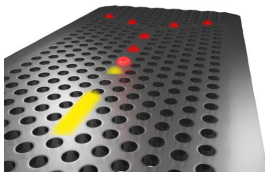


# Nanofotonik og fotoniske krystaller – Tryllekunster med lys

Jakob Rosenkrantz de Lasson

 @jakobrdl  
[www.jakobrdl.dk](http://www.jakobrdl.dk)  
[www.nanophotonics.dk](http://www.nanophotonics.dk)



Egedal Gymnasium & HF, 24. april 2015



 DTU Fotonik  
Institut for Fotonik



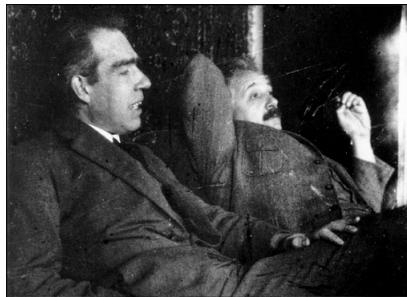
# I. En appetizer til jer











## II. Hvem vi er



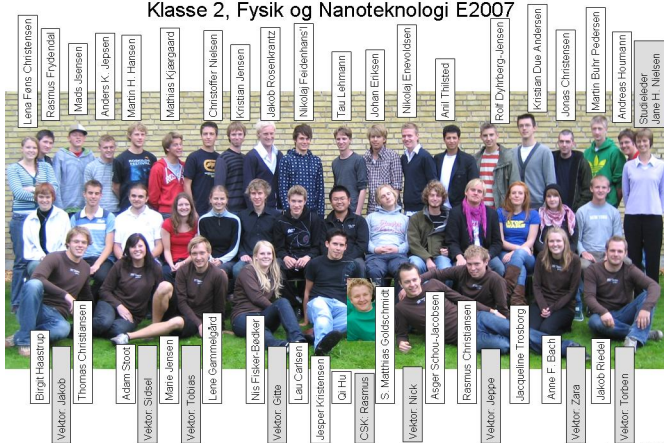


Sct. Knuds Gymnasium & HF-Kursus  
3.2 - 2006

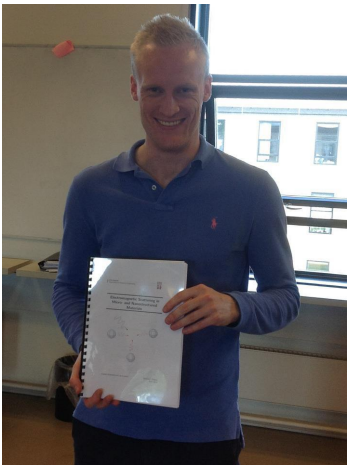
© Odense Skolefoto



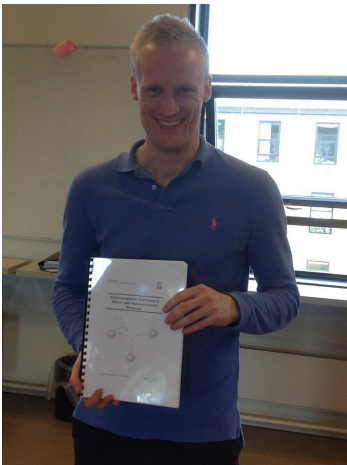
## Klasse 2, Fysik og Nanoteknologi E2007



3. september 2007

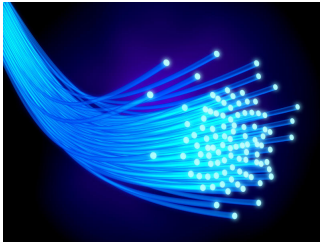












# III. Hvorfor der er behov for os





Google





Google



Google



Instagram



Google



Instagram



Dropbox



Spotify®

Google



Instagram

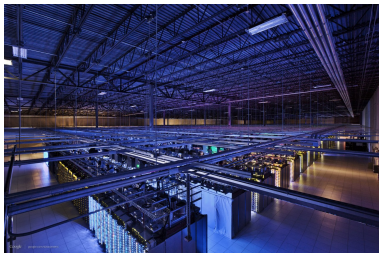


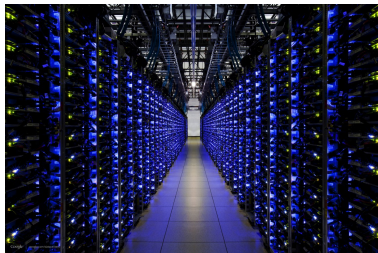
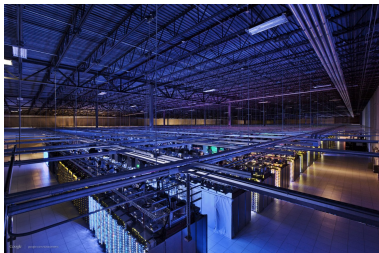
Dropbox

