Interdisciplinary Physics

- Atmospheric and Environmental Physics

  Prof. Patrick Esby
- Laser Physics

  Prof. Irina T. Sorokina
- Soft and Complex Matter

  Profs: Jon Otto Fossum

  Steinar Raaen

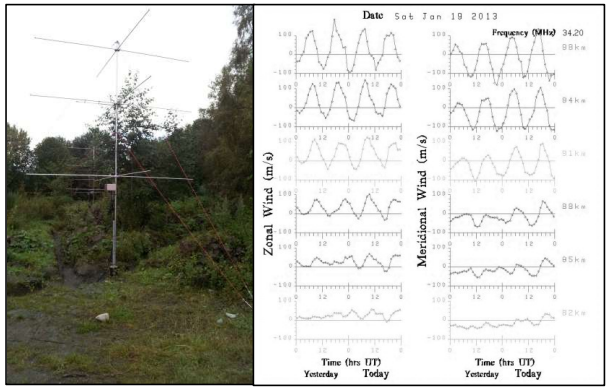
  Paul Dommersnes

We are physicists!
Collaboration with other fields, applications in other fields.

Atmospheric and Environmental Physics group

- Projects to improve numerical weather prediction and climate models using remote sensing instrumentation and data:
  - Ground based instrumentation
    - Advanced meteor-wind radar at Trondheim
    - Airglow imaging and spectroscopy at Trondheim
    - mm-wave radiometer for atmospheric composition in Antarctica
    - EISCAT
  - Space borne instrumentation
    - Sounding of Atmosphere using Broadband Emission Radiometry (SABER) on NASA-TIMED
    - NASA Aeronomy of Ice in the Mesosphere (AIM) satellite
    - Swedish Mesosphere Airglow and Transient Signatures (MATS) satellite

NTNU Atmospheric Observations

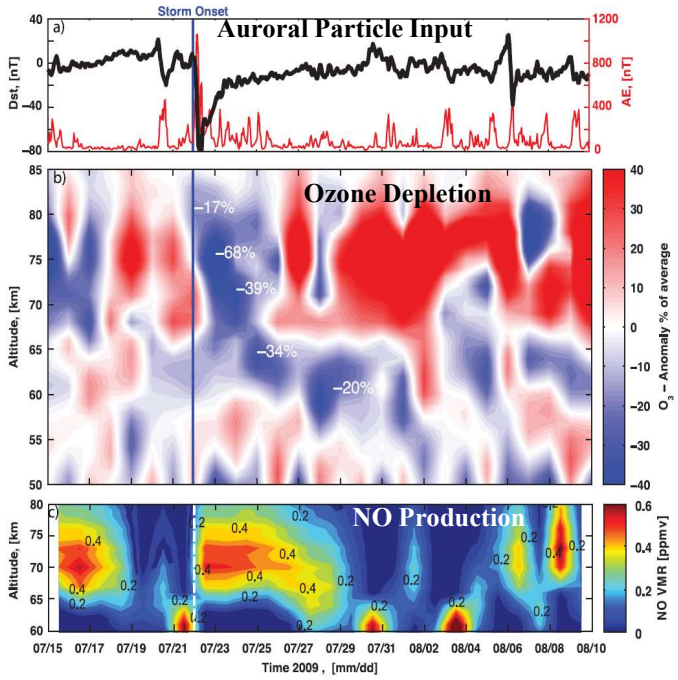


Momentum-flux meteor radar

Winds, Temperatures and momentum from 70 to 110 km

All-sky airglow imager

Small-scale gravity wave forcing of winds and temperatures at 87-95 km



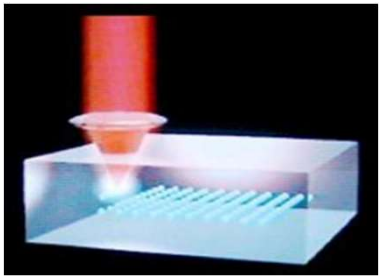
NTNU-BAS Ozone & Nitric Oxide Radiometer

