

# Hundred Young Academic Leaders Program of Nankai University

## 南开大学“百名青年学科带头人培养计划”面试报告

Georgios A. Siviloglou



UNIVERSITY OF AMSTERDAM



# Basic personal information

## 个人简介

### 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

荷兰阿姆斯特丹大学玛丽居里Fellow

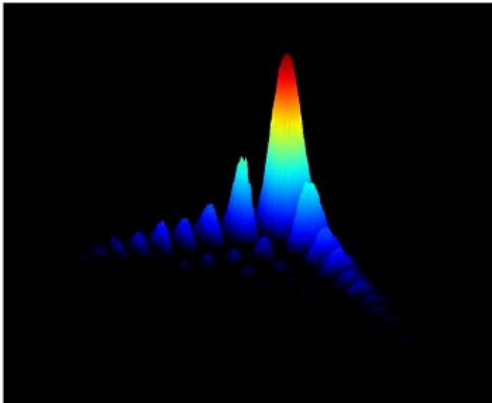
# Main research accomplishments

## 主要学术成果

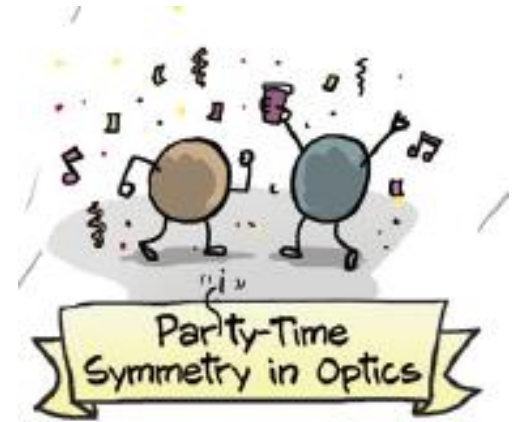


7 papers in the top 1% in the field of Physics (ISI Web of Science)

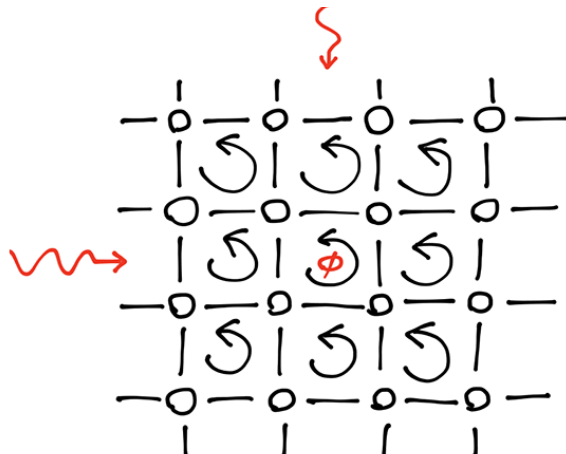
Self-bending Airy beams (>2000 citations)



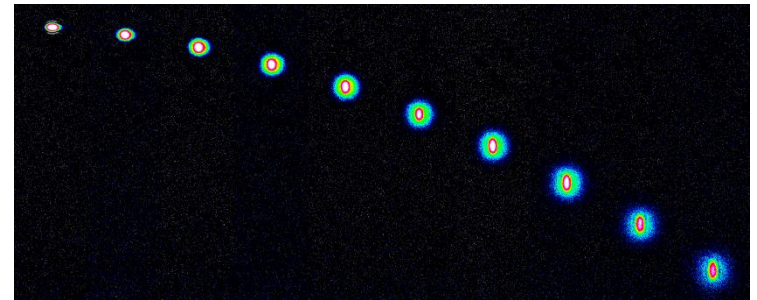
$\mathcal{PT}$ -symmetry (1005 citations)



Hofstadter Hamiltonian (citations 449)



Quantum gases of strontium



7篇文章成为SCI 排名1%的高引论文

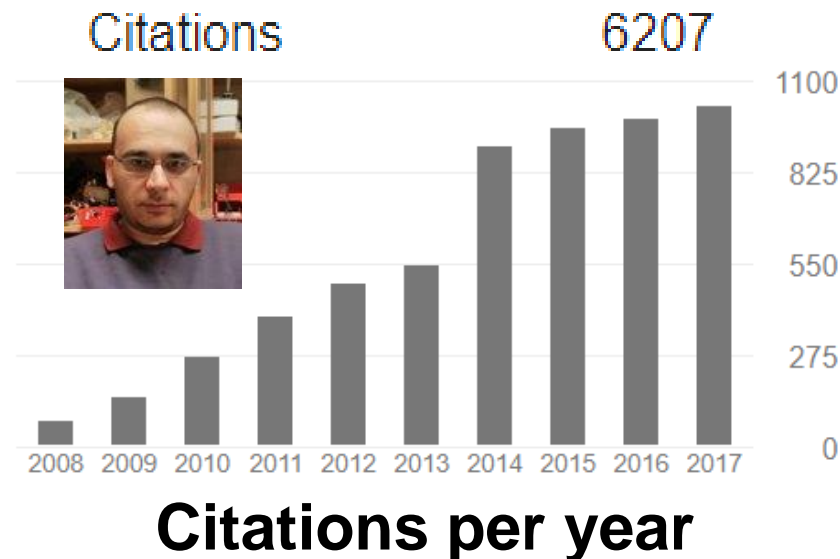
# Publication summary

## 发表论文概况

- 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
- 224 citations per paper



