

Hundred Young Academic Leaders Program of Nankai University

Georgios A. Siviloglou

8 May, 2018



UNIVERSITY OF AMSTERDAM



Basic personal information

Basic information

Place of birth: Athens, Greece

Date of birth: 27.09.1978

Education

1996 – 2003	NTUA, Greece	Diploma of Electrical Engineering
2004 – 2010	CREOL, USA	PhD in Optics

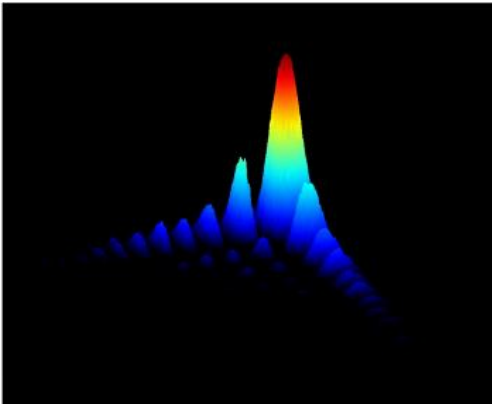
Research

2010 – 2014	MIT, USA	Postdoc and Research Scientist
2014 – 2018	UvA, Holland	Postdoc and Marie Curie Fellow

Main research accomplishments

7 papers in the top 1% in the field of Physics (ISI Web of Science)  Highly Cited Paper

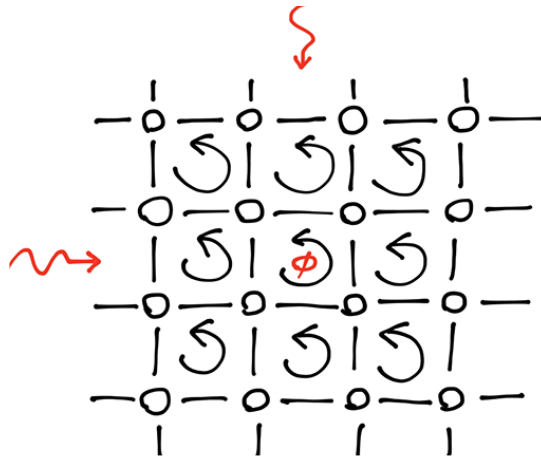
Self-bending Airy beams (>2000 citations)



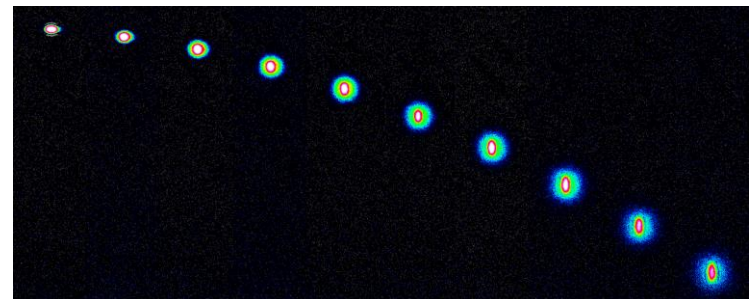
\mathcal{PT} -symmetry (1005 citations)




Hofstadter Hamiltonian (citations 449)



Quantum gases of strontium



Publication summary

- 18 + 1 (in preparation) peer-reviewed articles
- Among them 6 Phys. Rev. Lett. and 1 Science
- 4 publications in Optics and Photonics News (published by OSA)
- 1 invited book chapter
- Total citations > 4250
- 7 papers in the top 1% of physics  Highly Cited Paper
- 224 citations per paper



Publication list

1. J. Schachenmayer, D. M. Weld, H. Miyake, **G. A. Siviloglou**, W. Ketterle, and A. J. Daley,
"Adiabatic cooling of bosons in lattices to magnetically ordered quantum states"
Physical Review A 92, 041602(R) (2015). (ISI citations 5)
2. H. Miyake, **G. A. Siviloglou**, C. J. Kennedy, W. C. Burton, and W. Ketterle,
"Realizing the Harper Hamiltonian with Laser-Assisted Tunneling in Optical Lattices"
Physical Review Letters 111, 185302 (2013). (ISI citations 431)
3. C. J. Kennedy, **G. A. Siviloglou**, H. Miyake, W. C. Burton, and W. Ketterle,
"Spin-Orbit Coupling and Spin Hall Effect for Neutral Atoms without Spin Flips"
Physical Review Letters 111, 225301 (2013). (ISI citations 75)
4. H. Miyake, **G. A. Siviloglou**, G. Puentes, D. E. Pritchard, W. Ketterle, and D. M. Weld.
"Bragg scattering as a probe of atomic wave functions and quantum phase transitions in optical lattices"
Physical Review Letters 107, 175302 (2011). (ISI citations 37)
5. **G. A. Siviloglou**, J. Broky, A. Dogariu, and D. N. Christodoulides,
"Observation of Accelerating Airy Beams"
Physical Review Letters 99, 213901 (2007). (ISI citations 845)
6. P. Polynkin, M. Kolesik, J. V. Moloney, **G. A. Siviloglou**, D. N. Christodoulides,
"Curved Plasma Channel Generation Using Ultraintense Airy Beams"
Science 324, 229-232 (2009). (ISI citations 396)
7. A. Guo, G. J. Salamo, D. Duchesne, R. Morandotti, M. Volatier-Ravat, V. Aimez, **G. A. Siviloglou**, and D. N. Christodoulides,
"Observation of PT-Symmetry Breaking in Complex Optical Potentials"
Physical Review Letters 103, 093902 (2009). (ISI citations 948)
8. J. Shu, J. Lee, J. W. Fleischer, **G. A. Siviloglou**, and D. N. Christodoulides,
"Diffusion-trapped Airy beams in photorefractive media"
Physical Review Letters 104, 253904 (2010). (ISI citations 59)

