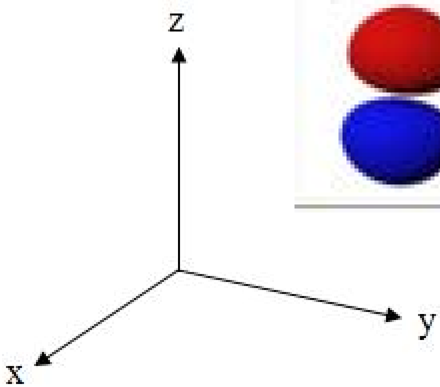
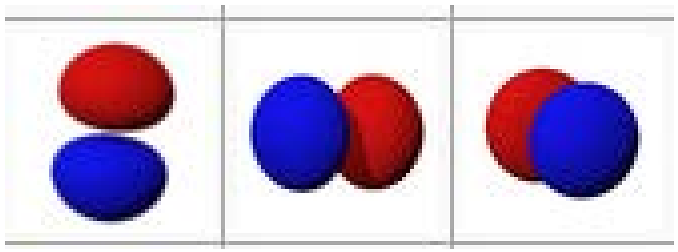
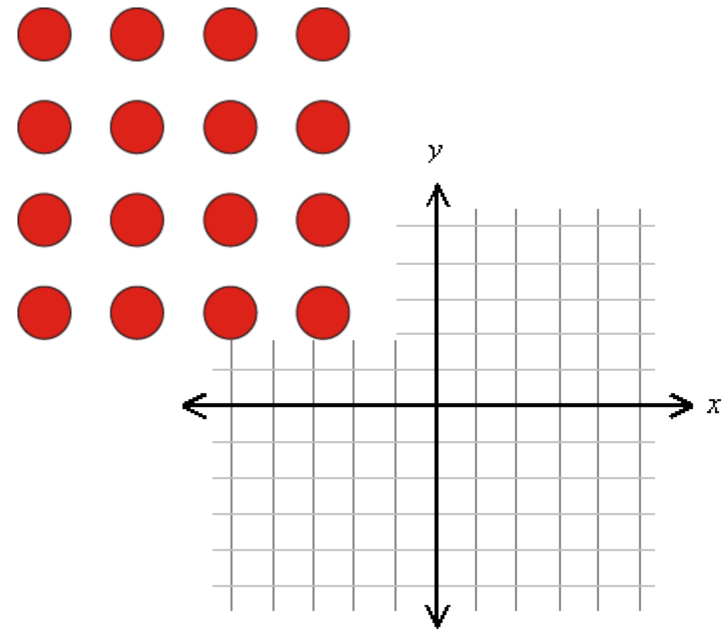
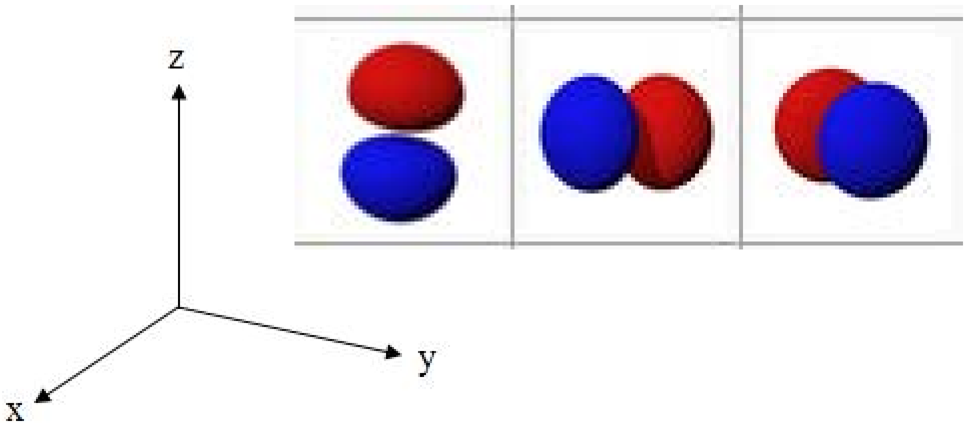
p orbitals in the square lattice