Google Scholar



总引6000余次  
他引4000余次



# 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

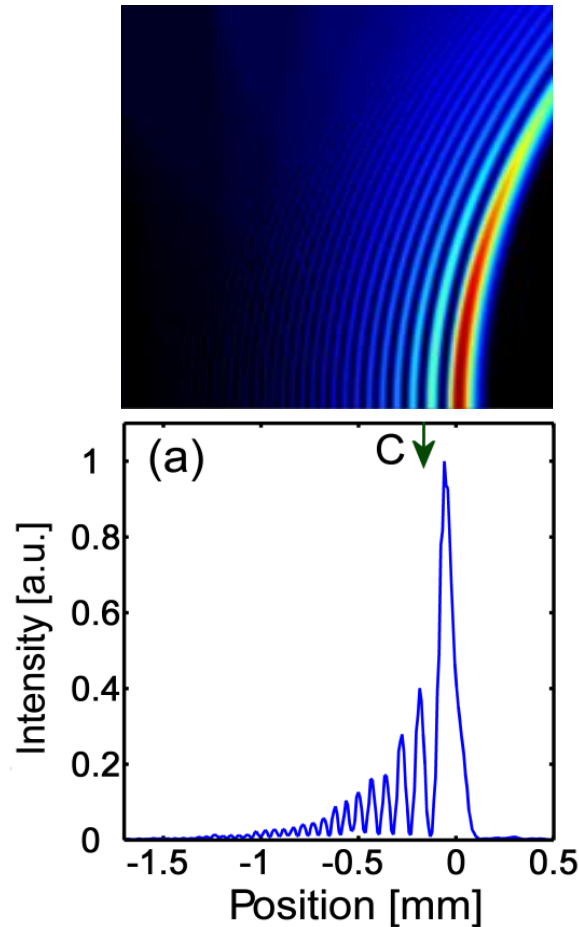
Y. Hu, **G. A. Siviloglou**, P. Zhang, N. K. Efremidis, D. N. Christodoulides, and Z. Chen.  
*Self-accelerating Airy beams: generation, control, and applications.*  
*In Nonlinear Photonics and Novel Optical Phenomena*, pp. 1-46. Springer New York, 2012.



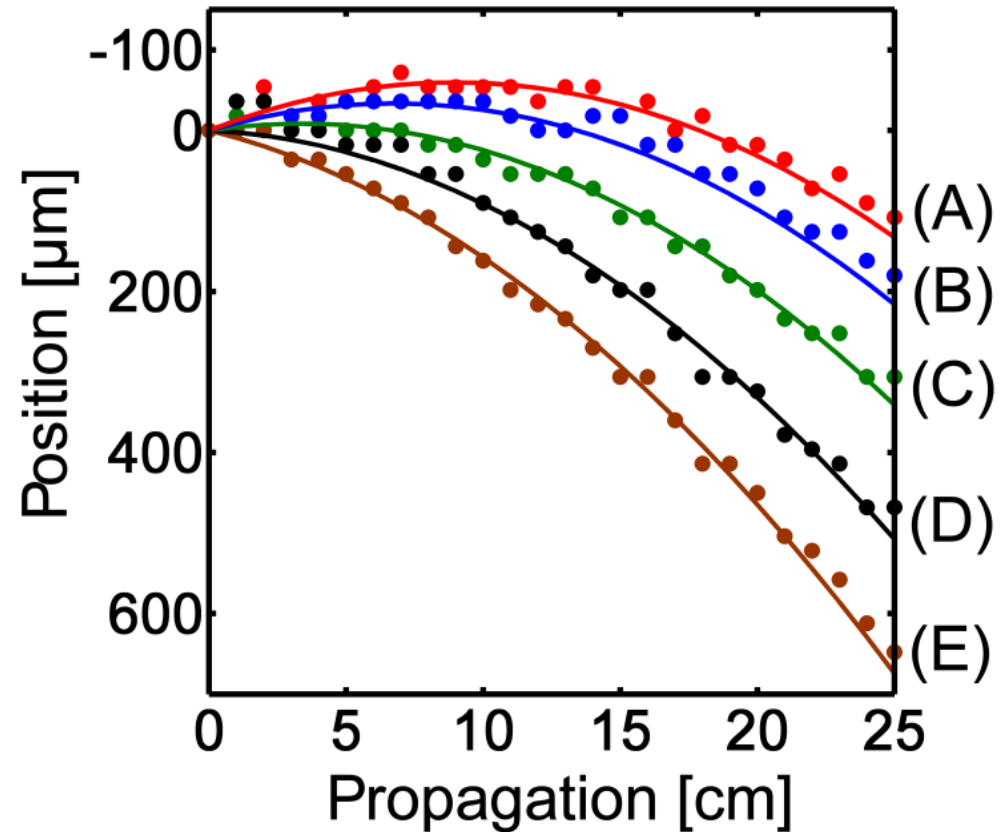
# 主要学术贡献 Optical Airy beams

国际上首次实现光学艾里光，开创了自加速光的研究

## 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

一度成为诸多科学杂志新闻集锦

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?