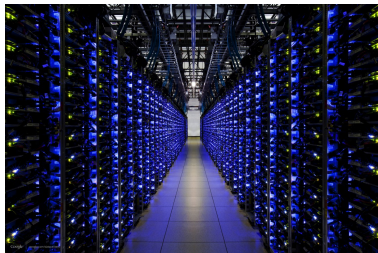
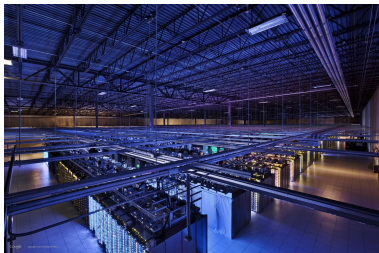


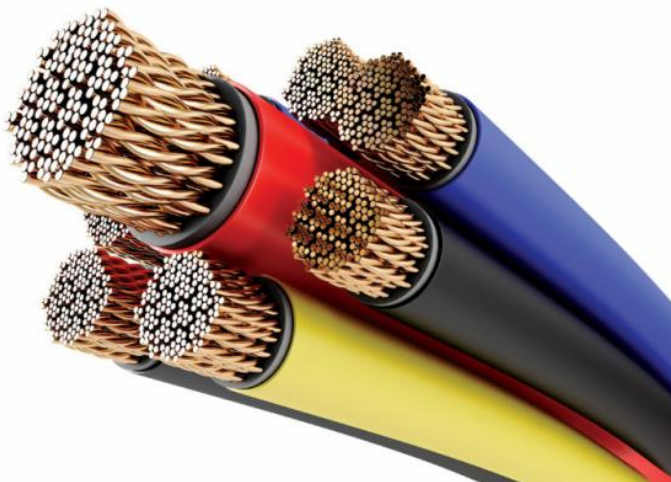
Spotify®

coursera

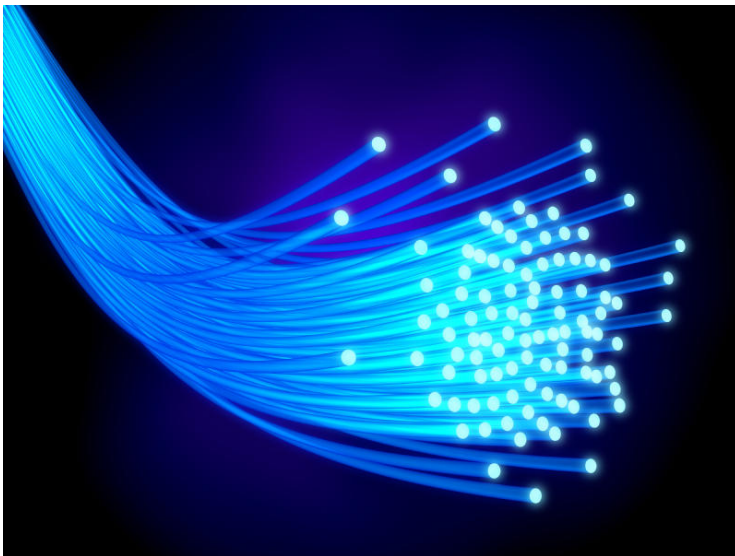














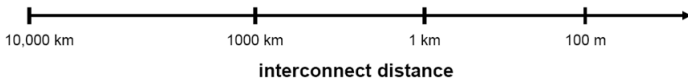
Telecommunications



Campus networks



LANs





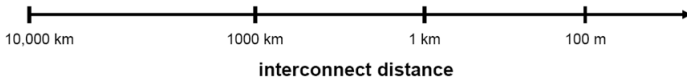
Telecommunications



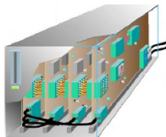
Campus networks



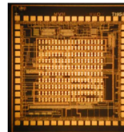
LANs



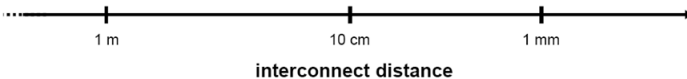
Backplanes & board-to-board



Chip-to-chip



On-chip

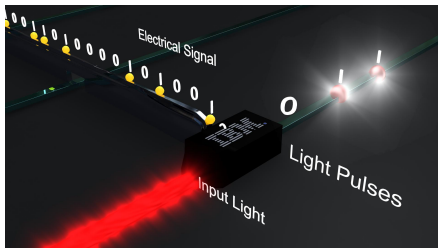


# IBM: Nanophotonics Will Smash Data Center Bottlenecks

*Rather than use electricity to move data between processors, IBM is preparing to use light, giving high-end customers enough power to keep pace with the growing information flowing through data centers.*