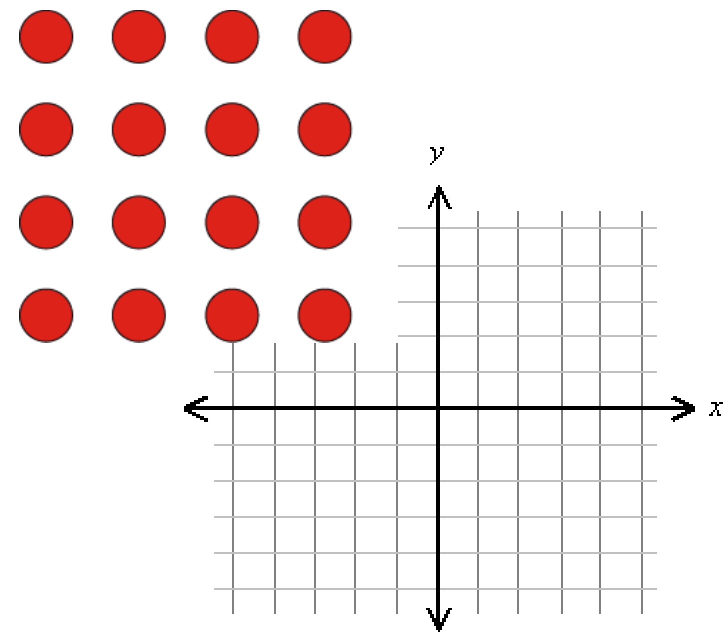






p orbitals in the square lattice





a. three-fold degenerate
b. one nondegenerate, two-fold degenerate
c. three non-degenerate states

C_{4v} point group

not Abelian, 5(6) irreducible representations

Subgroups: C_s, C_2, C_4, C_{2v}

Character table

	E	$2C_4$ (z)	C_2	$2\sigma_v$	$2\sigma_d$	linear, rotations	quadratic
A_1	1	1	1	1	1	z	x^2+y^2, z^2
A_2	1	1	1	-1	-1	R_z	
B_1	1	-1	1	1	-1		x^2-y^2
B_2	1	-1	1	-1	1		xy
E	2	0	-2	0	0	(x, y) (R_x, R_y)	(xz, yz)

Character table for D_{6h} point group

	E	$2C_6$	$2C_3$	C_2	$3C'_2$	$3C''_2$	i	$2S_3$	$2S_6$	σ_h	$3\sigma_d$	$3\sigma_v$	Linear, rotations	Quadratic
A_{1g}	1	1	1	1	1	1	1	1	1	1	1	1		x^2+y^2, z^2
A_{2g}	1	1	1	1	-1	-1	1	1	1	1	-1	-1	R_z	
B_{1g}	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1		
B_{2g}	1	-1	1	-1	-1	1	1	-1	1	-1	-1	1		
E_{1g}	2	1	-1	-2	0	0	2	1	-1	-2	0	0	(R_x, R_y)	(xz, yz)
E_{2g}	2	-1	-1	2	0	0	2	-1	-1	2	0	0		(x^2-y^2, xy)
A_{1u}	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1		
A_{2u}	1	1	1	1	-1	-1	-1	-1	-1	-1	1	1	z	
B_{1u}	1	-1	1	-1	1	-1	-1	1	-1	1	-1	1		
B_{2u}	1	-1	1	-1	-1	1	-1	1	-1	1	1	-1		
E_{1u}	2	1	-1	-2	0	0	-2	-1	1	2	0	0	(x, y)	
E_{2u}	2	-1	-1	2	0	0	-2	1	1	-2	0	0		