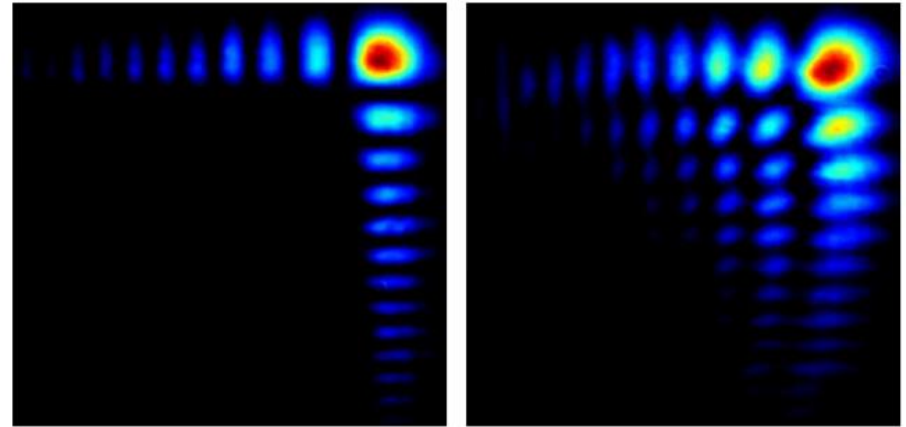
在多个领域得到广泛应用

## Commercial Airy microscopy



*500x faster than confocal microscopy*

## Self-healing



*Robust even in biological tissue*

D. Christodoulides, A. Dogariu, and **G. Siviloglou** United States Patent US 8,101,929 B1 (2012)

J. Broky, **G. A. Siviloglou**, A. Dogariu, and D. N. Christodoulides, **Opt. Express** 16, 12880 (2008) (cited 378)

# 主要学术贡献

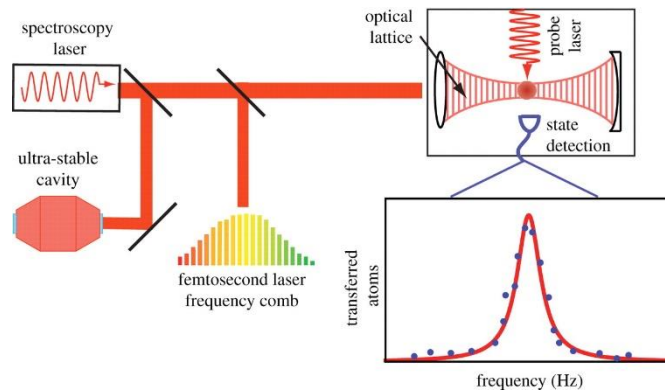
**From optics to ultracold quantum gases**

从光学到超冷原子量子气体

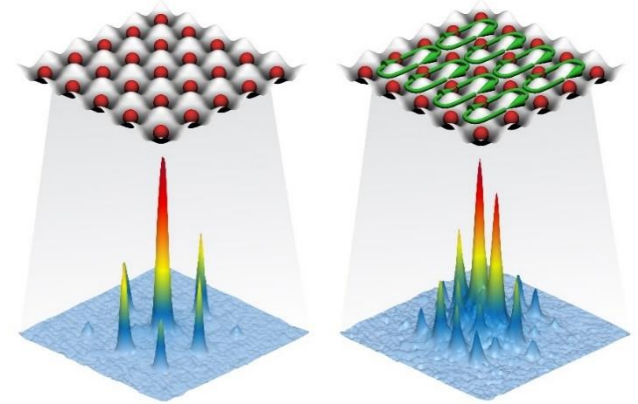
# Applications and quantum simulation with ultracold atoms

## 超冷原子的量子模拟

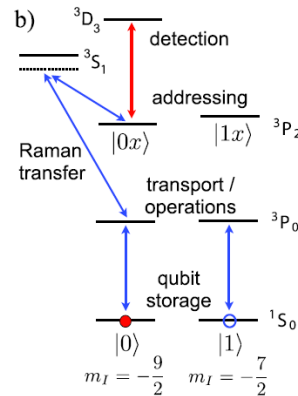
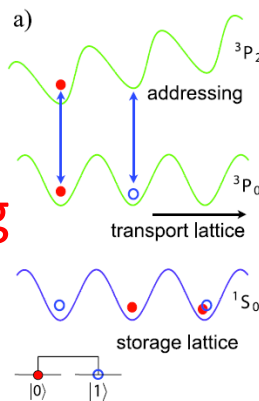
Lattice  
clocks



