NORDITA

Nordita Open Doors

Astrophysics

Lars Mattsson

Group members

- Faculty:
  - Axel Brandenburg (prof., group leader)
  - Katherine Freese (affiliate professor)
  - Bengt Gustafsson (affiliate professor)
  - Christopher Pethick (prof. emeritus)
  - Fred Gent (researcher)
  - Lars Mattsson (assistant professor)
  - Alexandra Veledina (assistant professor)
  - Beatriz Villarroel (assistant professor)

- Postdocs and fellows:
  - Kyrylo Bondarenko
  - Vikash Pandey

- Students:
  - Yutong He (PhD)
  - Patrik Tengnér (Master)

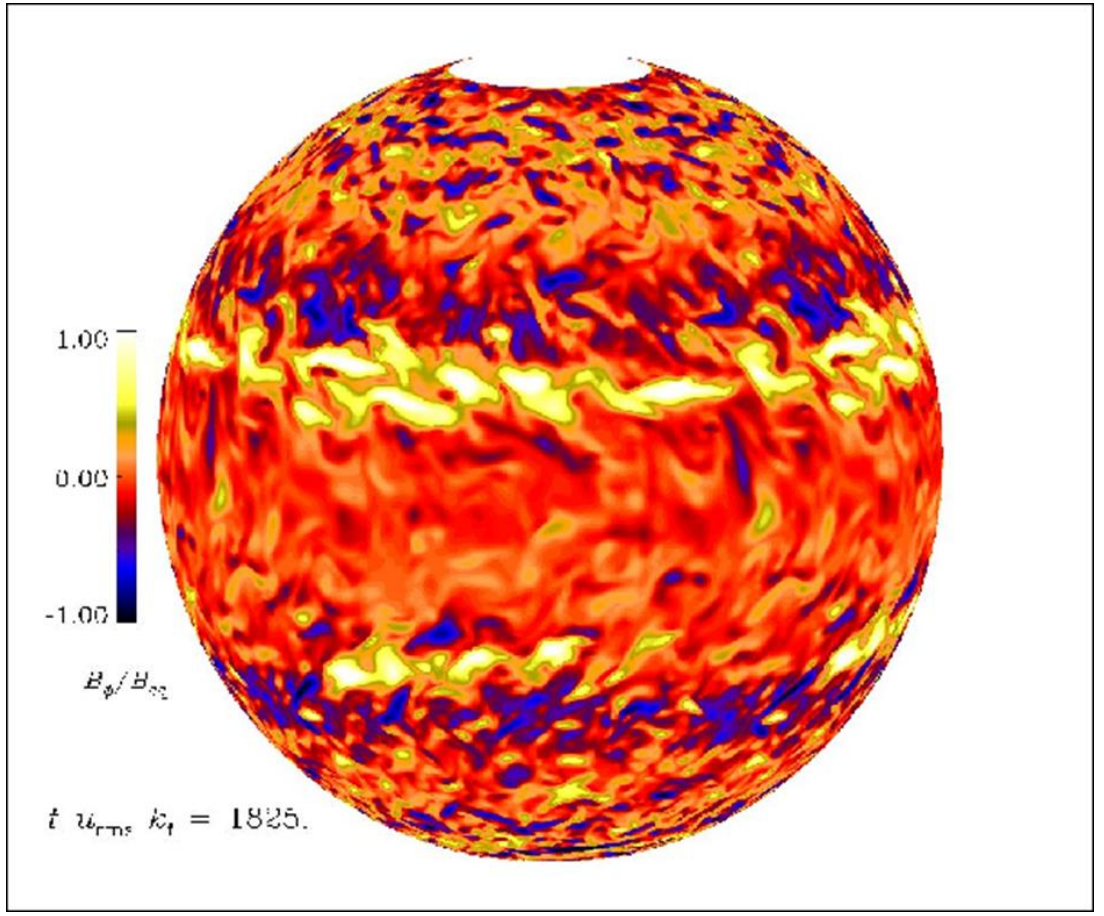
- Visitors and guest researchers:
  - Nils E. Haugen
  - Michael Liberman
  - Alexandre Petrov
  - Igor Rogachevskii

Research in Astrophysics @ Nordita

- Astrophysical fluid dynamics and magneto-hydrodynamics:
  - Forced and decaying MHD turbulence; dynamo theory
  - Cosmic dust and particles in flows; theories of turbulent clustering
  - Supernova-blast waves and supernova-driven turbulence
- Early universe and Relic Gravitational Waves:
  - Chiral MHD
  - Simulations of magnetogenesis and gravitational waves
  - Graviton-photon conversion due to magnetic fields
- Astrobiology, SETI and related research:
  - VASCO project and it's "derivatives"
  - UAPs in an astronomical context
- Other:
  - X-Ray Binaries
  - Compact objects