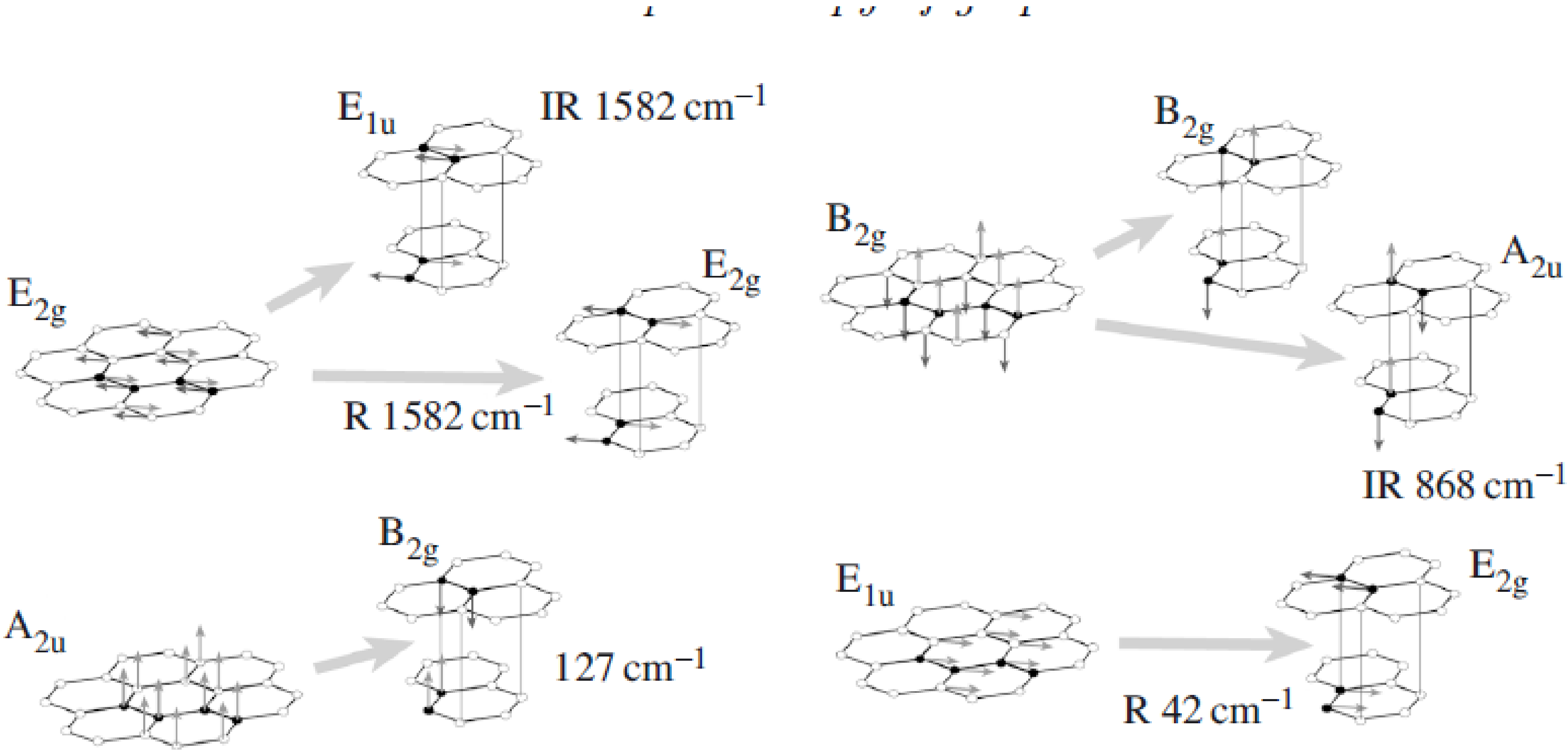
Character table for D_{6h} point group

	E	$2C_6$	$2C_3$	C_2	$3C'_2$	$3C''_2$	i	$2S_3$	$2S_6$	σ_h	$3\sigma_d$	$3\sigma_v$	Linear, rotations	Quadratic
A_{1g}	1	1	1	1	1	1	1	1	1	1	1	1		x^2+y^2, z^2
A_{2g}	1	1	1	1	-1	-1	1	1	1	1	-1	-1	R_z	
B_{1g}	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1		
B_{2g}	1	-1	1	-1	-1	1	1	-1	1	-1	-1	1		
E_{1g}	2	1	-1	-2	0	0	2	1	-1	-2	0	0	(R_x, R_y)	(xz, yz)
E_{2g}	2	-1	-1	2	0	0	2	-1	-1	2	0	0		(x^2-y^2, xy)
A_{1u}	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1		
A_{2u}	1	1	1	1	-1	-1	-1	-1	-1	-1	1	1	z	
B_{1u}	1	-1	1	-1	1	-1	-1	1	-1	1	-1	1		
B_{2u}	1	-1	1	-1	-1	1	-1	1	-1	1	1	-1		
E_{1u}	2	1	-1	-2	0	0	-2	-1	1	2	0	0	(x, y)	
E_{2u}	2	-1	-1	2	0	0	-2	1	1	-2	0	0		

	2	**1**	**-1**	**-2**	**0**	**0**	**2**	**1**	**-1**	**-2**	**0**	**0**
	4	1	1	4	0	0	4	1	1	4	0	0

ment.