Ozone destruction from 30 to 85 km by catalytic chemicals produced in aurora over Troll Research Station, Antarctica

EISCAT ionospheric radar

NTNU part of the Birkeland Centre for Space Science SFF

The Laser Physics group works in the three main directions:



- *Ultrafast mid-infrared solid-state laser technology*
- *Novel all-fiber pulsed laser systems*
- *Applications in fundamental science, NFR project UNLOCK*

together with CERN and leading University groups in Austria, Germany, France, and USA (Stanford and Caltech)

- *Industrial applications: applications es to high-resolution spectroscopy, trace gas and remote-sensing, breath analysis, LIDAR, ranging and imaging, semiconductor material processing (e.g. Si for solar cells).*

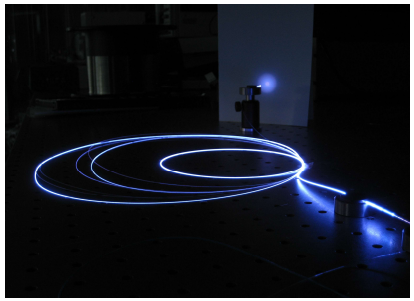
together with Norwegian and European industry, NTNU spin-off ATLA Lasers AS

in frames of the European ERA-NET projects MARTEC MLR, NANOMAT or ENERGIX NFR programs

High-end clean room laser labs and a optical fiber drawing tower in K1 building

A state-of-the-art Specialty fiber drawing tower

Can draw silica, plastic, other tissue friendly fibers, dispersion compensation fibers, delivery fibers



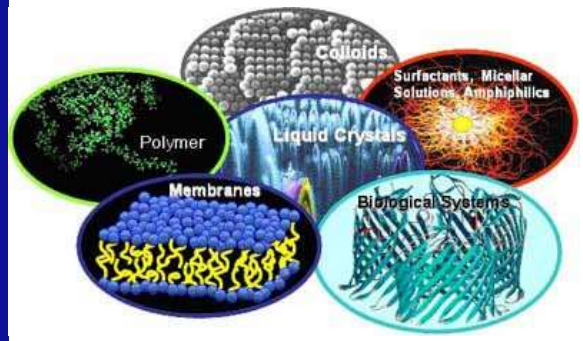
Upcoming master thesises – please, contact Irina.Sorokina@ntnu.no
Example: Positronium Laser Cooling – collaboration w/UiO & CERN

Soft and Complex Matter

https://www.softcomlab.com/

Colloidal self-assembly /natural materials

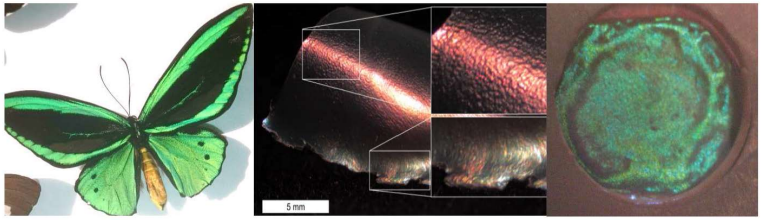
- Soft composite materials: clays and cellulose
- Self-assembly of colloids and nanoparticles in fluids
- Complex fluids: rheology, microcapsules, structural colors



http://soft-matter.seas.harvard.edu/

Liquid crystal

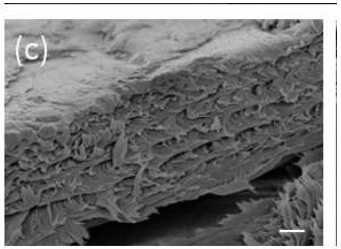
Colloidal Droplets (Emulsion)

