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Velkommen til Optikk og lys - UNIK4480





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Welcome to Optics and light - UNIK4480

(Lectures will be in English, if needed)



Why is light interesting?

- **Vision:** Light allows living things to map out the world around them
- **Illumination:** Sources of light make the world visible
- **Display:** Creating patterns of light that convey information
- **Imaging:** Recording views of the world



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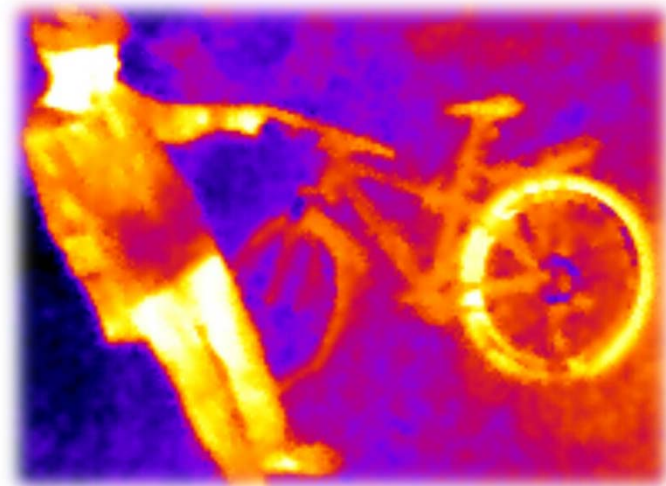


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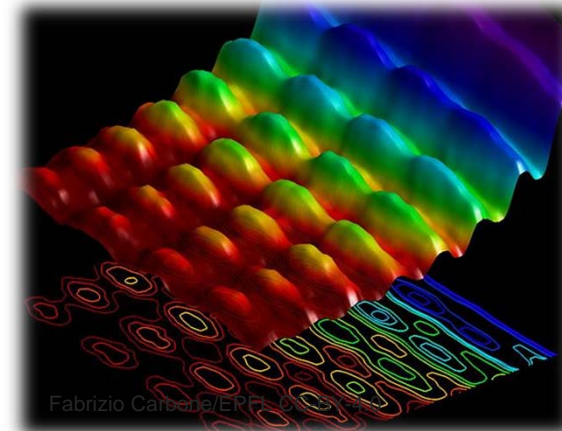
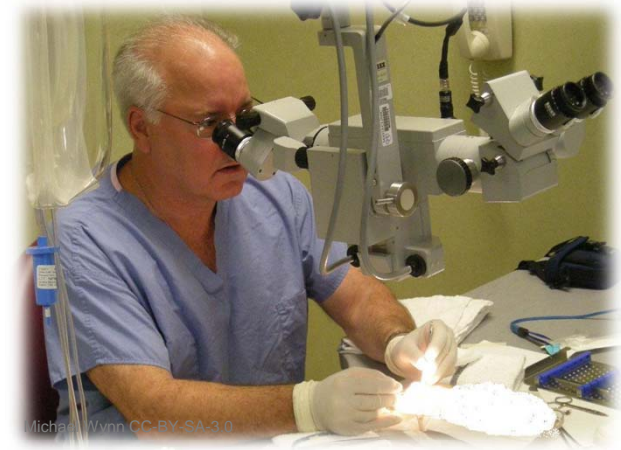
Why is light interesting?

- **Information transfer:** Most of the internet is optical fibers carrying information as light
- **Sensing:** Light for collecting information about the world, including machine vision
- **Energy:** Sunlight powers our ecosystem, soon our houses, and keeps earth from freezing over. Lasers cut and burn.



Why is light interesting?

- **Medicine:** Light can look inside organs and cells to diagnose diseases. In some cases, light is also the cure.
- **Philosophy:** Light is subject of our most successful theory of nature, and yet we wonder what it is.
- **Aesthetics:** Light can be beautiful in itself, and lets us see the beauty of the world



Evolution of the understanding of light, in brief

- Euclid: Light consists of rays proceeding from the eye to the object seen
- Newton: Light consists of a stream of particles ("corpuscles") coming from the light source
- Huygens, and many others: Light is waves
- Maxwell: Light is an electromagnetic wave
- Planck: Heat radiation can be modelled correctly by assuming that light is made up of discrete quanta
- Einstein: Photons are a real physical phenomenon
- Einstein: Light requires no medium ("aether") to propagate
- ... but still today, the interpretation of quantum mechanics is being debated

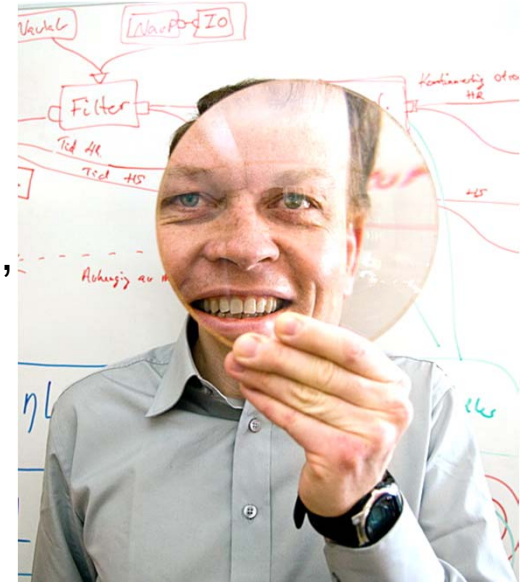
Why establish a course in Optics at UiO?

- A dedicated course in optics has been lacking at UiO for many years
- Optics is an important, interesting and fun part of physics
- Optics is a toolbox subject for many other fields
- The photon is an important carrier of information and energy (Compare to the number of courses on electrons, or bits.)
- Lots of work on optics is going on at Kjeller, at FFI and IFE. Hence,
 - course is funded through UNIK at Kjeller
 - aiming to recruit more students to Kjeller institutions



Who are those lecturers?

- Torbjørn Skauli
 - Siv. ing. in physics from NTH 1990 (presently NTNU), PhD in physics from UiO 1997
 - Scientist at FFI since 1990, also Prof. II at UiO
 - worked with infrared imaging, electronics, spectral imaging, remote sensing



- Stéphane Nicolas
 - Master of Physics from Paris VI 1995, Siv. ing from Institut d'Optique Graduate School 1997 (France)
 - Scientist at FFI since 2002
 - worked with laser propagation through turbulence, adaptive optics, optical design, space optics.



Prerequisites

- Mathematics
 - calculus
 - basic Fourier analysis
 - elementary trigonometry
- Physics of waves in 1D
 - harmonic oscillator, wave equation, phasor notation
 - wave phenomena such as dispersion, coherence, superposition
- Electromagnetism
 - Maxwell's equations
 - electromagnetic waves in 1D
 - Poynting vector
 - derivation of Fresnel's equations
- Quantum mechanics
 - photon energy and momentum
 - photon emission, absorption and scattering
- **Don't panic, we will recap at the beginning**