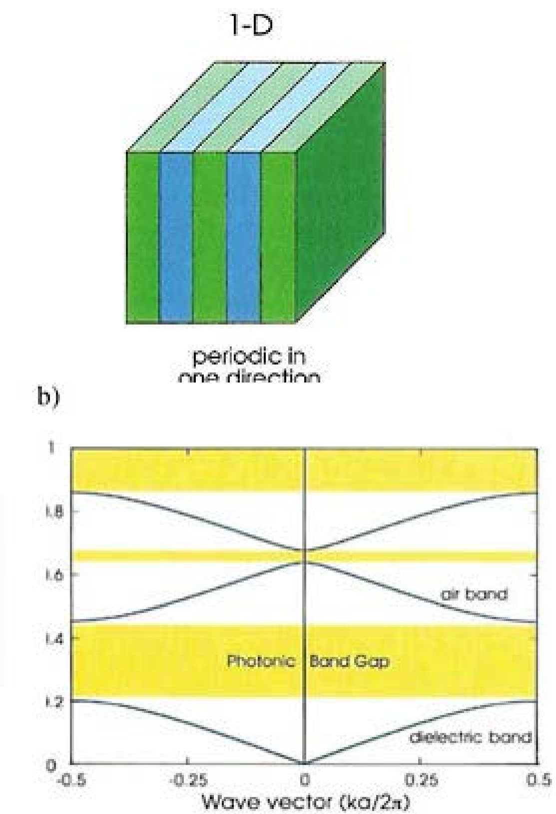
Vibrations of graphite

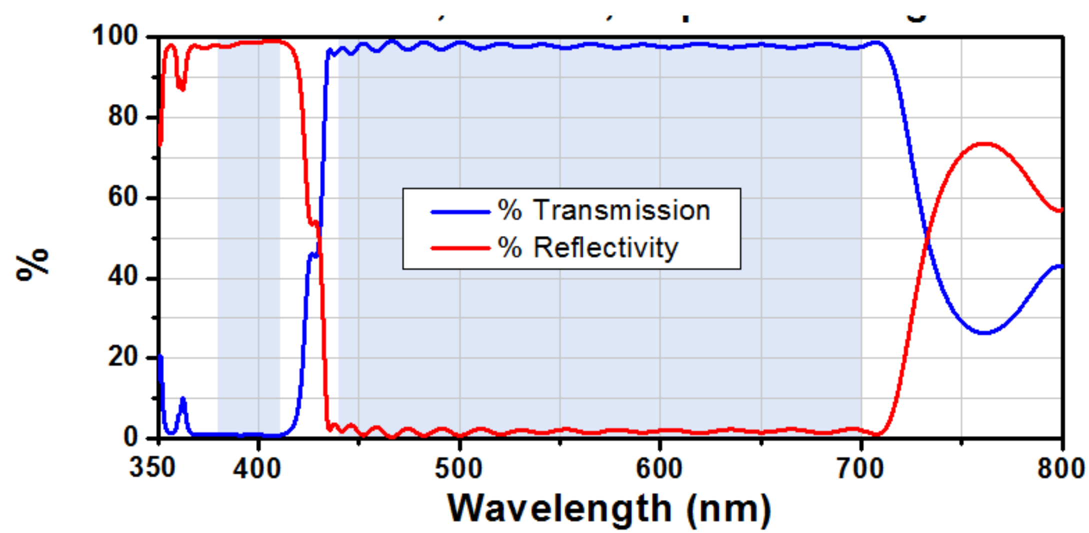


Reich & Thomsen (2007)

