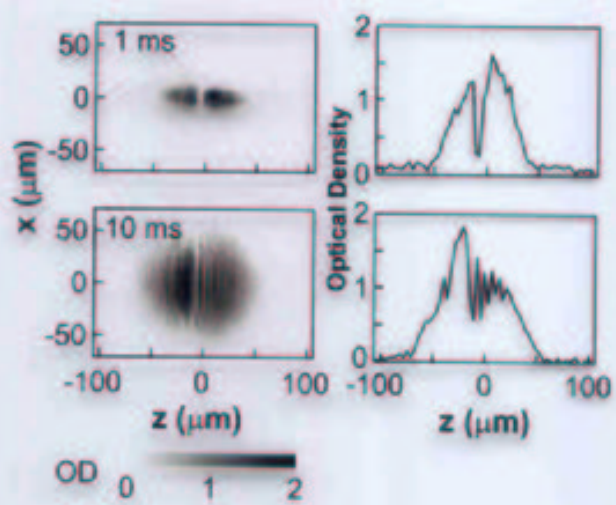
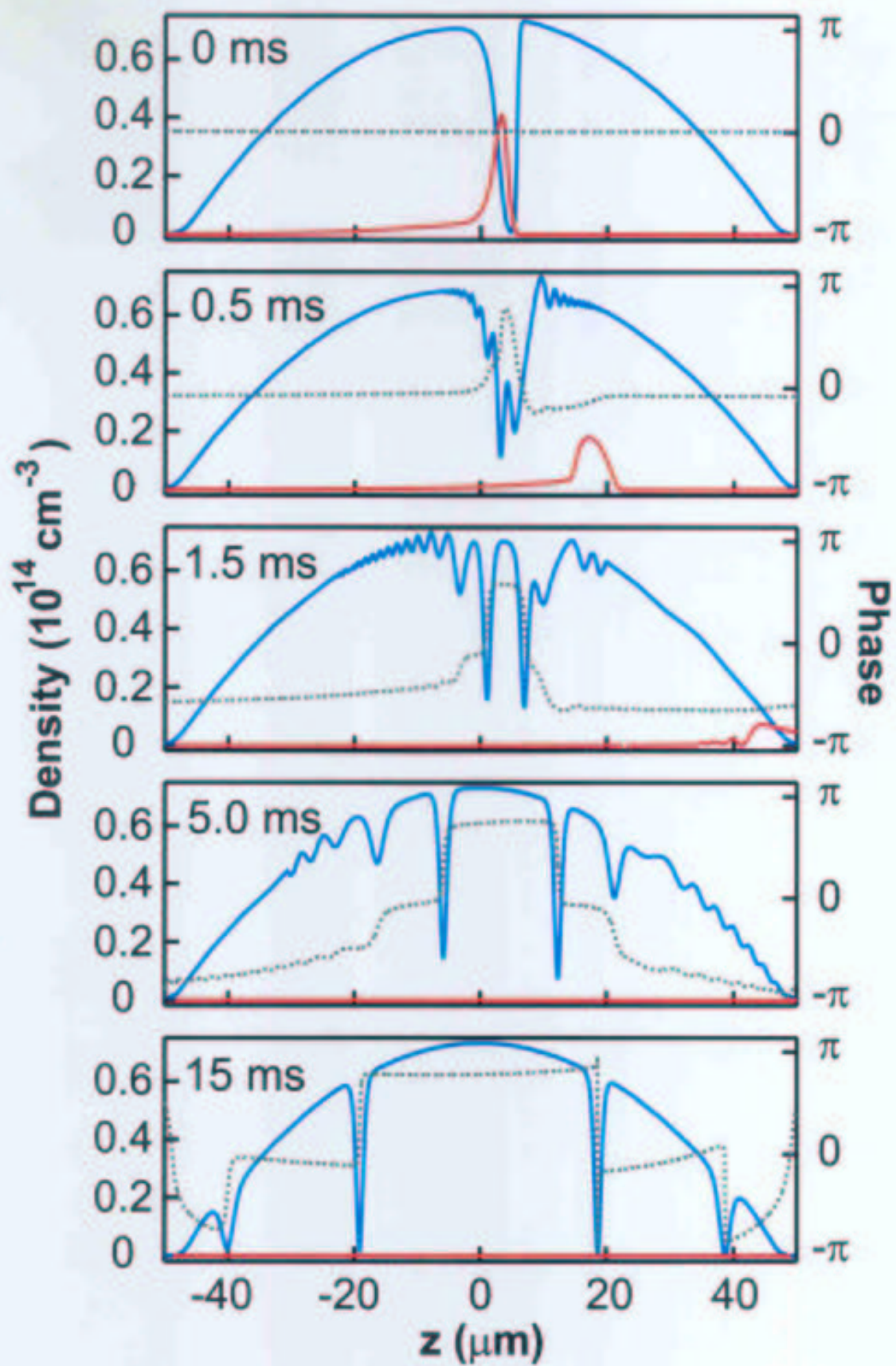
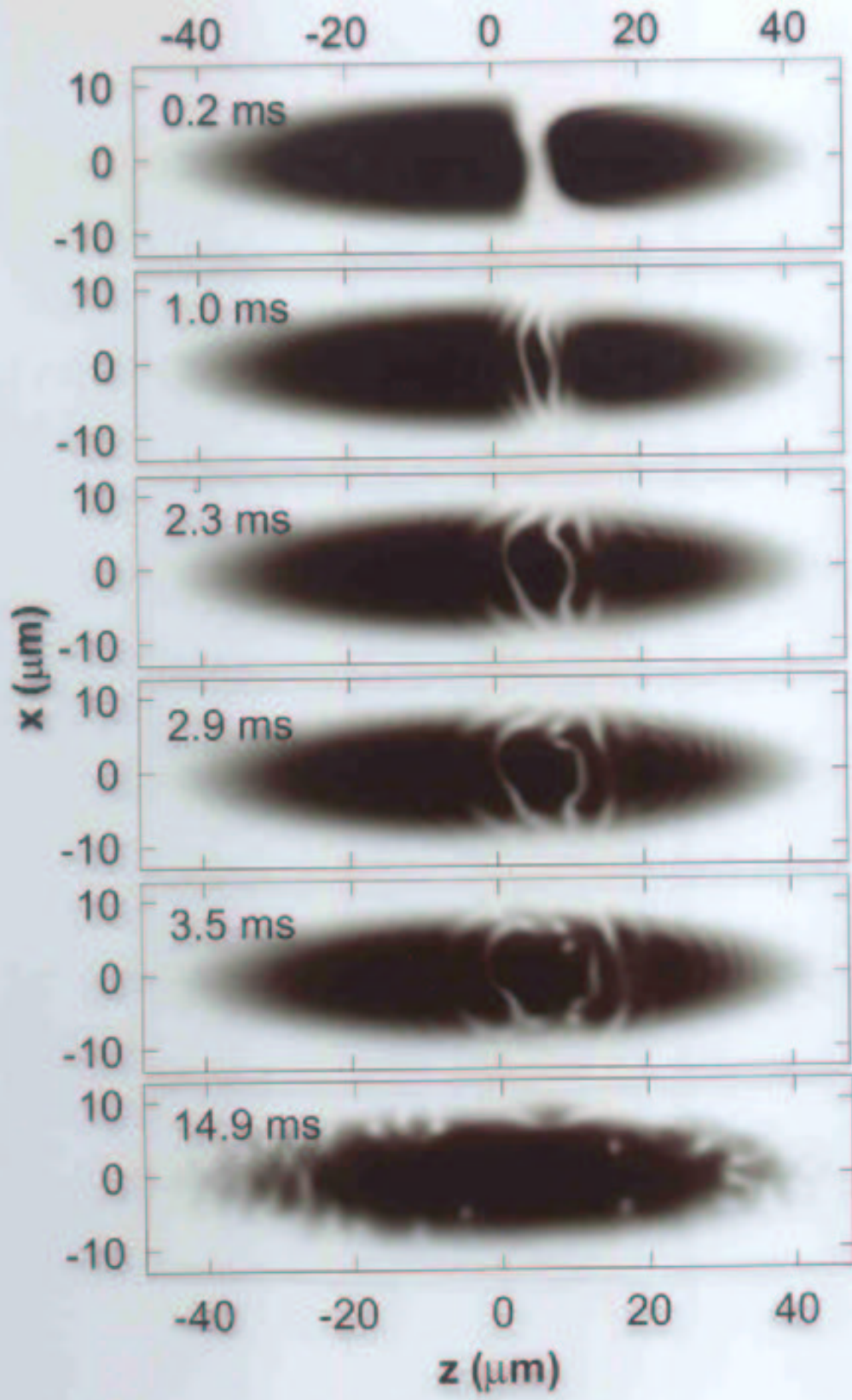
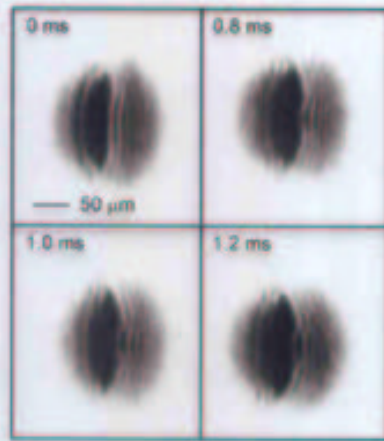