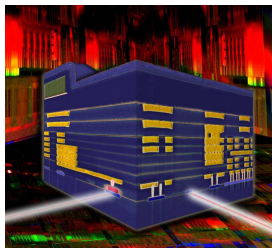
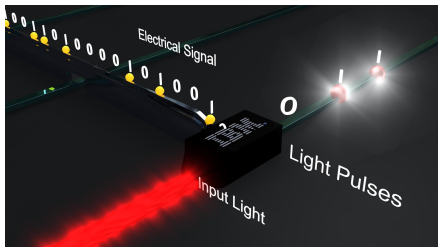
# IBM: Nanophotonics Will Smash Data Center Bottlenecks

*Rather than use electricity to move data between processors, IBM is preparing to use light, giving high-end customers enough power to keep pace with the growing information flowing through data centers.*



# IBM: Nanophotonics Will Smash Data Center Bottlenecks

*Rather than use electricity to move data between processors, IBM is preparing to use light, giving high-end customers enough power to keep pace with the growing information flowing through data centers.*

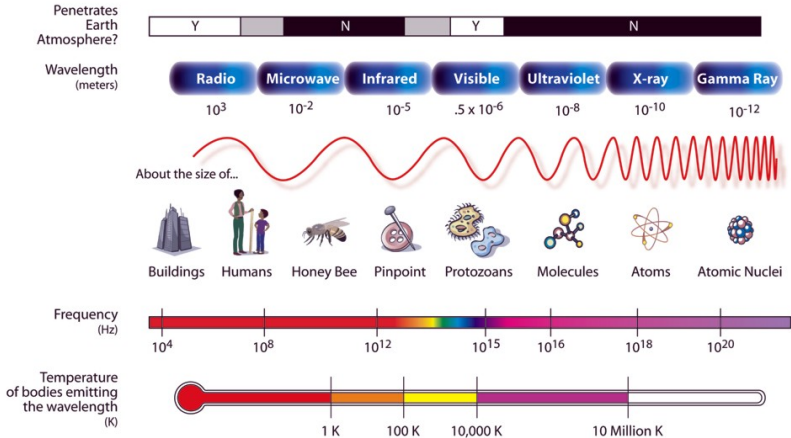


## IV. Hvad lys er

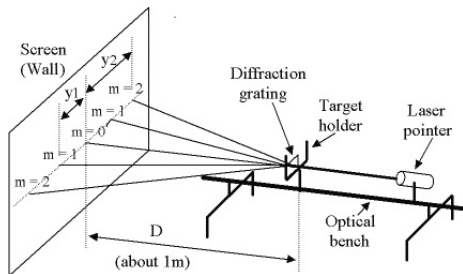


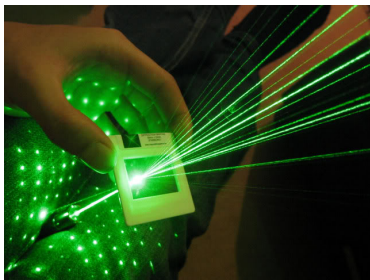
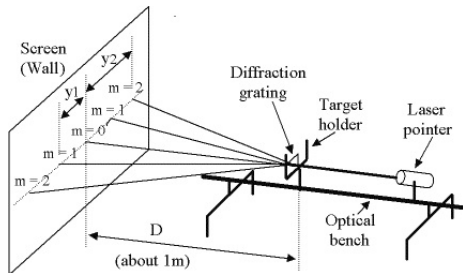


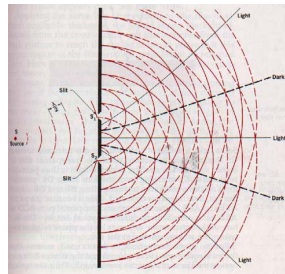
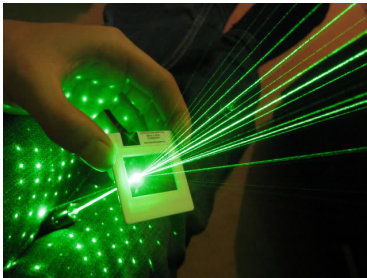
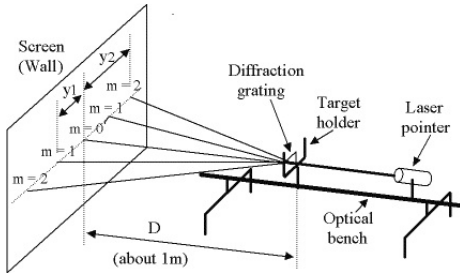
# THE ELECTROMAGNETIC SPECTRUM