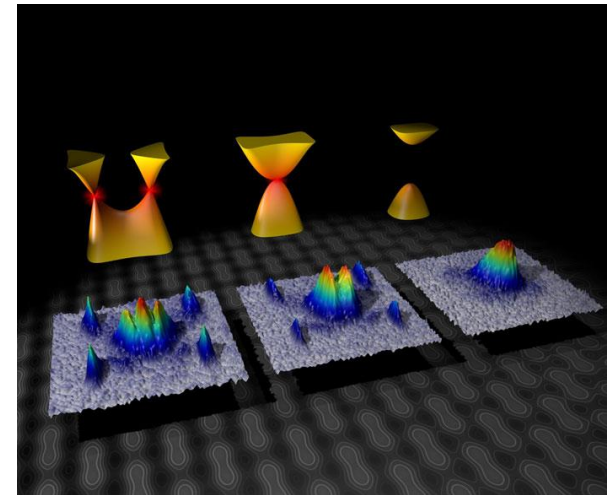
Strong  
magnetic  
fields



Quantum  
computing



Graphene  
physics

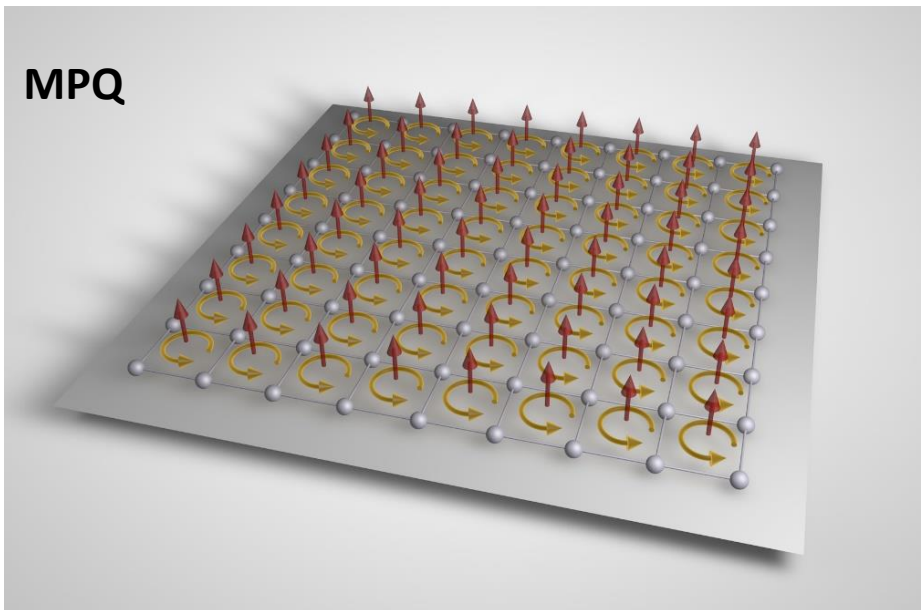




# The Hofstadter-Harper Hamiltonian

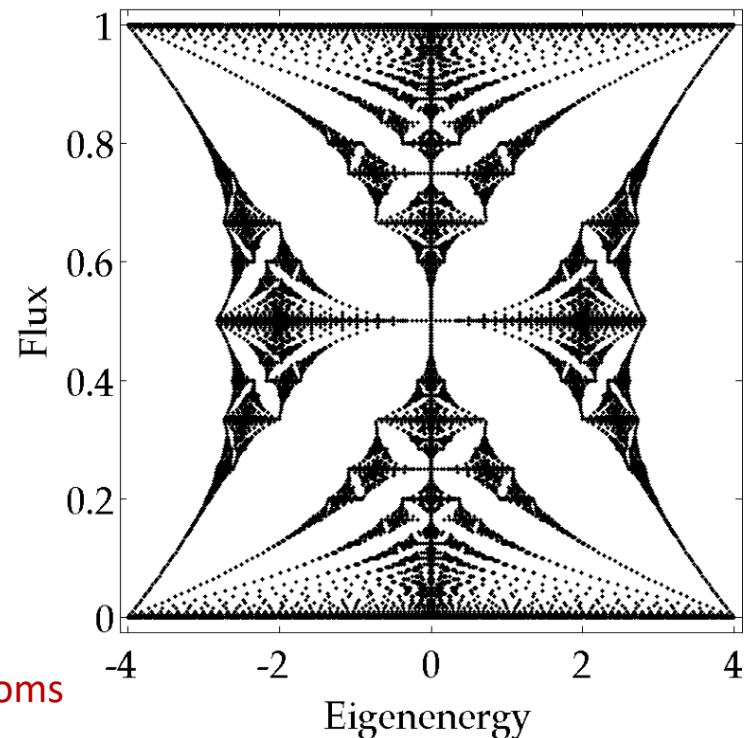
国际上首次实现Hofstadter 哈密顿，具有像首次实现BEC的意义

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

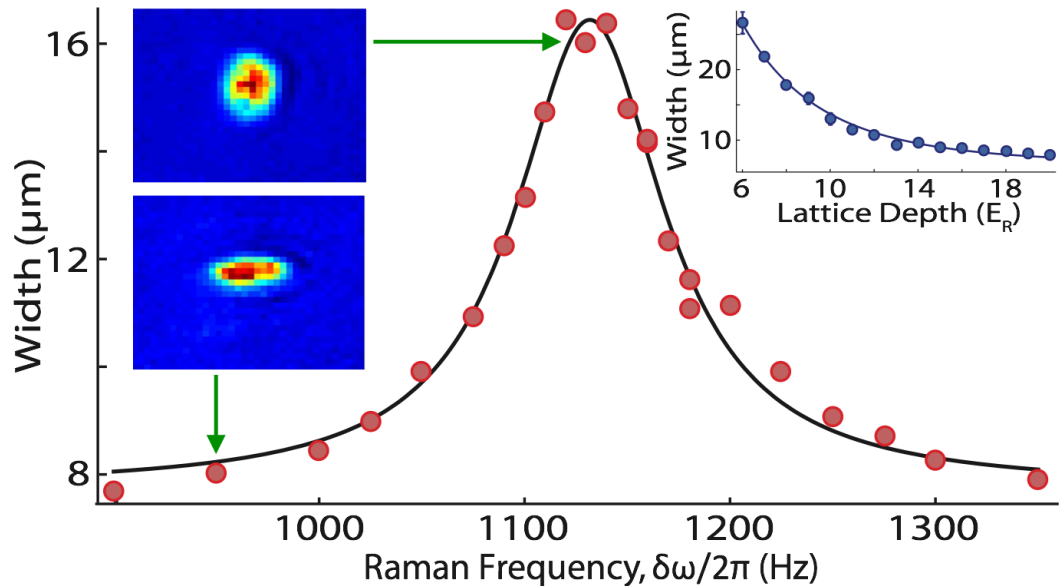
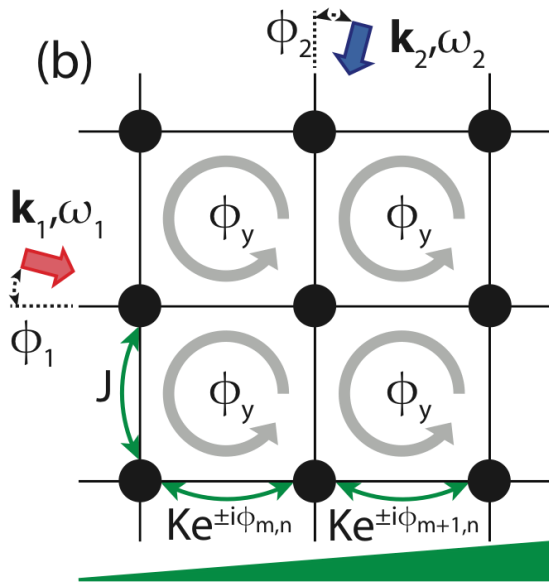