Publication list

9. **G. A. Siviloglou** and D. N. Christodoulides,
"Accelerating finite energy Airy beams"
Optics Letters 32, 979-981 (2007). (ISI citations 692)
10. **G. A. Siviloglou**, J. Broky, A. Dogariu, and D. N. Christodoulides,
"Ballistic dynamics of Airy beams"
Optics Letters 33, 207-209 (2008). (ISI citations 213)
11. **G. A. Siviloglou**, K. G. Makris, R. Iwanow, R. Schiek, D. N. Christodoulides, G. I. Stegeman, Y. Min, and W. Sohler,
"Observation of discrete quadratic surface solitons"
Optics Express 14, 5508-5516 (2006). (ISI citations 67)
12. **G. A. Siviloglou**, S. Suntsov, R. El-Ganainy, R. Iwanow, G. I. Stegeman, D. N. Christodoulides, R. Morandotti, D. Modotto, A. Locatelli, C. De Angelis, F. Pozzi, C. R. Stanley, and M. Sorel,
"Enhanced third-order nonlinear effects in optical AlGaAs nanowires"
Optics Express 14, 9377-9384 (2006). (ISI citations 42)
13. J. Broky, **G. A. Siviloglou**, A. Dogariu, and D. N. Christodoulides,
"Self-healing properties of optical Airy beams"
Optics Express 16, 12880-12891 (2008). (ISI citations 378)
14. S. Suntsov, K. G. Makris, **G. A. Siviloglou**, R. Iwanow, R. Schiek, D. N. Christodoulides, G. I. Stegeman, R. Morandotti, H. Yang, G. Salamo, M. Volatier, V. Aimez, R. Ares, M. Sorel, Y. Min, W. Sohler, X. S. Wang, A. Bezryadina, Z. G. Chen,
"Observation of one- and two-dimensional discrete surface spatial solitons"
Journal of Nonlin. Opt. Phys. & Mat. 16, 401-426 (2007). (Invited Paper) (ISI citations 33)
15. N. K. Efremidis, **G. A. Siviloglou**, and D. N. Christodoulides,
"Exact X-wave solutions of the hyperbolic nonlinear Schrödinger equation with a supporting potential"
Physics Letters A 373, 4073 (2009). (ISI citations 5)
16. T. J. Eichelkraut, **G. A. Siviloglou**, I. M. Besieris, and D. N. Christodoulides,
"Oblique Airy wave packets in bidispersive optical media"
Optics Letters 35, 3655 (2010). (ISI citations 18)

Publication list

17. N. Barbieri, M. Weidman, G. Katona, M. Baudelet, Z. Roth, E. Johnson, **G. A. Siviloglou**, D. N. Christodoulides, and M. Richardson,
"Double helical laser beams based on interfering first-order Bessel beams"
J. Opt. Soc. Am. A 28, 1462 (2011). (ISI citations 11)
18. M. S. Mills, **G. A. Siviloglou**, N. Efremidis, T. Graf, E. M. Wright, J. V. Moloney, D. N. Christodoulides,
"Localized Waves with Spherical Harmonic Symmetries"
Physical Review A 86.6 (2012). (ISI citations 4)

Other publications

Other publications

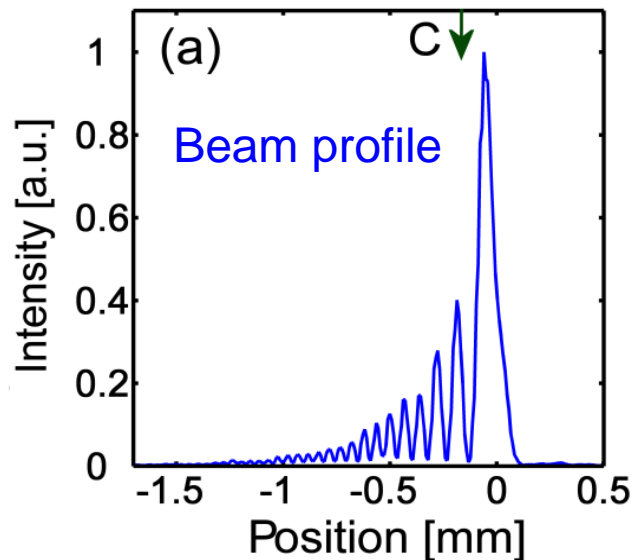
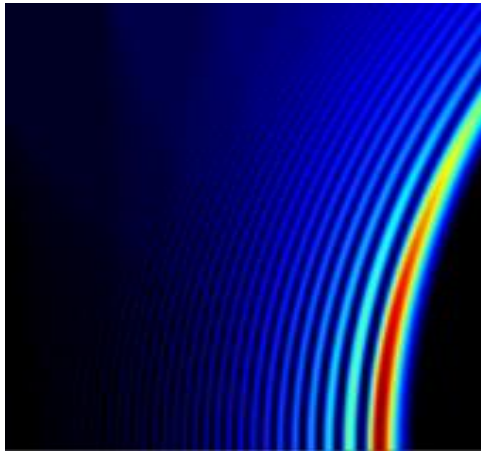
1. P. Polynkin, M. Kolesik, J. Moloney, **G. A. Siviloglou**, and D. Christodoulides,
“Extreme Nonlinear Optics with Ultra-Intense Self-Bending Airy Beams”
Optics and Photonics News, September 2010 (Invited publication)
2. P. Polynkin, M. Kolesik, J. Moloney, **G. A. Siviloglou**, and D. Christodoulides,
“Curved Plasma Channel Generation in Air Using Ultra-Intense Self-Bending Airy Beams”
Optics and Photonics News, Optics in 2009, December 2009
3. **G. A. Siviloglou**, J. Broky, A. Dogariu, and D. Christodoulides,
“Airy Beams: A New Class of Optical Waves”
Optics and Photonics News, Optics in 2008, December 2008
4. F. Pozzi, M. Sorel, **G.A. Siviloglou**, S. Suntsov, R. El-Ganainy, R. Iwanow, G.I. Stegeman,
D.N. Christodoulides, D. Modotto, A. Locatelli, C. De Angelis and R. Morandotti,
“Enhanced Third-Order Nonlinear Effects in Ultra-Compact AlGaAs Nanowires”
Optics and Photonics News, Optics in 2006, December 2006