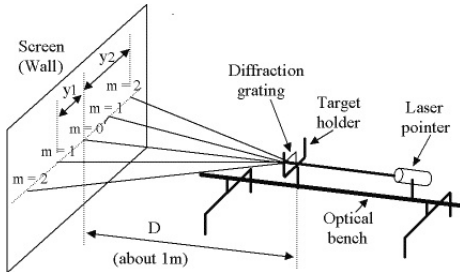






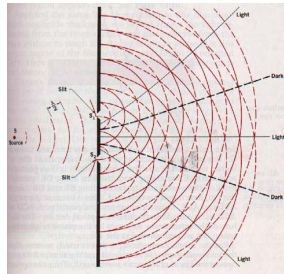
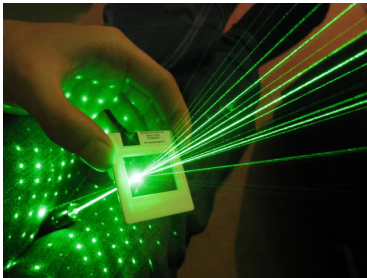


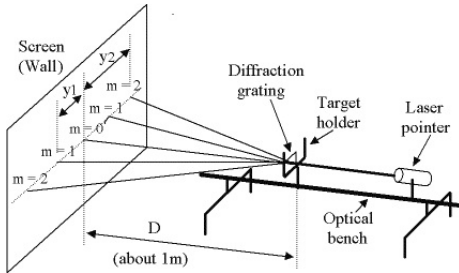




$$m\lambda = 2d \sin(\theta)$$

$$\frac{m}{2} \frac{\lambda}{d} = \sin(\theta)$$



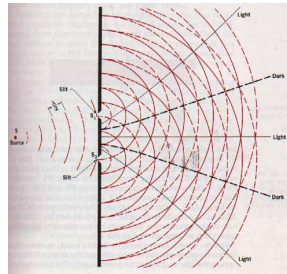
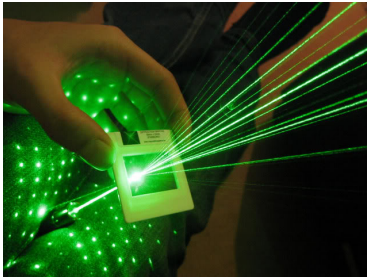


$$m\lambda = 2d \sin(\theta)$$

$$\frac{m}{2} \frac{\lambda}{d} = \sin(\theta)$$

$\lambda/d \ll 1$ : Lys som stråler

$\lambda/d \simeq 1$ : Lys som bølger





# V. Hvad vi gør

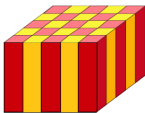
1-D



periodic in  
one direction

(a)

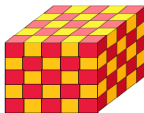
2-D



periodic in  
two directions

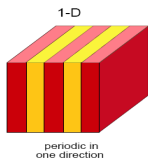
(b)

3-D

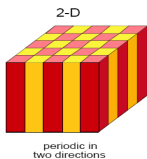


periodic in  
three directions

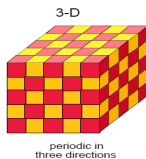
(c)



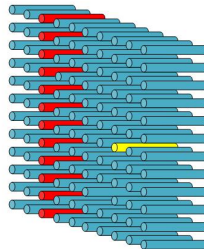
(a)

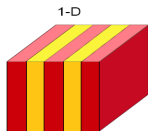


(b)



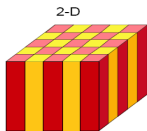
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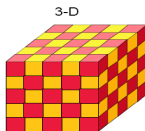
periodic in  
one direction

(a)



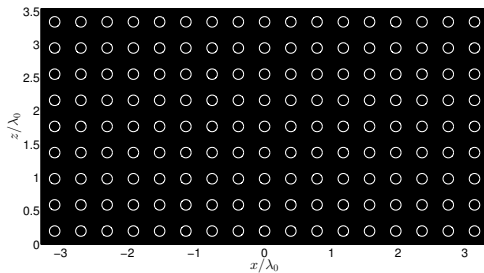
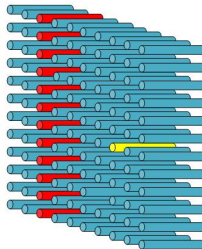
periodic in  
two directions