# Strong synthetic fields for neutral atoms

## 实现中性原子的超强鹰磁场

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

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

这一工作也一度成为诸多科学杂志新闻集锦



## 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



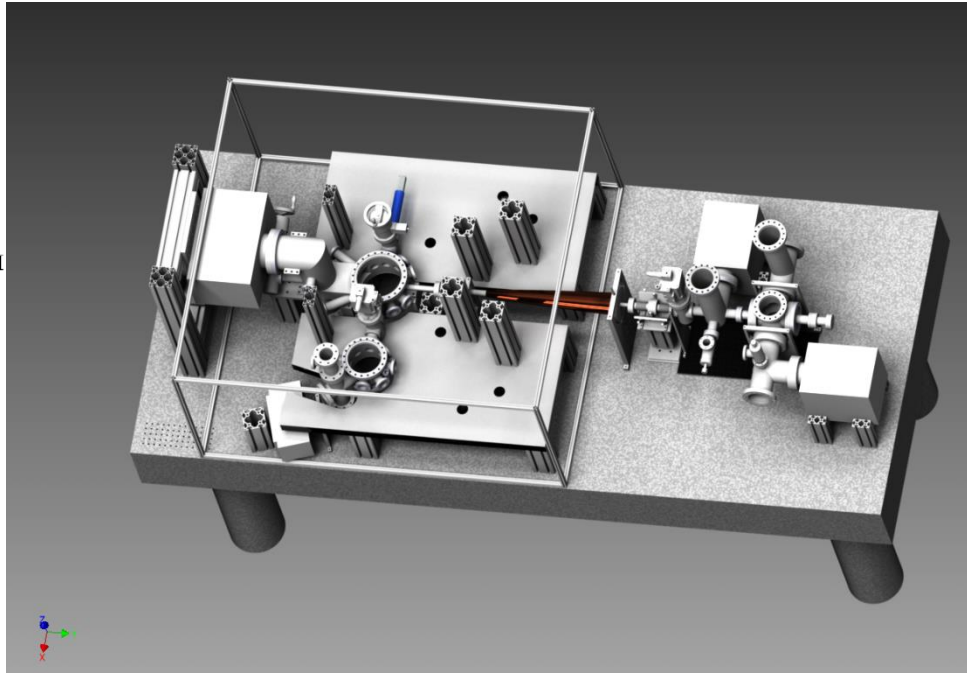
## Physicists net fractal butterfly

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