Book chapter

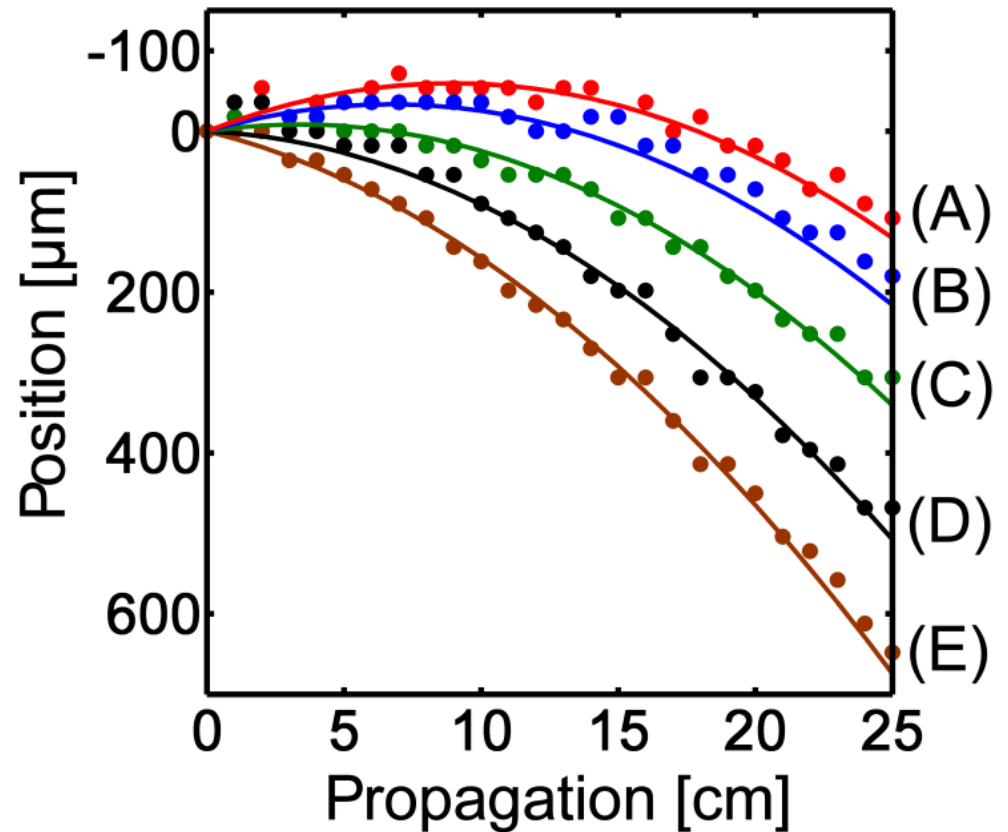
Y. Hu, **G. A. Siviloglou**, P. Zhang, N. K. Efremidis, D. N. Christodoulides, and Z. Chen.
Self-accelerating Airy beams: generation, control, and applications.
In Nonlinear Photonics and Novel Optical Phenomena, pp. 1-46. Springer New York, 2012.

Optical Airy beams

Beam propagation



Position of the beam maximum



G. A. Siviloglou and D. N. Christodoulides, **Opt. Lett.** 32, 979 (2007). (cited 878)

G. A. Siviloglou, J. Broky, A. Dogariu, and D. N. Christodoulides, **Phys. Rev. Lett.** 99, 213901 (2007) (cited 718)

G. A. Siviloglou, J. Broky, A. Dogariu, and D. N. Christodoulides, **Opt. Lett.** 33, 207 (2008) (cited 213)

Optical Airy beams



News & Views

Optics: Against the spread of the light

Kishan Dholakia



Focus: Light Beam with a Curve

November 28, 2007 • *Phys. Rev. Focus* 20, 19

SCIENTIFIC
AMERICAN®

High-Intensity Lasers Throw Scientists a Curve

Researchers defy the laws of physics by making a laser beam bend



PERSPECTIVE | APPLIED PHYSICS

Laser Beams Take a Curve

G. A. Siviloglou and D. N. Christodoulides, **Opt. Lett.** 32, 979 (2007).

G. A. Siviloglou, J. Broky, A. Dogariu, and D. N. Christodoulides, **Phys. Rev. Lett.** 99, 213901 (2007)

P. Polynkin, M. Kolesik, J. V. Moloney, G. A. Siviloglou, and D. N. Christodoulides, **Science** 324, 229 (2009) (cited 396)

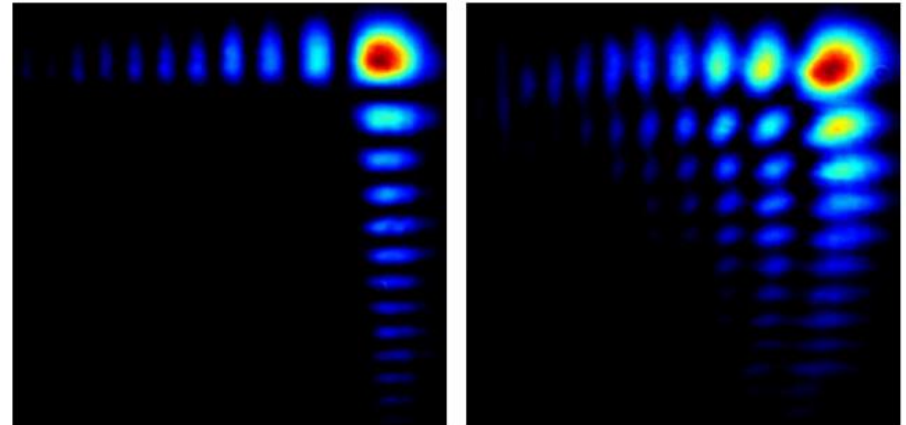
Why non-diffracting, self-bending Airy beams are important?