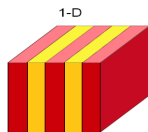
(b)



periodic in  
three directions

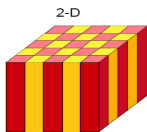
(c)





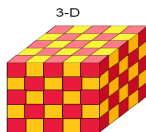
periodic in  
one direction

(a)



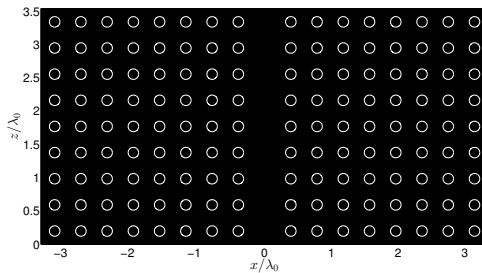
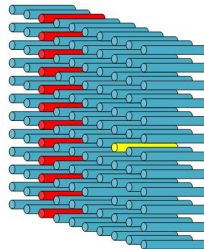
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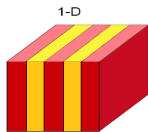
(b)



periodic in  
three directions

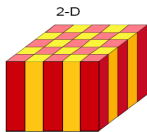
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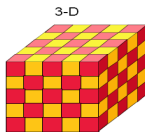
periodic in  
one direction

(a)



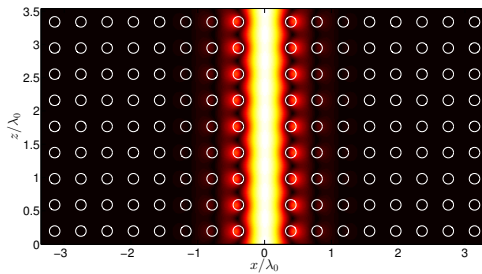
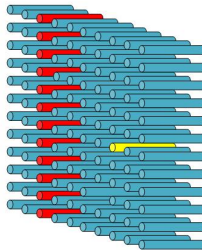
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two directions

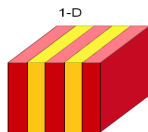
(b)



periodic in  
three directions

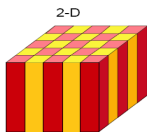
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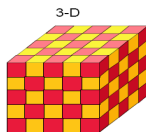
periodic in  
one direction

(a)



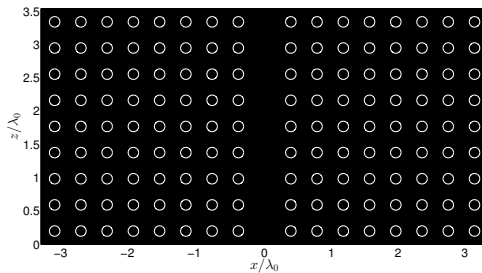
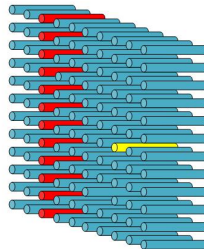
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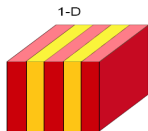
(b)



periodic in  
three directions

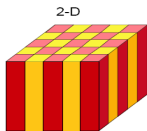
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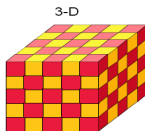
periodic in  
one direction

(a)



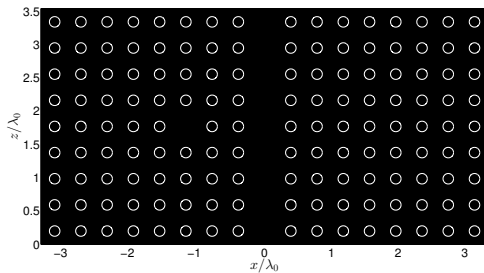
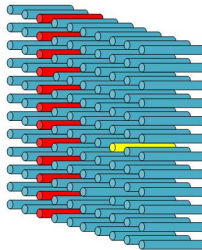
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(b)

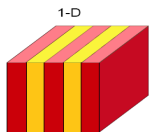


periodic in  
three directions

(c)

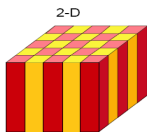






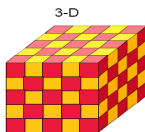
periodic in  
one direction

(a)