Photonic crystal

- Band structure for photons from translational symmetry

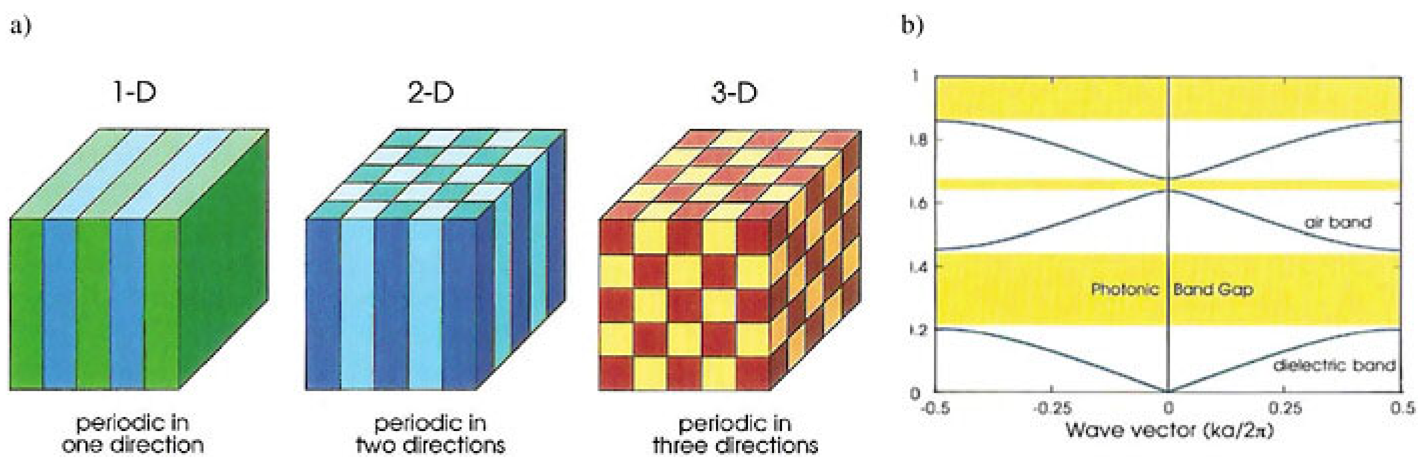


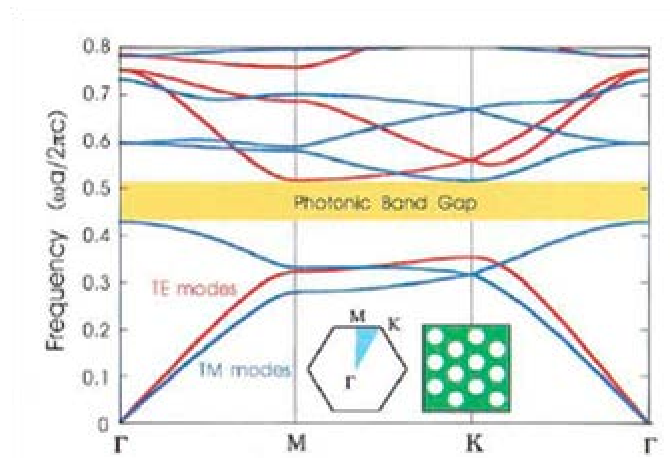


Key player: Joanopoulos (MIT, 90th first concepts); Thorlabs

Photonic crystal

- Band structure for photons from translational symmetry

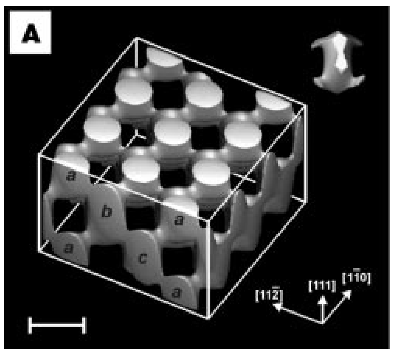


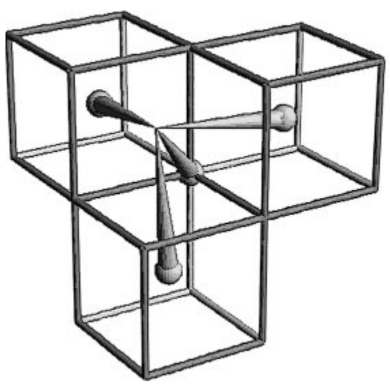


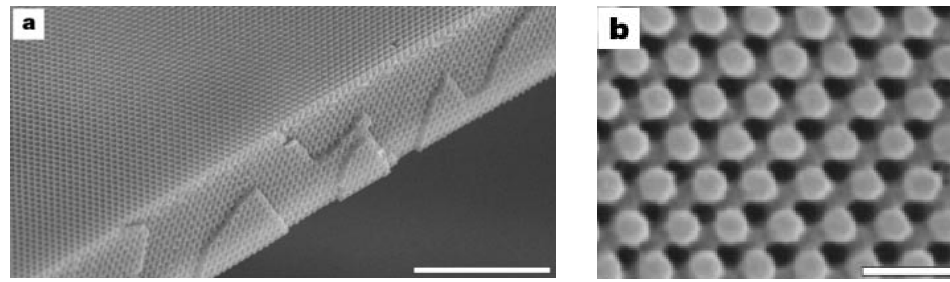
Key player: Joanopoulos (MIT, 90th first concepts)