Commercial Airy microscopy



500x faster than confocal microscopy

Self-healing

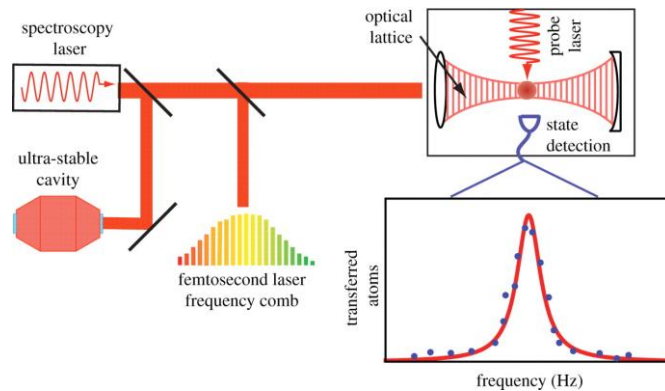


Robust even in biological tissue

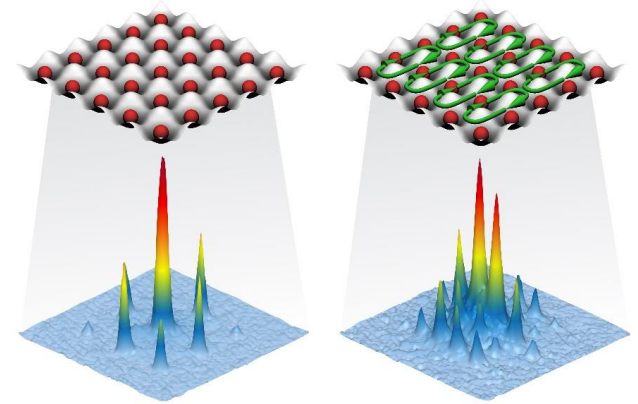
From optics to ultracold quantum gases

Applications and quantum simulation with ultracold atoms

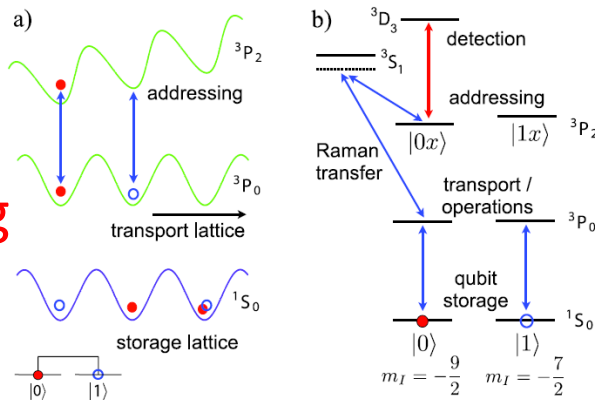
Lattice
clocks



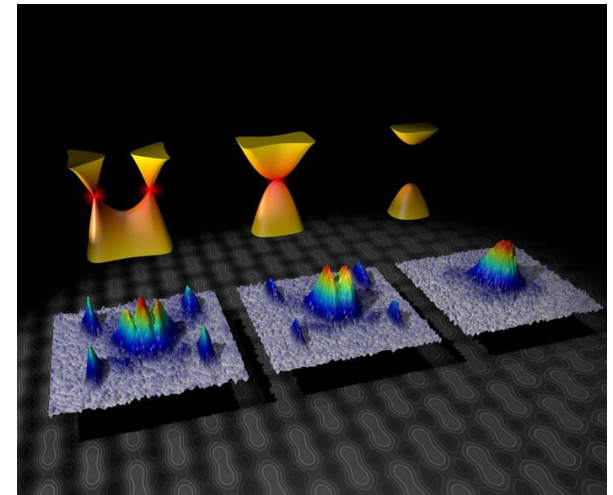
Strong
magnetic
fields



Quantum
computing



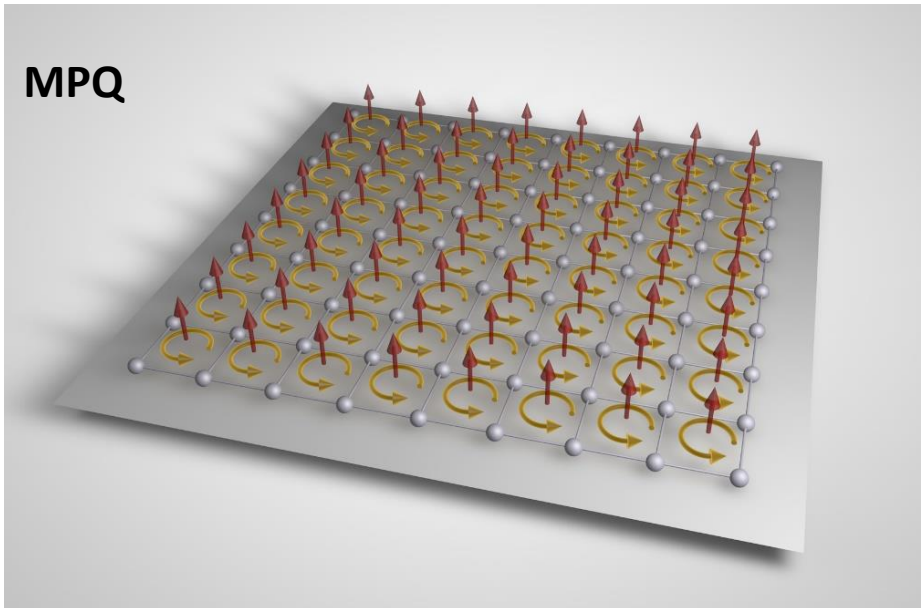
Graphene
physics



The Hofstadter-Harper Hamiltonian

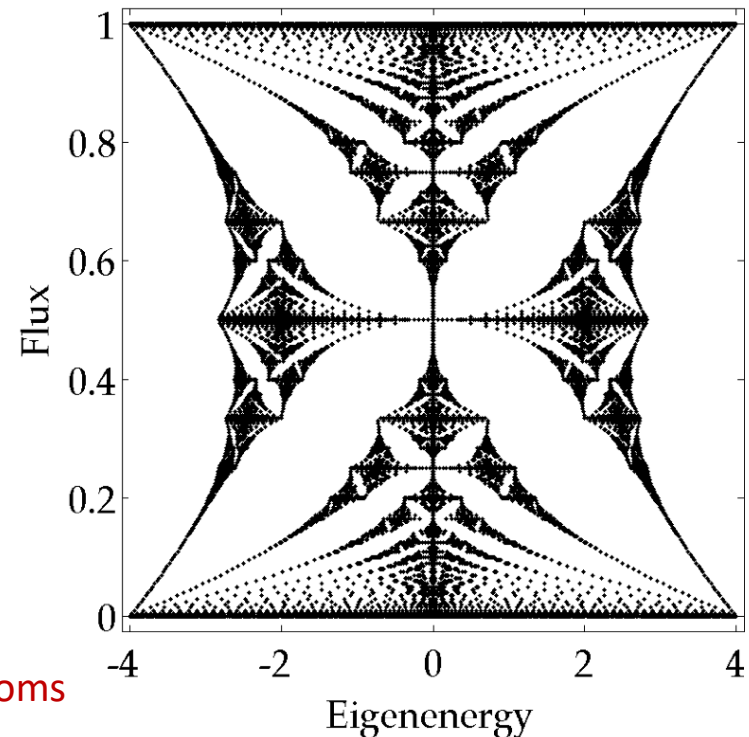
14

Created for the first time the Hofstadter Hamiltonian in an atomic system



Previous experiments had less than one vortex per 1000 atoms

Hofstadter butterfly spectrum

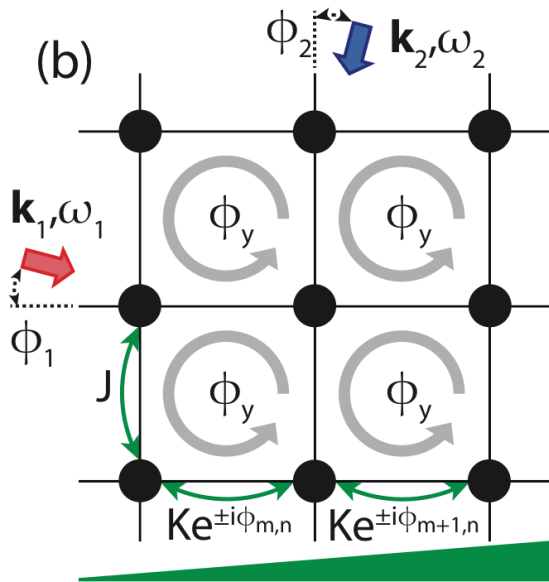


Strong synthetic fields for neutral atoms