MHD turbulence and dynamos

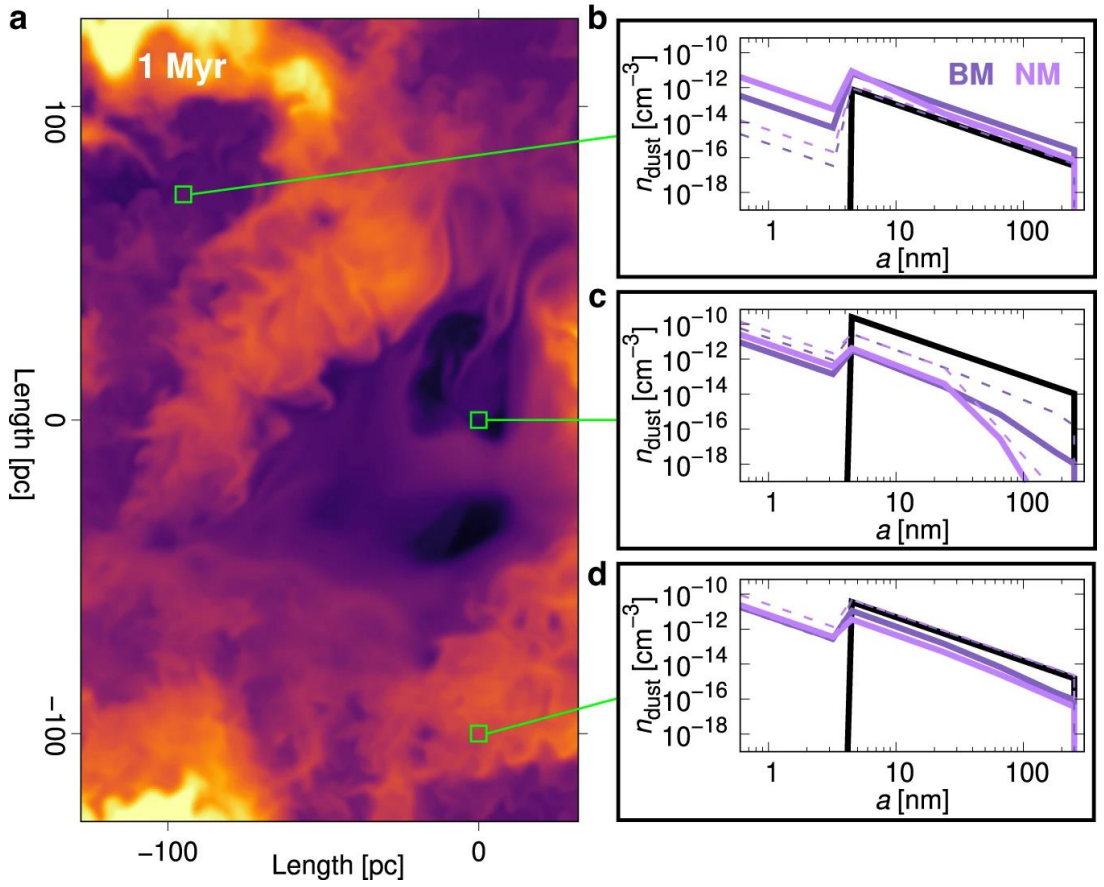
- Magnetic fields in stars, planets accretion discs and galaxies are the results of dynamo processes.
- Particular focus on the solar dynamo.
- Convection and turbulence.
- Simulations with the Pencil Code.