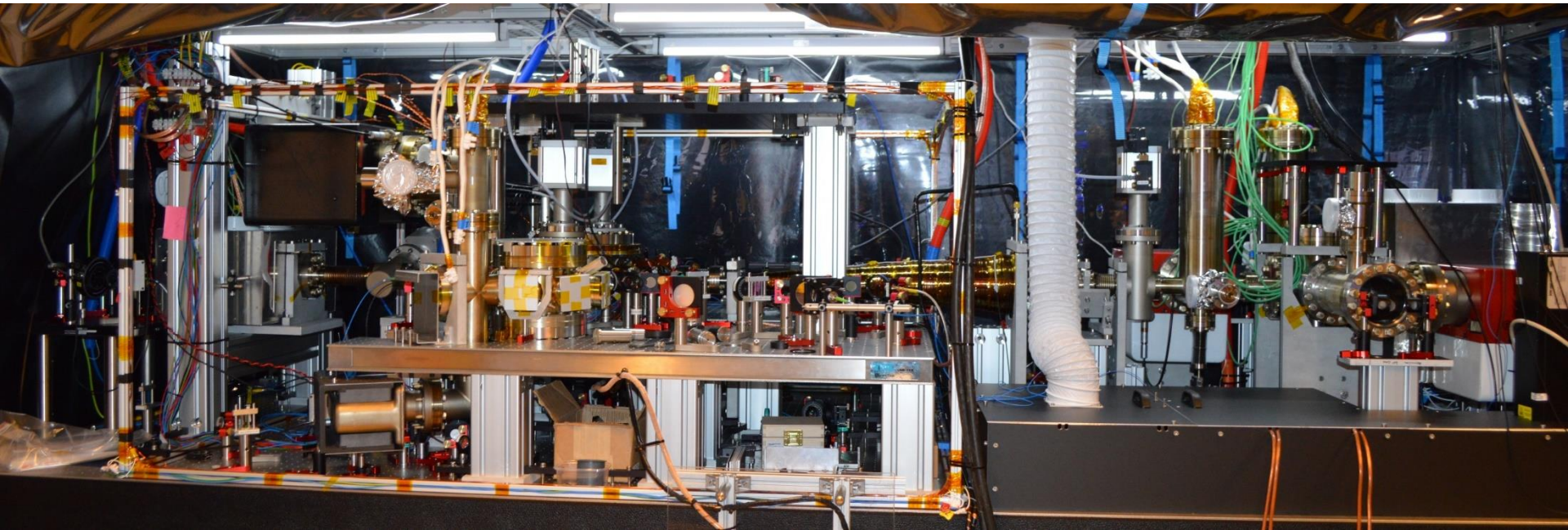
# I designed and built a strontium quantum gas experiment



UNIVERSITEIT VAN AMSTERDAM



在阿姆斯特丹大学  
建立了国际上少有的  
锶原子量子气体实验





# Free fall expansion of a $^{84}\text{Sr}$ BEC

2 ms

BEC fraction:  $> 90\%$

Temperature:  $< 100$  nK

Number of atoms:  $2 \cdot 10^5$

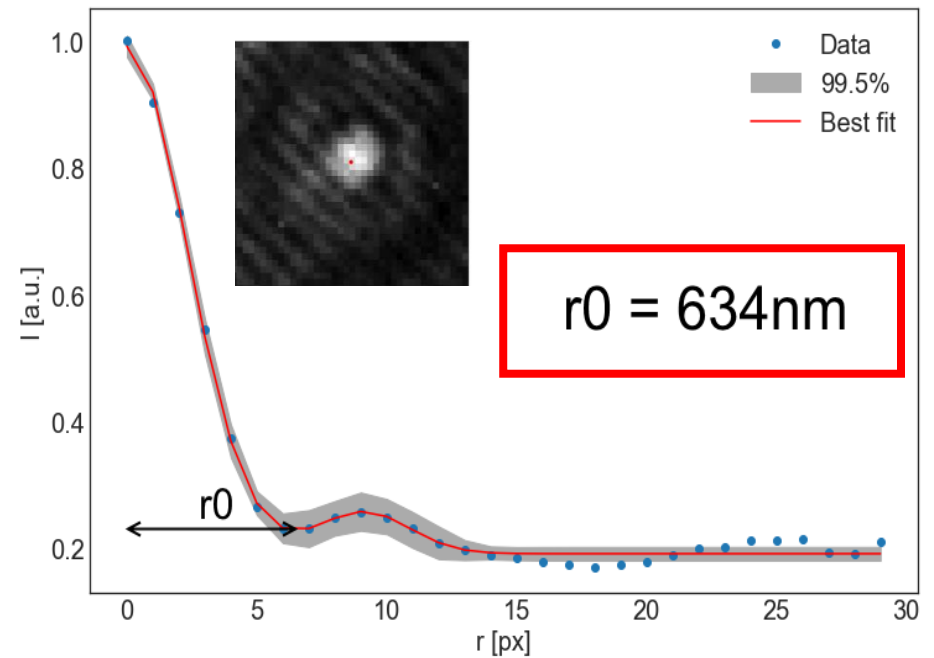
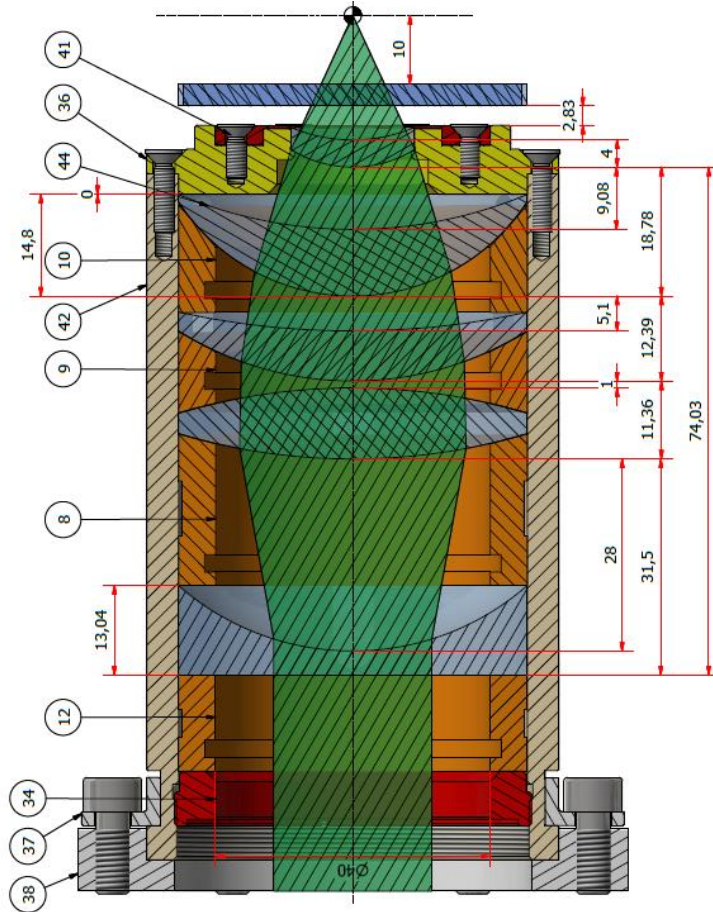
Lifetime: 7 s