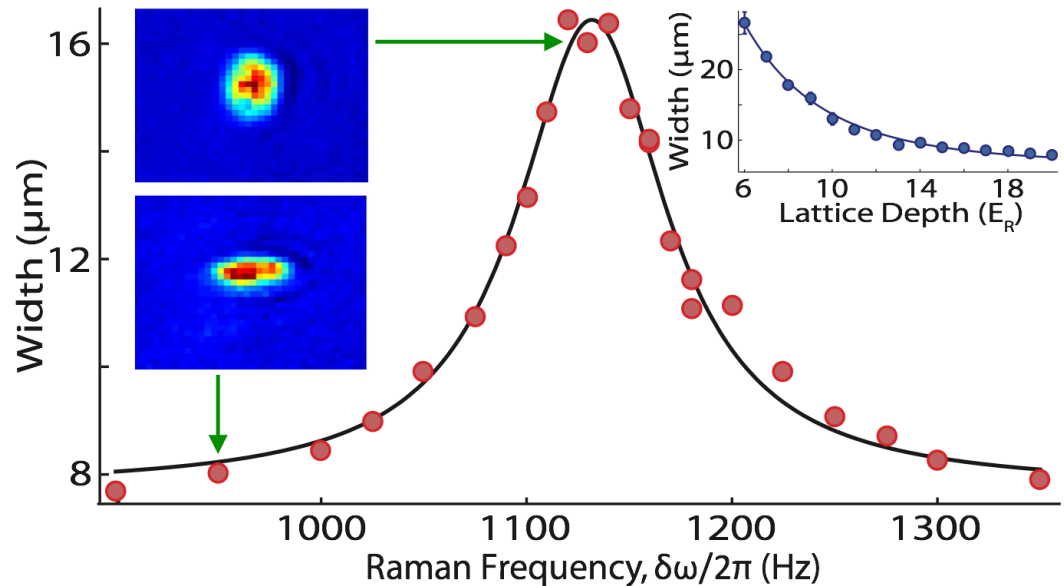
15

$$\alpha = \phi_y / 2\pi$$

Larger width corresponds to stronger coupling



Scheme to induce complex tunneling



When $\omega_2 - \omega_1 = \Delta$ resonant tunneling is established

Artificial magnetic fields in an optical lattice



Viewpoint: Looking for Hofstadter's Butterfly in Cold Atoms

Cheng Chin, James Franck Institute, Enrico Fermi Institute, and Department of Physics, University of Chicago, Chicago, IL 60637, USA

Erich J. Mueller, Laboratory of Atomic and Solid State Physics, Cornell University, Ithaca, NY 14853, USA

October 28, 2013 • *Physics* 6, 118

physicsworld

ULTRACOLD MATTER | RESEARCH UPDATE

Ultracold atoms set the stage for Hofstadter's butterfly

28 Oct 2013



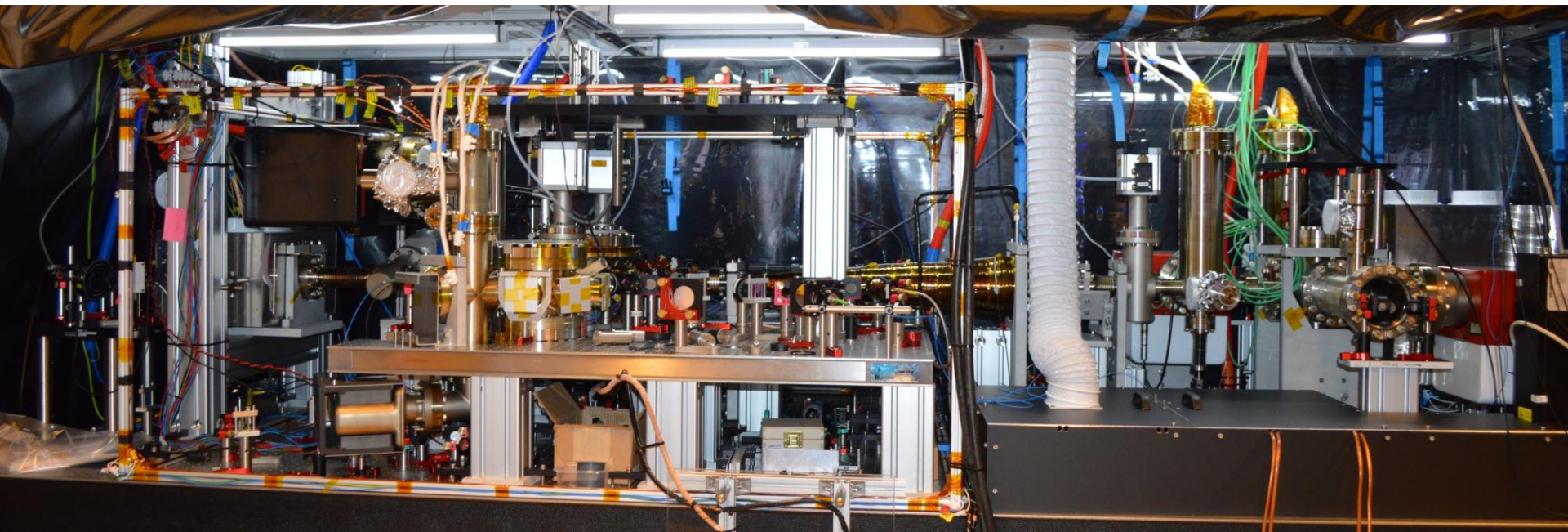
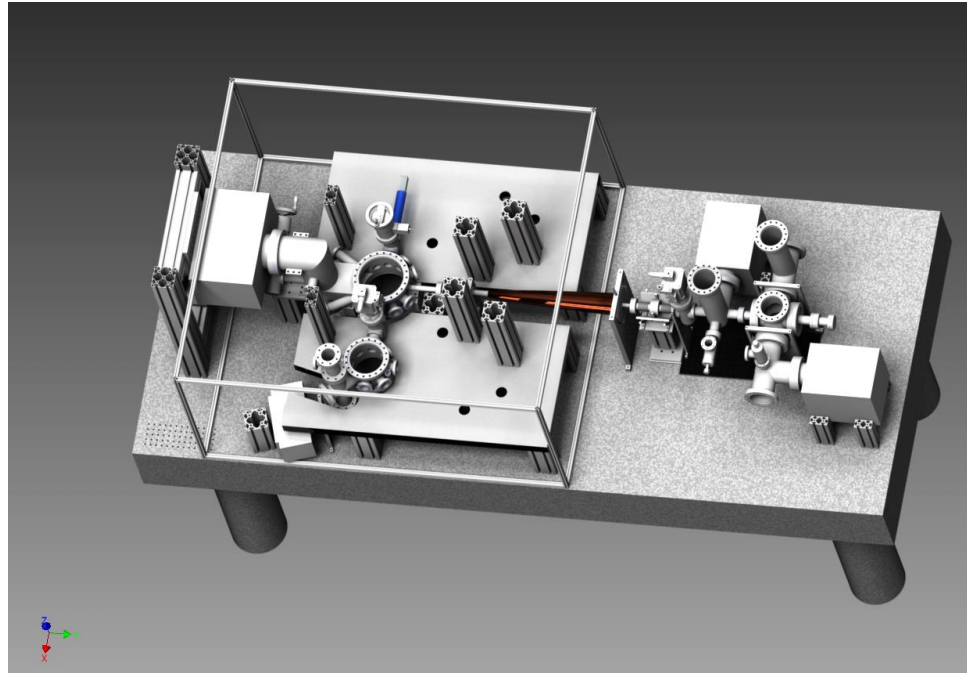
Physicists net fractal butterfly