Fig. 4

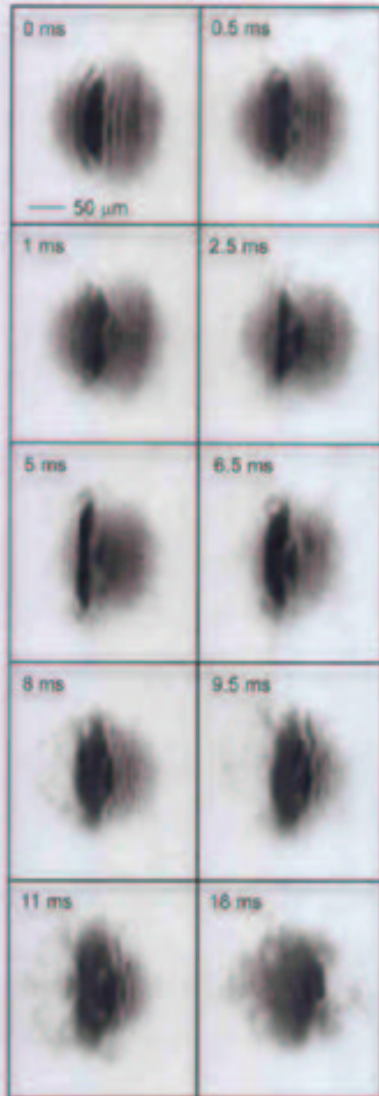






A

OD 0 1.15 2.3

B

OD 0 0.9 1.8