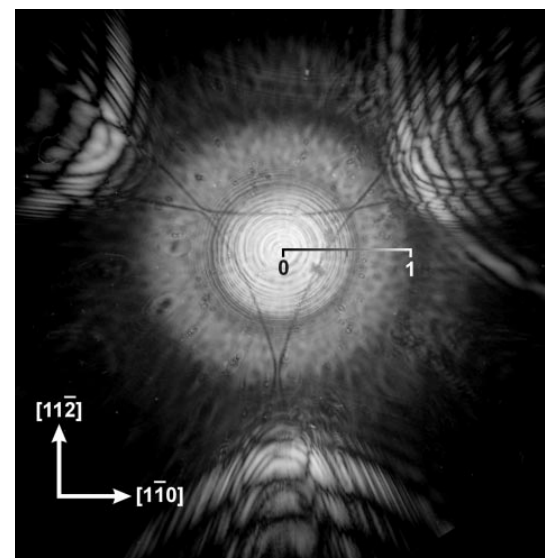
Holographic 3D photonic crystal

- Laser wave vectors span reciprocal lattice -> pattern in real space





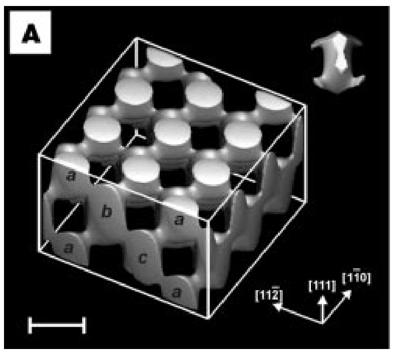


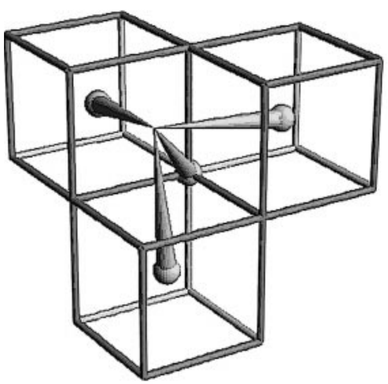


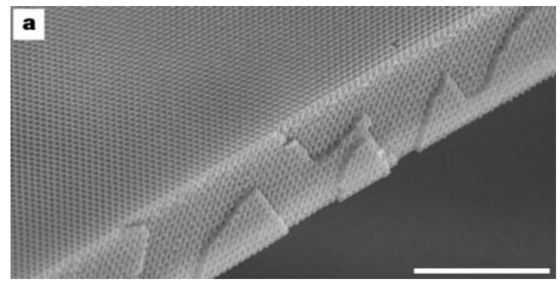
Campbell, Nature (2000)

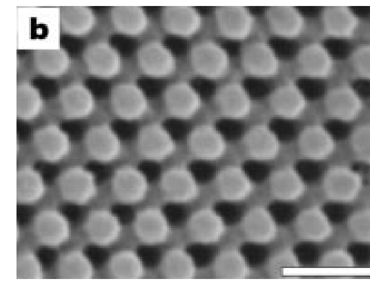
Holographic 3D photonic crystal

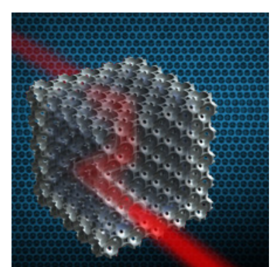
- Laser wave vectors span reciprocal lattice -> pattern in real space