Decades-old search closes in on recursive pattern that describes electron behaviour.

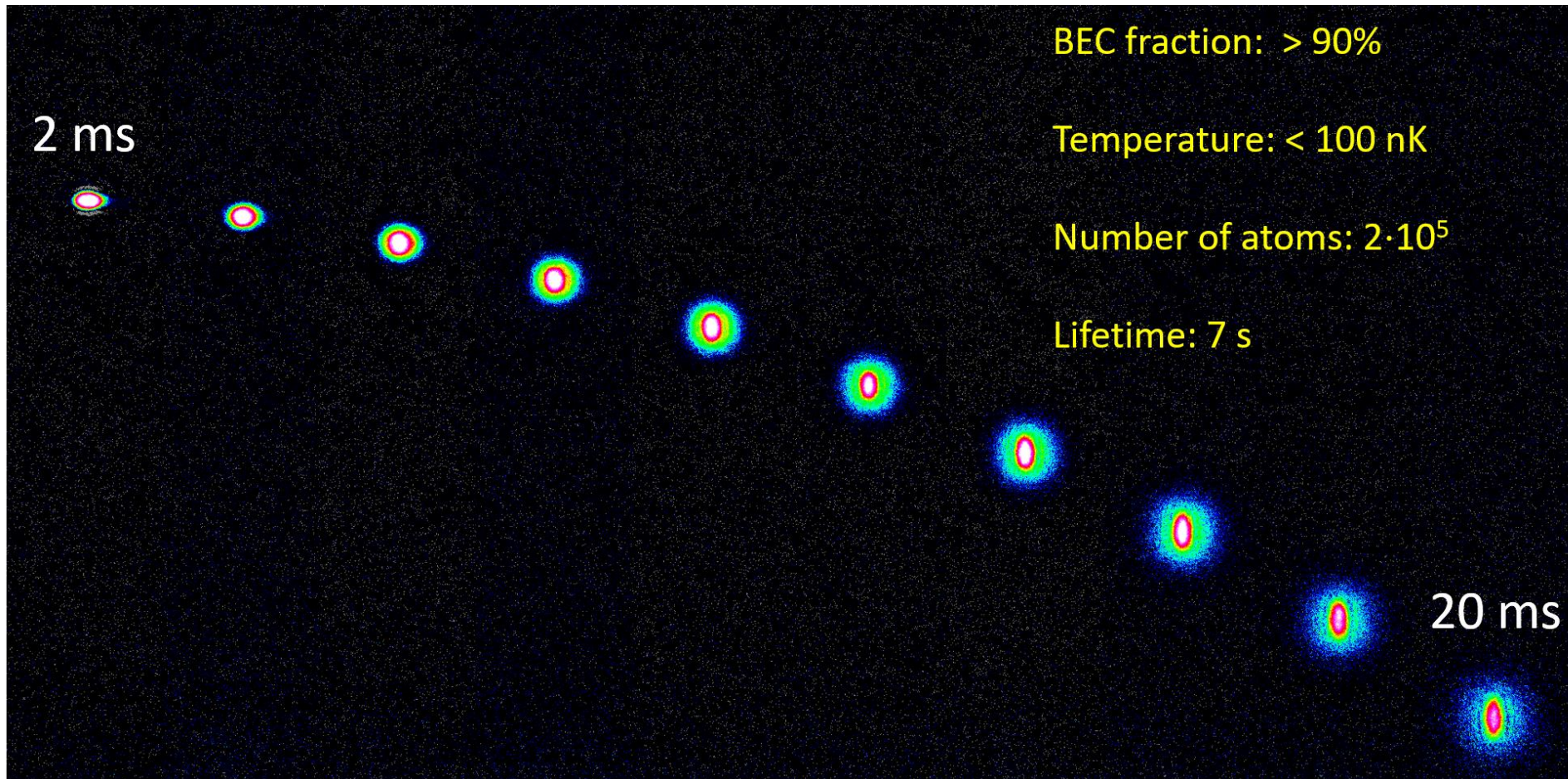
I designed and built a strontium quantum gas experiment