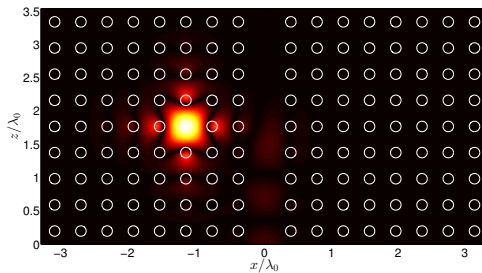
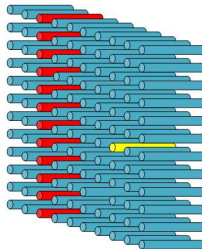
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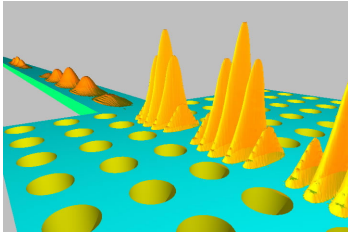
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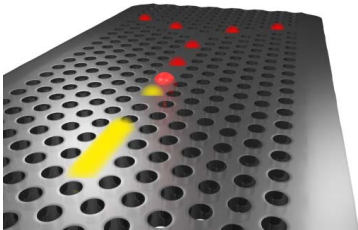
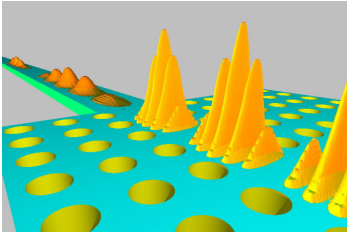


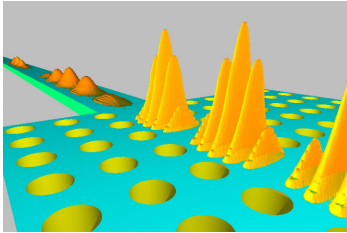
periodic in  
three directions

(c)

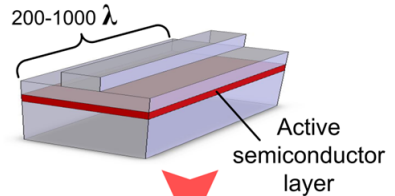




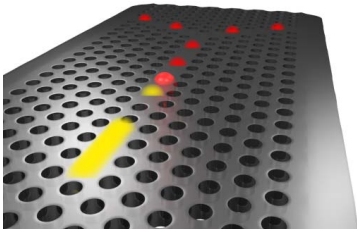
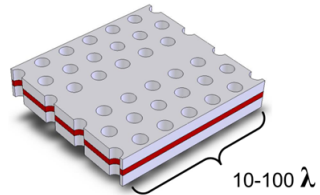


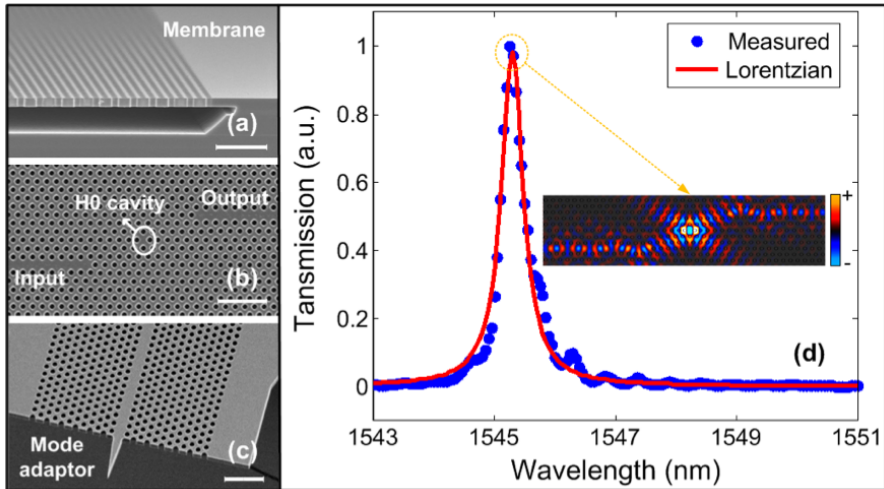


## Standard Optical Waveguide

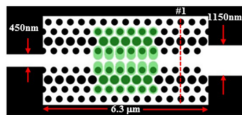


## Photonic Crystal Waveguide

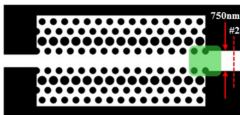




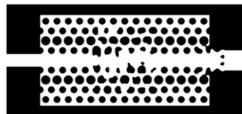
[Yi Yu *et al.*, Opt. Express **21**, 31047 (2013)]