20 ms

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

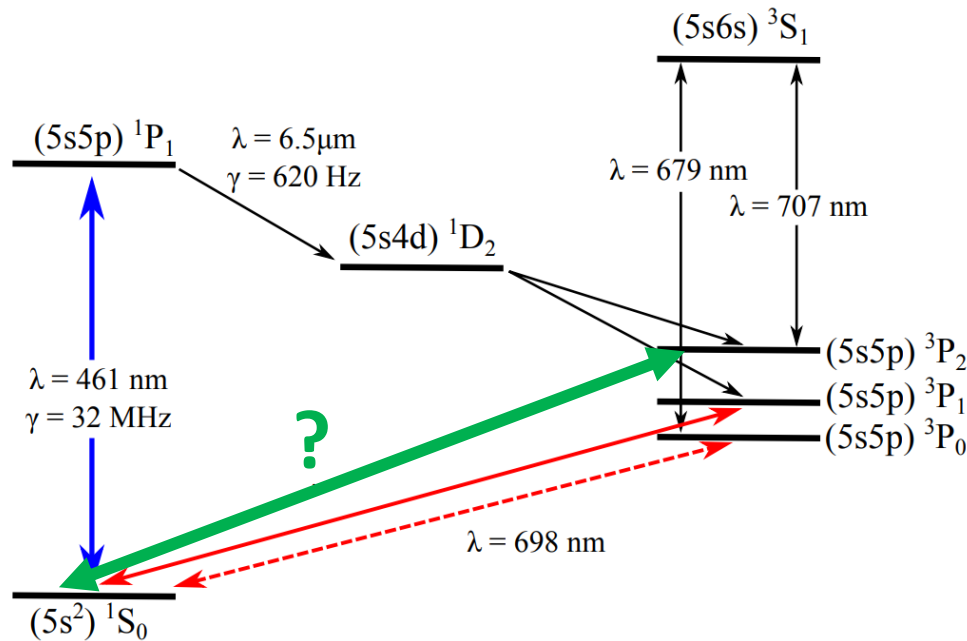


# Microscope objective to resolve individual atoms in a lattice

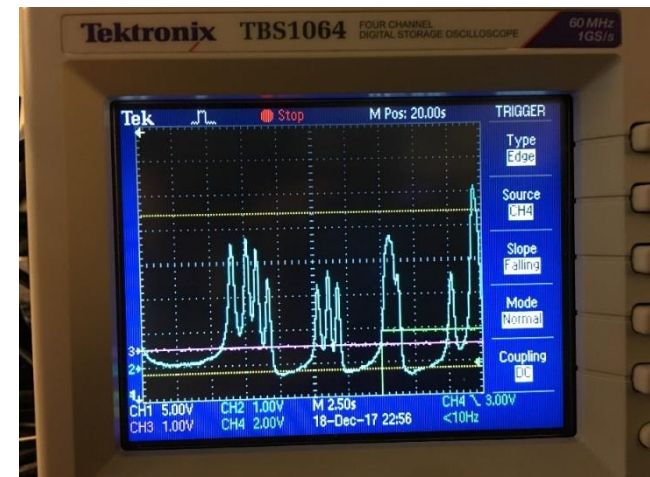
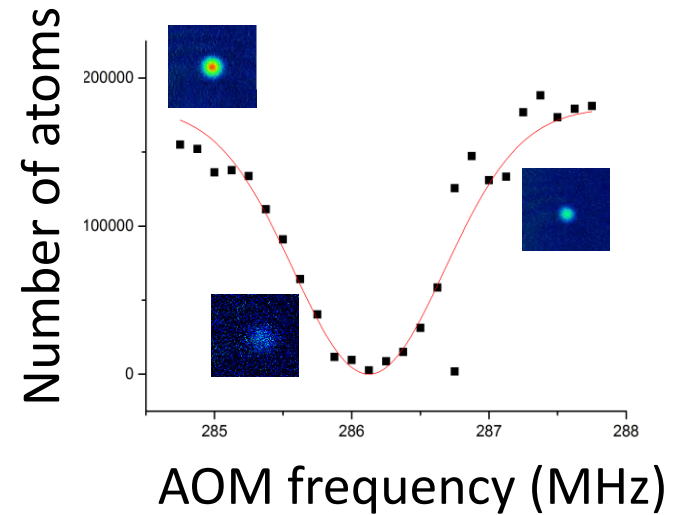


I have designed a microscope capable of resolving individual lattice sites.