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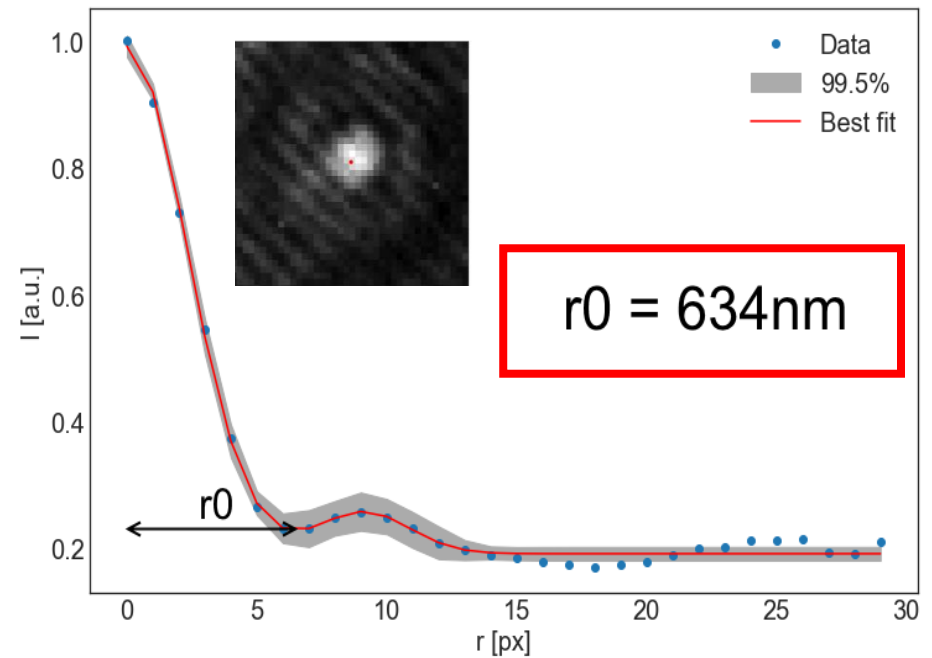
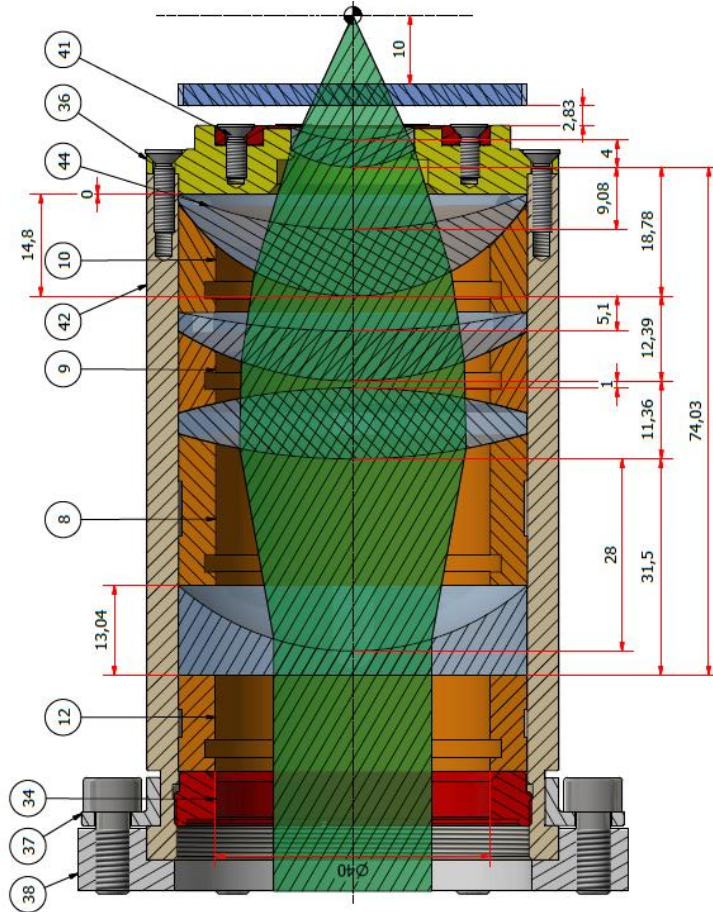


Free fall expansion of a ^{84}Sr BEC



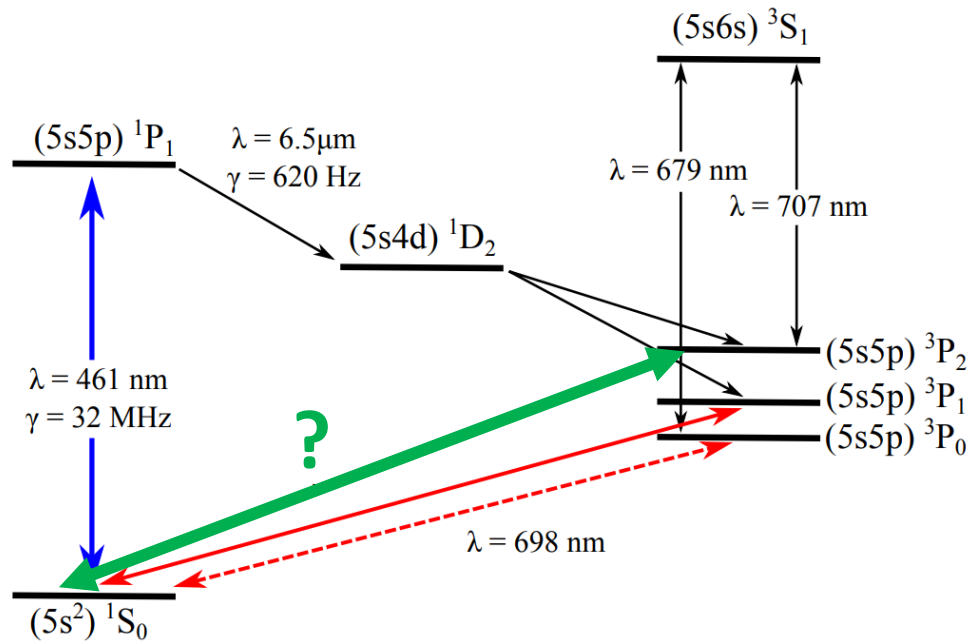
We have created BEC and Fermi gases of strontium
(only few experiments in the world can do that)