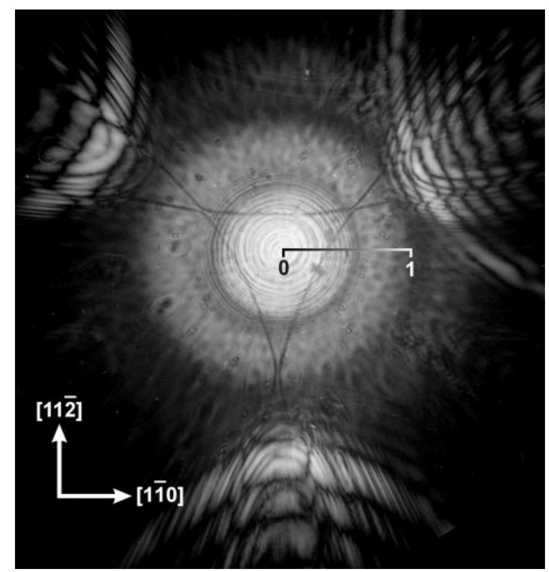






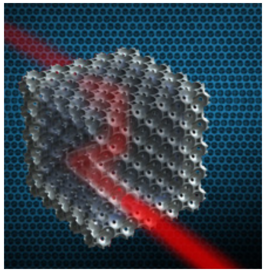


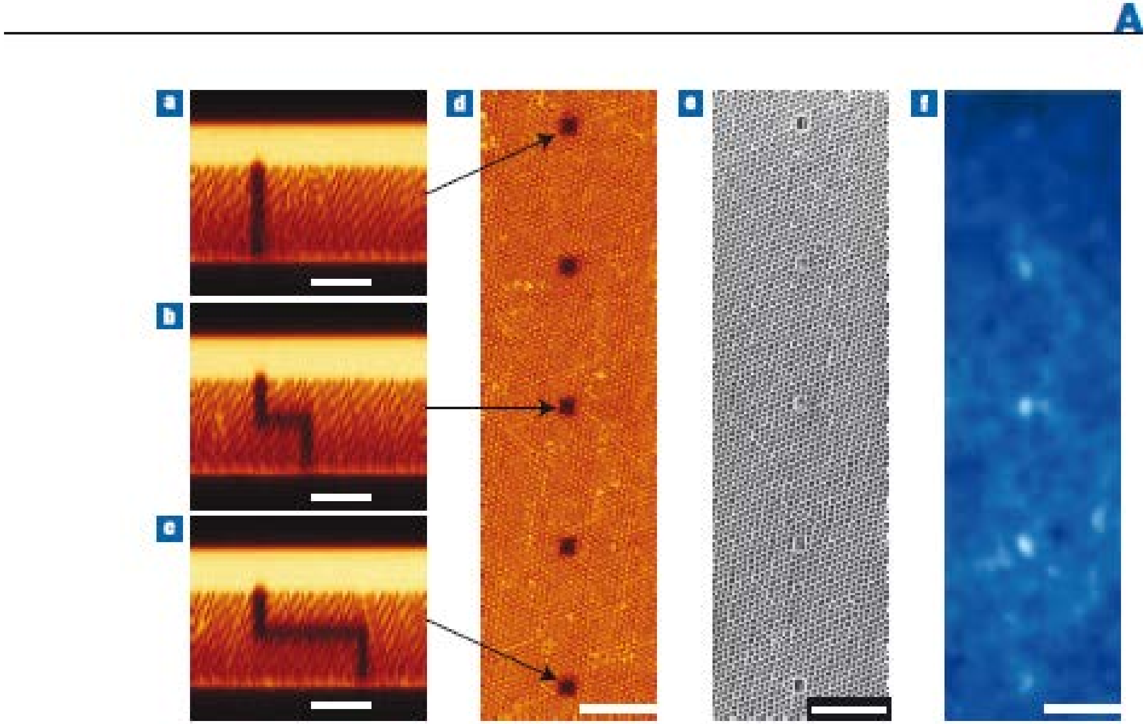




Campbell, Nature (2000)

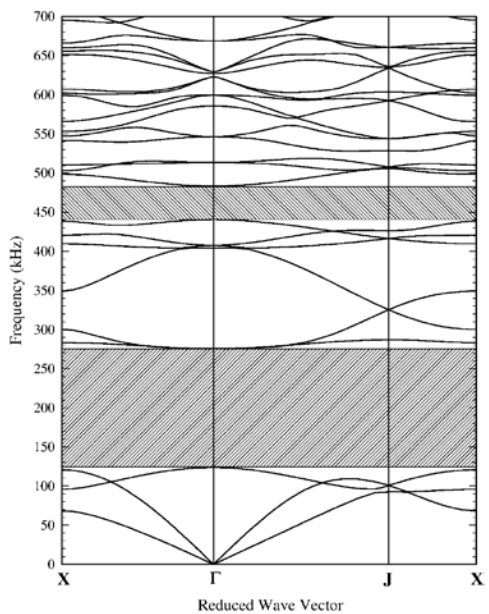
Wave guide

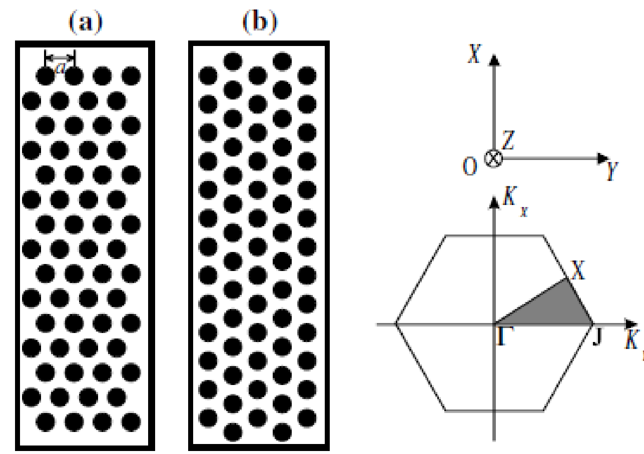


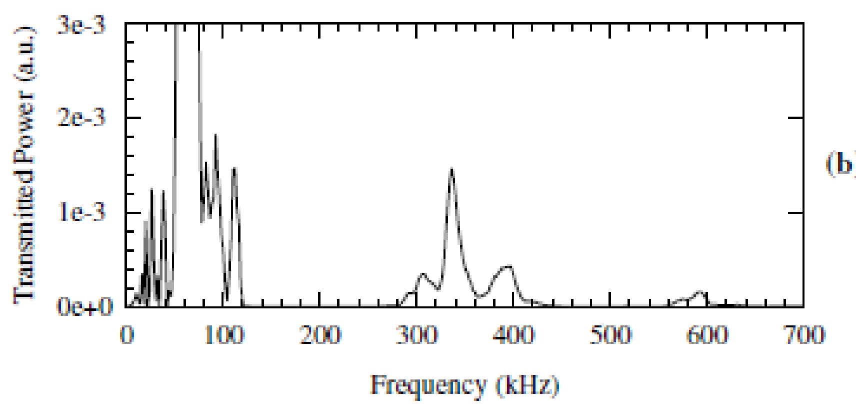


Rinne, Nat. Photonics (2008)