PI: Axel Brandenburg

Supernovae and processing of cosmic dust

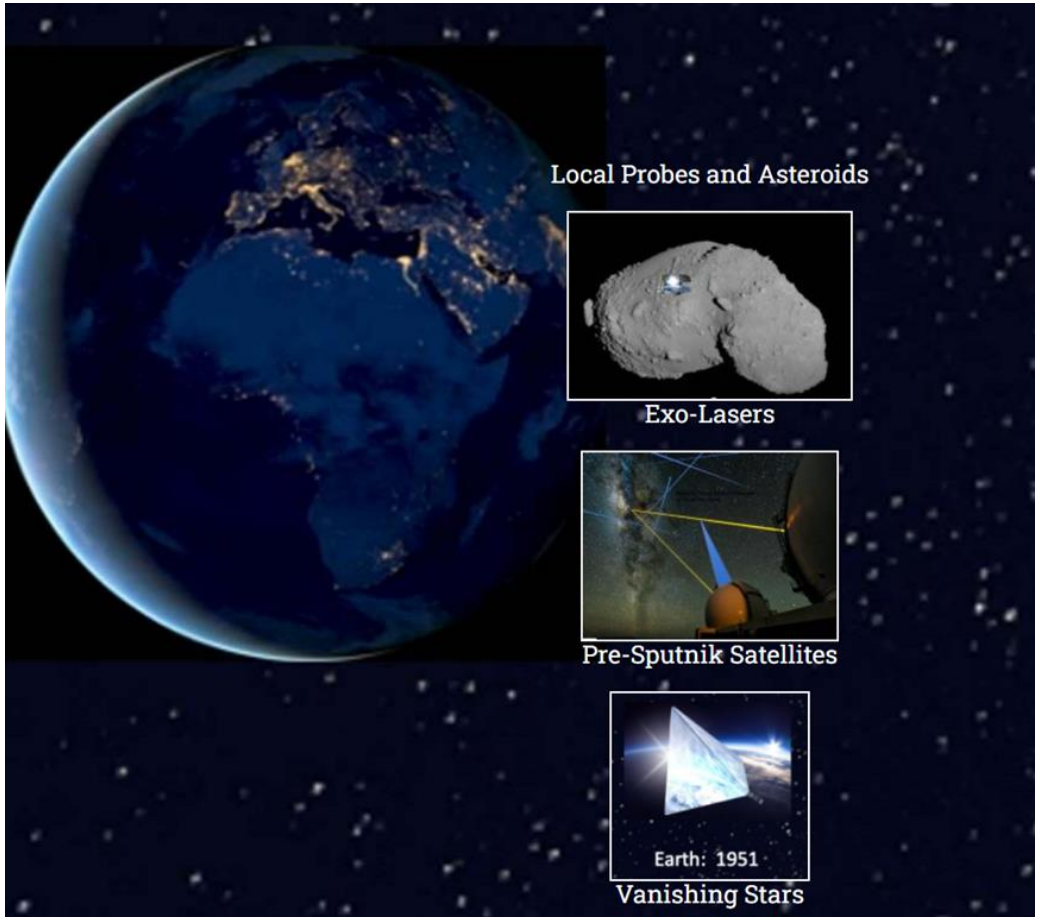
- SN blast waves may drive the turbulence of the ISM creating a highly inhomogeneous ISM.
- SN blast waves may also induce significant dust processing.
- Destruction of dust depends complicated physics where magnetic fields have been shown to be very important.