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



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



Iodine spectroscopy

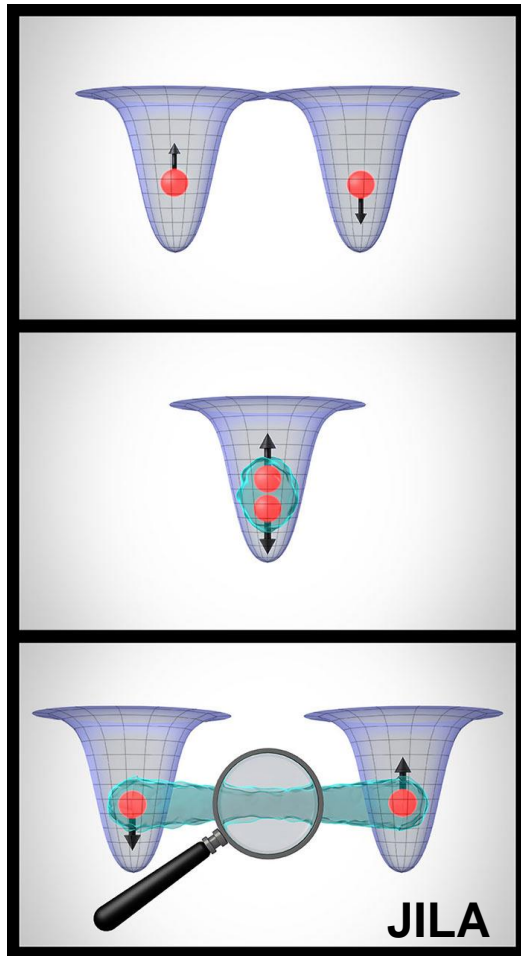
Observation of the ultranarrow doubly-forbidden transition in a Fermi gas of strontium (**in preparation**)

# 未来研究计划

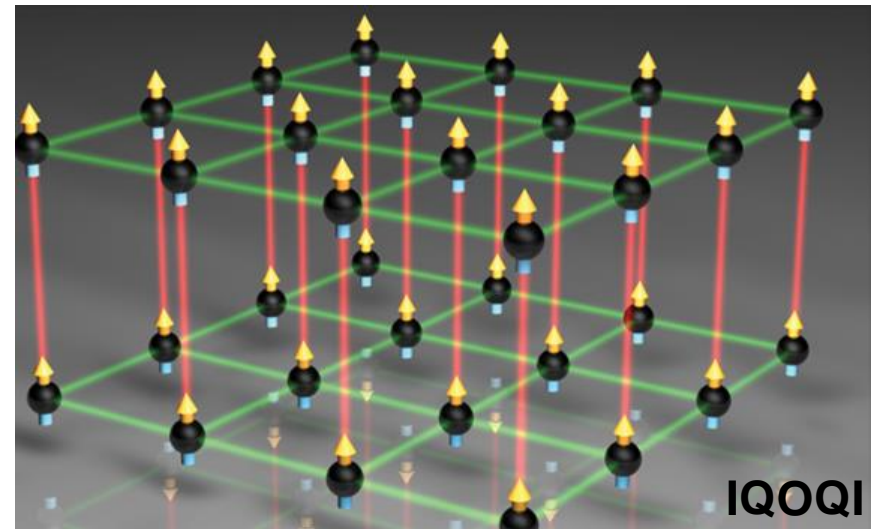
What I want to achieve next

# My plan for a quantum physics and quantum engineering lab

## A few-atom quantum assembler

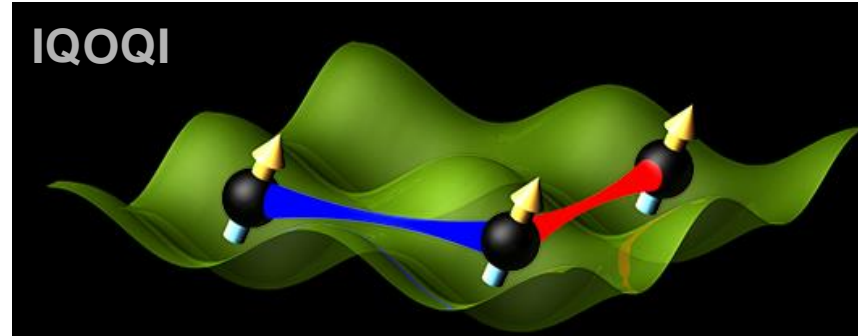


## A quantum gas experiment



# Why erbium?

铒



- Only **3 experiments in the world** have BEC of erbium (Innsbruck, Bonn, Paris)
- It has several stable **fermionic** and **bosonic** isotopes with **high abundancy** (>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

## 团队建设，国际合作，基金申请，论文发表

- 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 m<sup>2</sup>)
- Apply actively for (university, national, local) start-up funding (5-10 million RMB)

愿与物理学院的老师一起为推进南开科研多做贡献！！！！

**Thank you!**

**谢谢！**