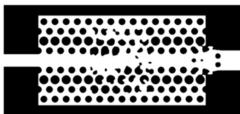
(a)



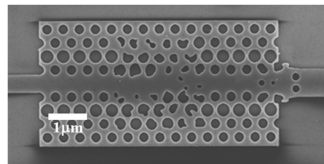
(b)



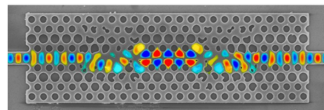
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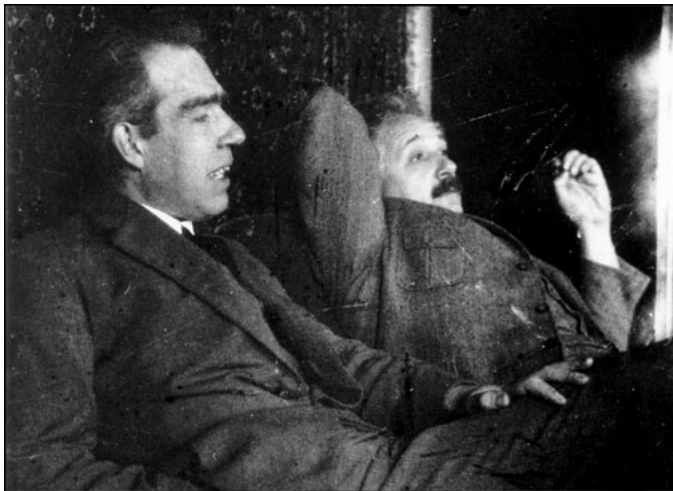
(d)

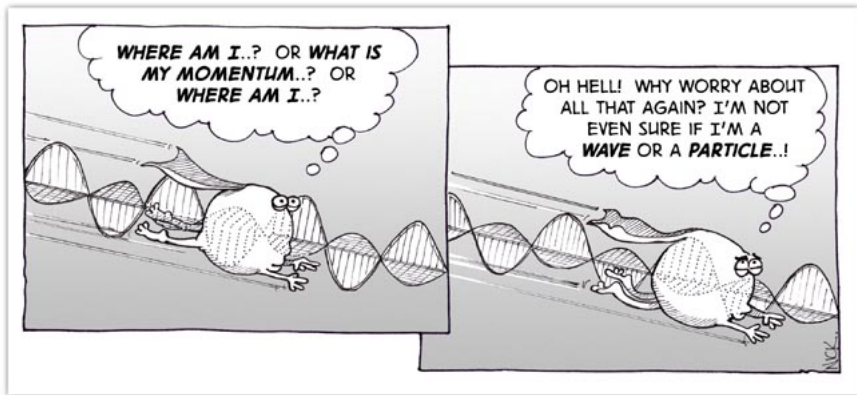


(a)



(b)

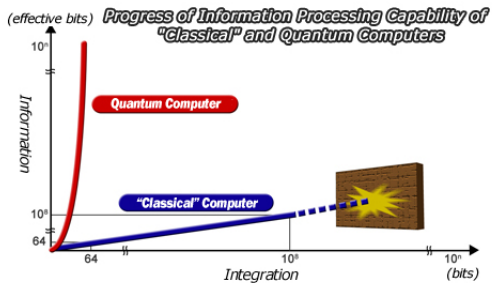




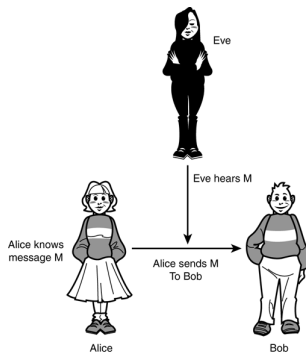
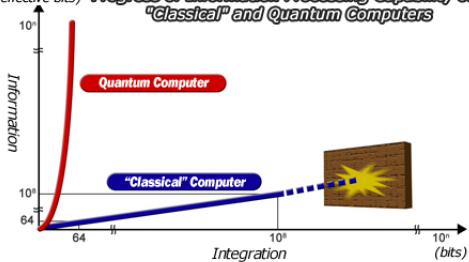
Photon self-identity issues

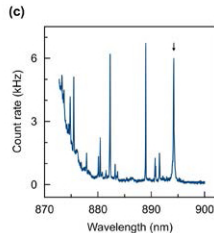
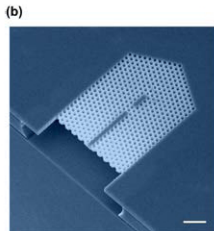
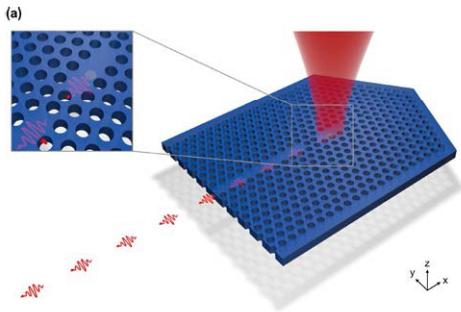


LIGHT IS A  
WAVE!