Microscope objective to resolve individual atoms in a lattice

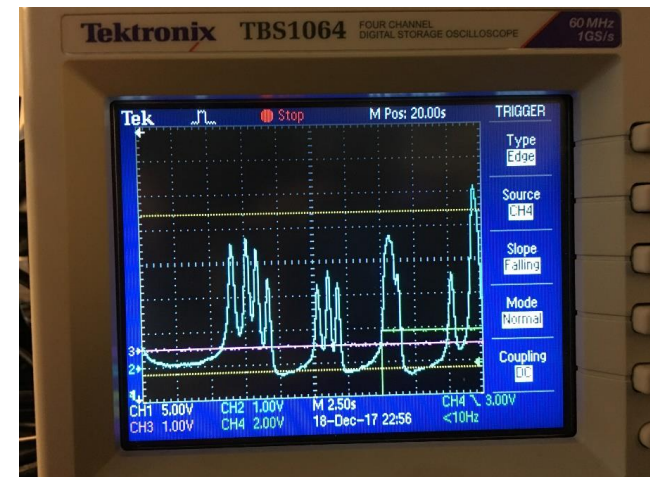
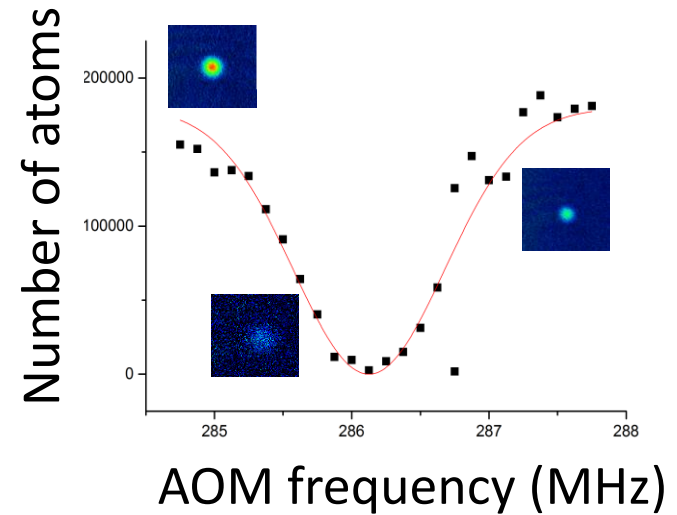


I have designed a microscope capable of resolving individual lattice sites.

Spectroscopy for the ultranarrow transition $^1S_0 \rightarrow ^3P_2$ of ^{87}Sr



First observation of the ultranarrow transition in fermionic Sr (<mHz)



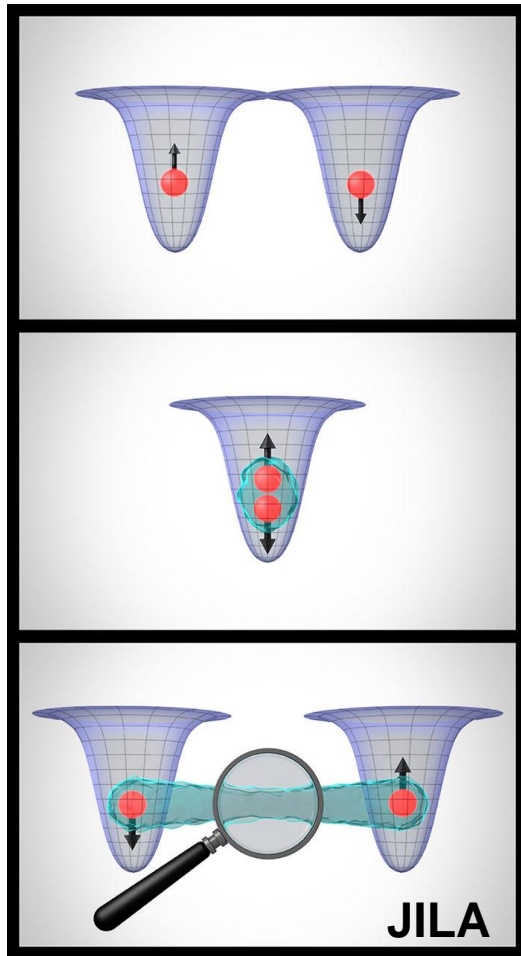
Iodine spectroscopy

Observation of the ultranarrow doubly-forbidden transition in a Fermi gas of strontium (**in preparation**)

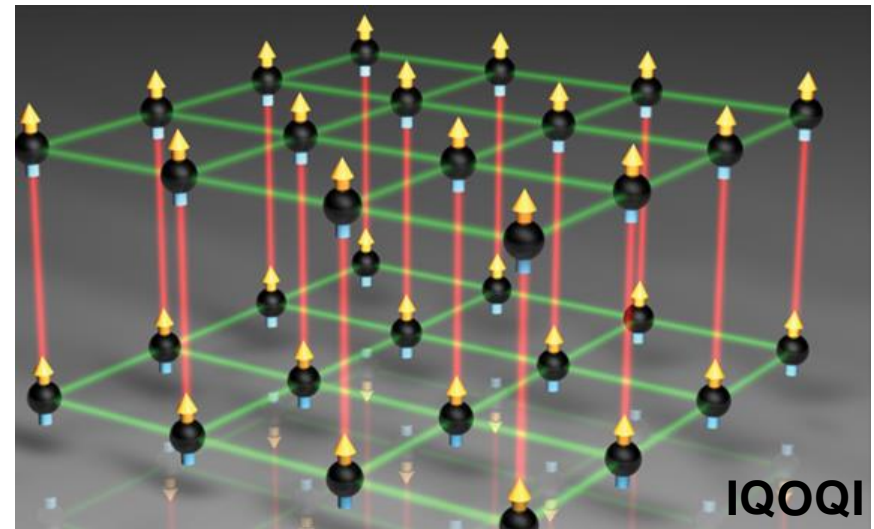
What I want to achieve next

My plan for a quantum physics and quantum engineering lab

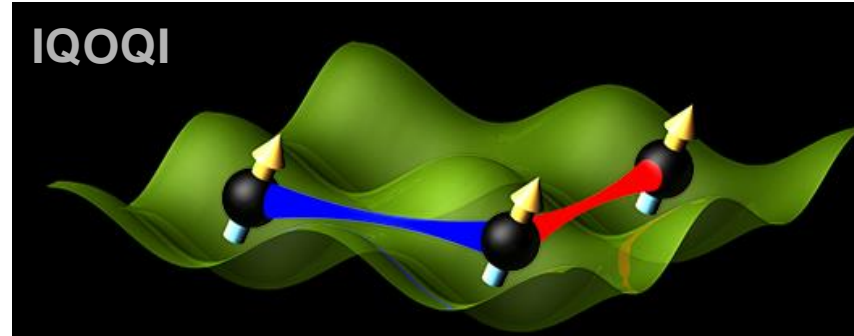
A few-atom quantum assembler



A quantum gas experiment



Why erbium?



- Only **3 experiments in the world** have BEC of erbium (Innsbruck, Bonn, Paris)
- It has several stable **fermionic** and **bosonic** isotopes with **high abundance** (>25%)
- It is **highly magnetic** $\mu = 7\mu_B$ and thus **strongly dipolar**
- A transition at 401 nm can lead to **submicrometer** resolution

How can I achieve that at Nankai University

- Form a team with strong physics and engineering skills (4-5 team members)
- Collaborate with the Nankai teams and former international colleagues
- Standard optics lab space (100-200 m²)
- Apply actively for (university, national, local) start-up funding (5-10 million RMB)

Thank you!