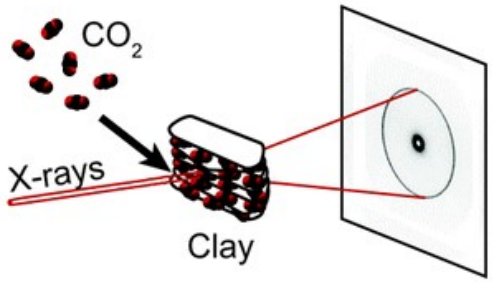


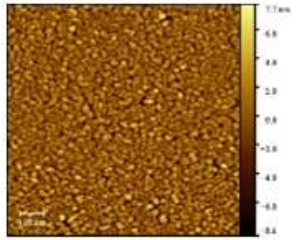
Structural color with clay (NTNU)

Surfaces and molecular adsorption

- X-ray scattering from nano-layered materials (clays)
- Hetero structures: clay-graphene stacks
- Experiment in ultra-high vacuum environment
- New materials for applications like storage (CO_2) or environmental remediation.







Ni nanoparticles on a muscovite mica substrate

Experiment in an ultra-high-vacuum environment

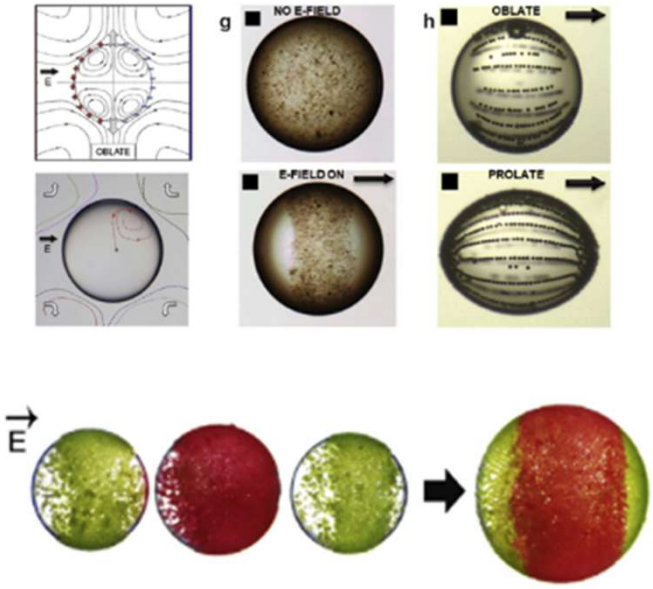
(Fossum, Raaen, Knaapila, Dommersnes)

Animate Soft Matter

https://www.softcomlab.com/

Dynamic self-assembly

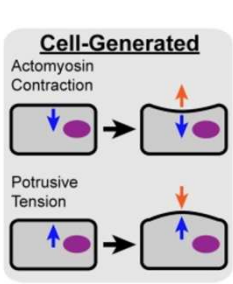
- Use external electric or magnetic fields
- Out of equilibrium self-assembly
- New materials with designed electric/magnetic properties, capsules technology, responsive materials

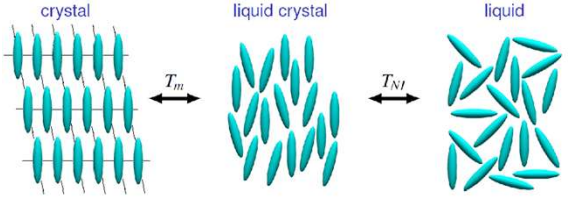


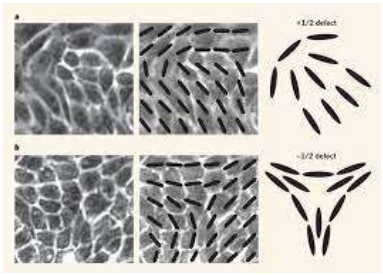
Experiments & Theory (Fossum, Dommersnes)

Active Soft Matter

- Particles (cells, animals..) generate their own force
- Collective dynamics, geometry, topology,…







Topological defects

Theory & Simulations (Dommersnes)

Interdisciplinary Physics:contacts

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