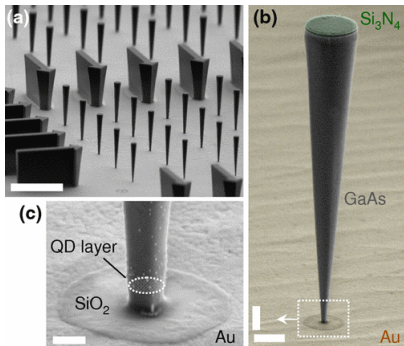


(effective bits) *Progress of Information Processing Capability of  
"Classical" and Quantum Computers*





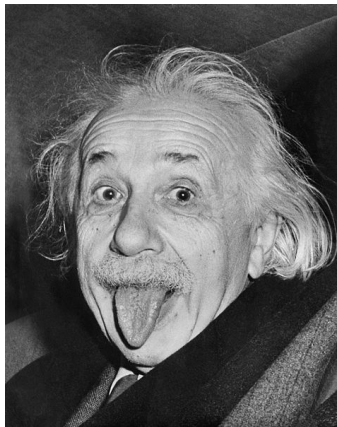
[Schwagmann *et al.*, Opt. Express **20**, 28614 (2012)]

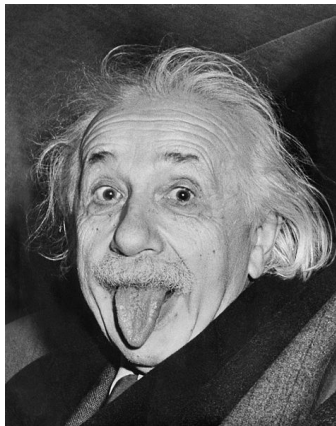


[Munsch *et al.*, Phys. Rev. Lett. **110**, 177402 (2013)]

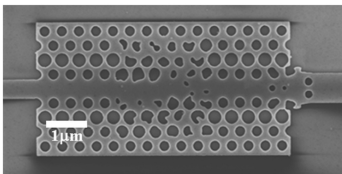
[Claudon *et al.*, Nat. Photon. **4**, 174 (2010)]

# VI. Afrundingen

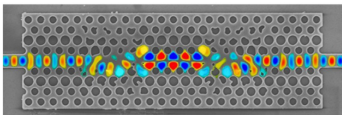




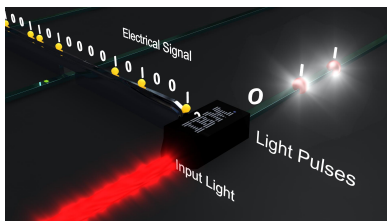


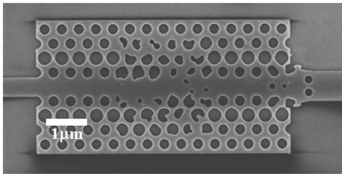


(a)

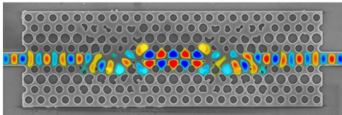


(b)

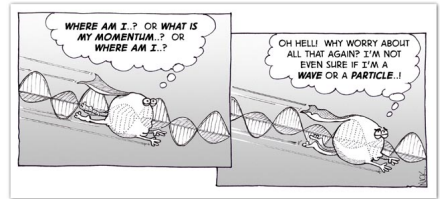
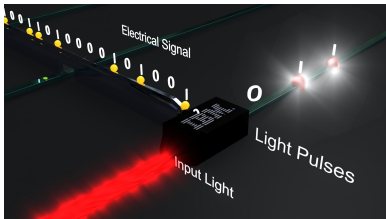




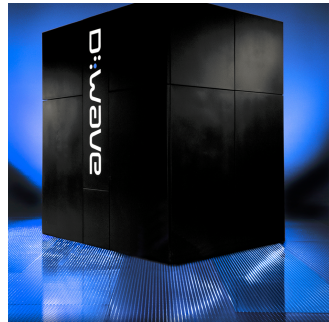
(a)



(b)



Photon self-identity issues



# Tak for opmærksomheden!