PI: Lars Mattsson

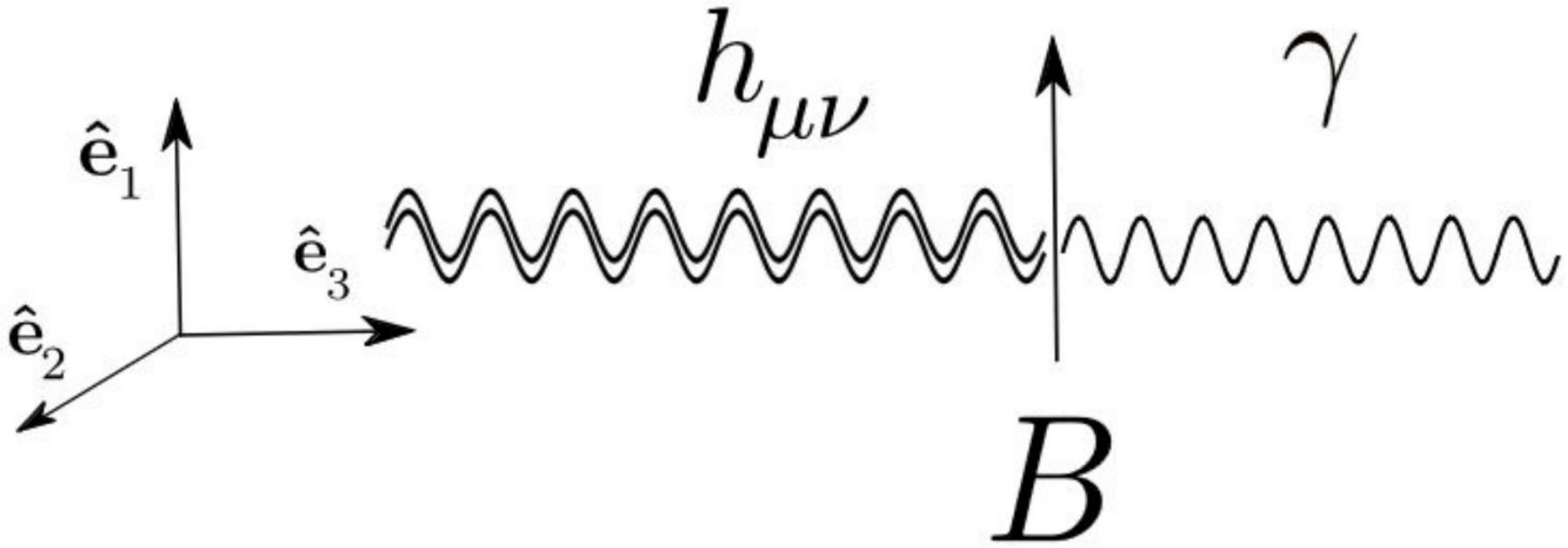
VASCO project and beyond

- So far, we have found not a single failed supernova or Dyson sphere candidate, setting the detection rate to less than 1 in 600 million during 70 years.
- All VASCO transients are used to search for interstellar communication lasers.
- Glints that can occur from satellites, detectable in telescope photographs taken before 1959.

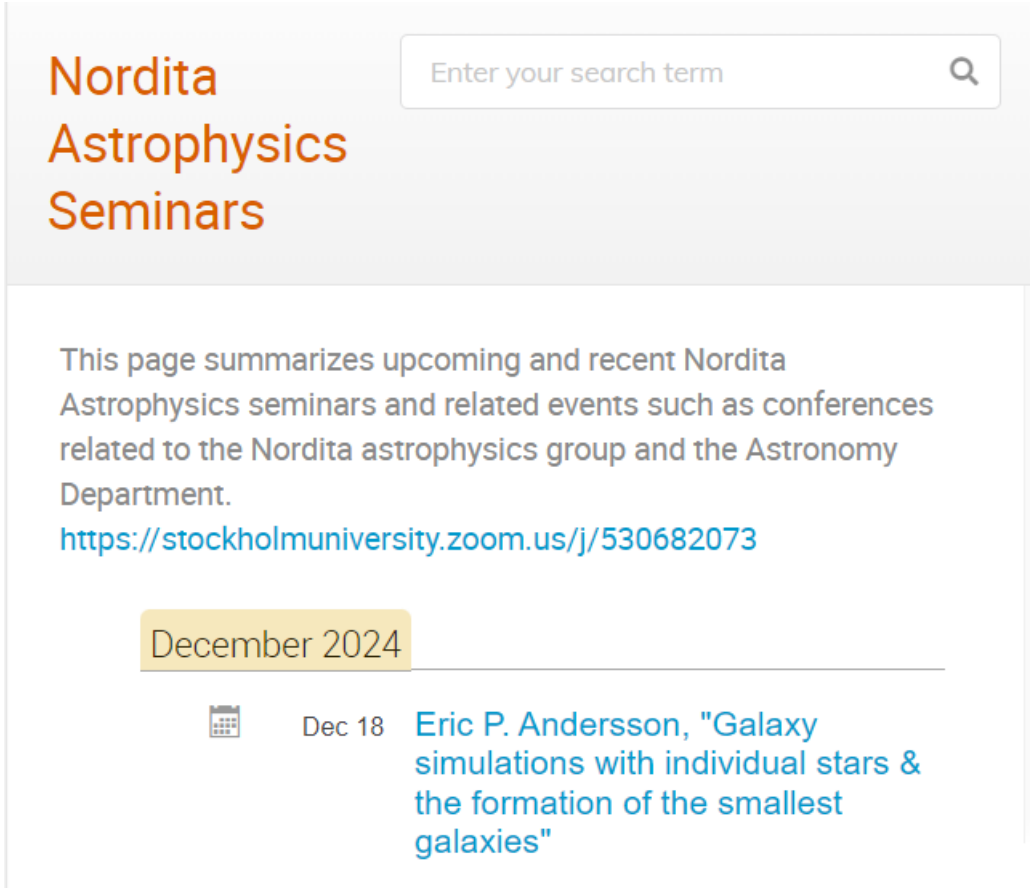


PI: Beatriz Villarroel

Graviton-photon conversion due to B-fields



Seminars and programmes



Student projects

- Master projects:
  - Most of the research topics mentioned previously.
  - Mainly computational physics.
  - Contact me, Axel or Fred for further information.
  - Students can be enrolled at SU and KTH, may also be visitors enrolled at any other university.
- Bachelor projects:
  - Crater formation theory
  - Shock-wave theory
  - High-density plasmas
  - Not so much focus on computation!