Phononic crystals



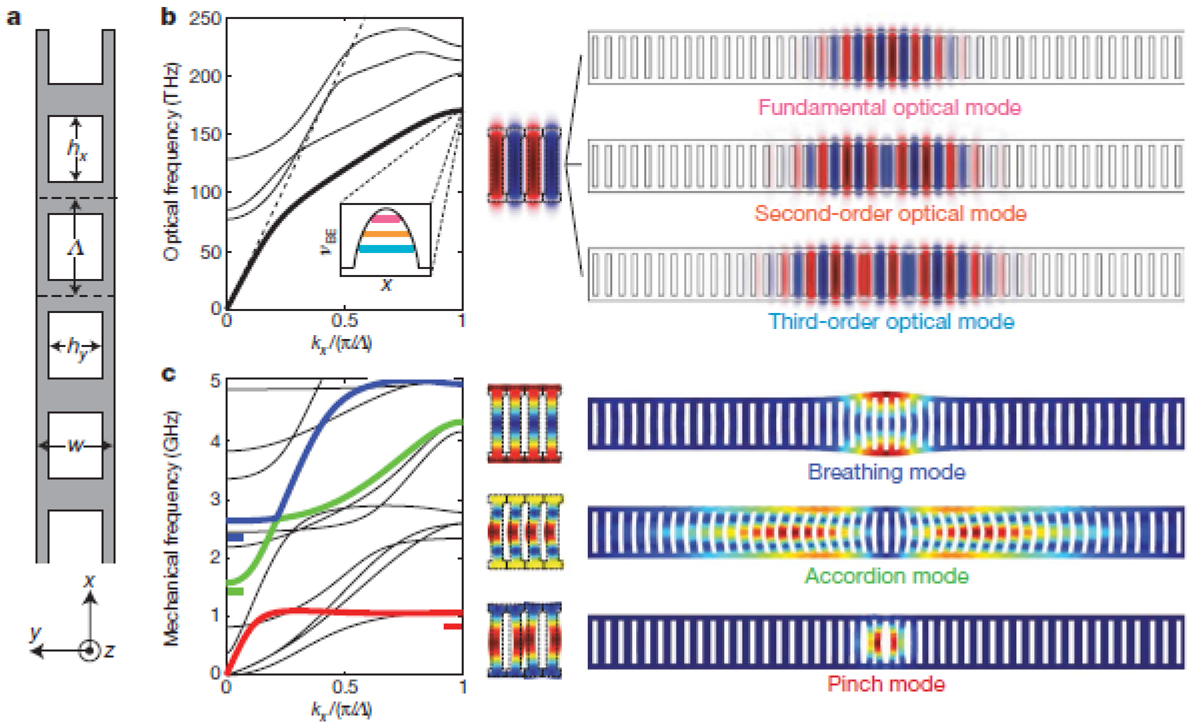




Vasseur, Phys. Rev. Lett. (2001).

Keep going!

- Optomechanical crystals & circuits



Eichenfield, Nature (2009)

Structure & real space imaging

a. Focus: High resolution & abberation corrected TEM
b. Focus: Atomic force microscopy & its derivatives
c. Everything, but keep it brief & broad
d. As you see fit

Firefox | Studying Atomic Structures by Aberr... | 506.full.pdf (application/pdf-Objekt) | nature00972.pdf (application/pdf-Obj... | Transmission Electron Aberration-Co...

en.wikipedia.org/wiki/Transmission_Electron_Aberration-Corrected_Microscope

Meistbesucht | Naturwindel-Seiten: Fl... | Erste Schritte | Leo & Liese | Öko & Bi... | Aktuelle Nachrichten | Lesezeichen

WIKIPEDIA
The Free Encyclopedia

Create account | Log in

Article | Talk | Read | Edit | View history | Search

Main page
Contents
Featured content
Current events
Random article
Donate to Wikipedia

Interaction
Help
About Wikipedia
Community portal
Recent changes
Contact Wikipedia

Toolbox

Print/export

Languages
Português
Edit links

Transmission Electron Aberration-Corrected Microscope

From Wikipedia, the free encyclopedia

Transmission Electron Aberration-Corrected Microscope (TEAM) is a collaborative research project between four US laboratories and two companies. It is based at the Lawrence Berkeley National Laboratory in Berkeley, California and involves Argonne National Laboratory, Oak Ridge National Laboratory and Frederick Seitz Materials Research Laboratory at the University of Illinois at Urbana-Champaign, as well as FEI and CEOS companies, and is supported by the U.S. Department of Energy. The project's main activity is design and application of a transmission electron microscope (TEM) with a spatial resolution below 0.05 nanometers, which is roughly half the size of an atom of hydrogen.[1] The project was started in 2004; the operational microscope was built in 2008 and achieved the 0.05 nm resolution target in 2009. The microscope is a shared facility available to external users.[2]

Contents [hide]

Scientific background [edit]

It has long been known that the best achievable spatial resolution of an optical microscope, that is the smallest feature it can observe, is of the order of the wavelength of the light λ, which is about 550 nm for green light. One route to improve this resolution is to use particles with smaller λ, such as high-energy electrons. Practical limitations set a convenient electron energy to 100–300 keV that corresponds to λ = 3.7–2.0 pm. Unfortunately, the resolution of electron microscopes is limited not by the electron wavelength, but by intrinsic imperfections of electron lenses. These are referred to as spherical and chromatic aberrations because of their similarity to aberrations in optical lenses. Those aberrations are reduced by installing in a microscope a set of specially designed auxiliary "lenses" which are called aberration correctors.[3][4]

Hardware [edit]