Brookhaven National Laboratory

U.S. DEPARTMENT OF ENERGY

Welcome to BNL Physics Department Summer Lectures

Hong Ma

Chair, Physics Department

Brookhaven National Lab

June 8, 2026

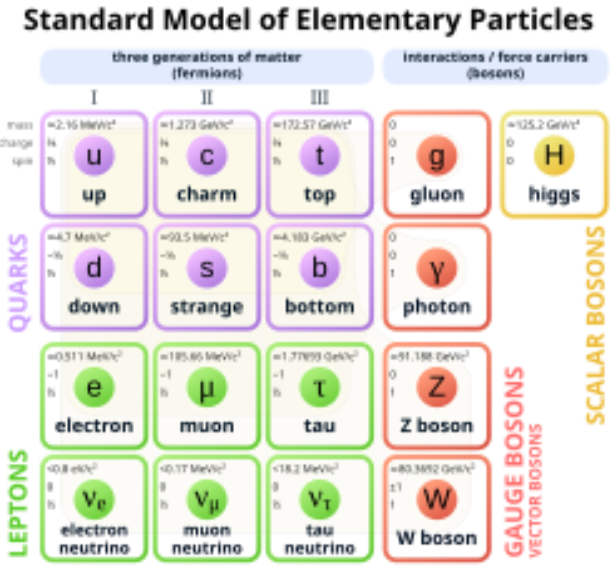
@BrookhavenLab

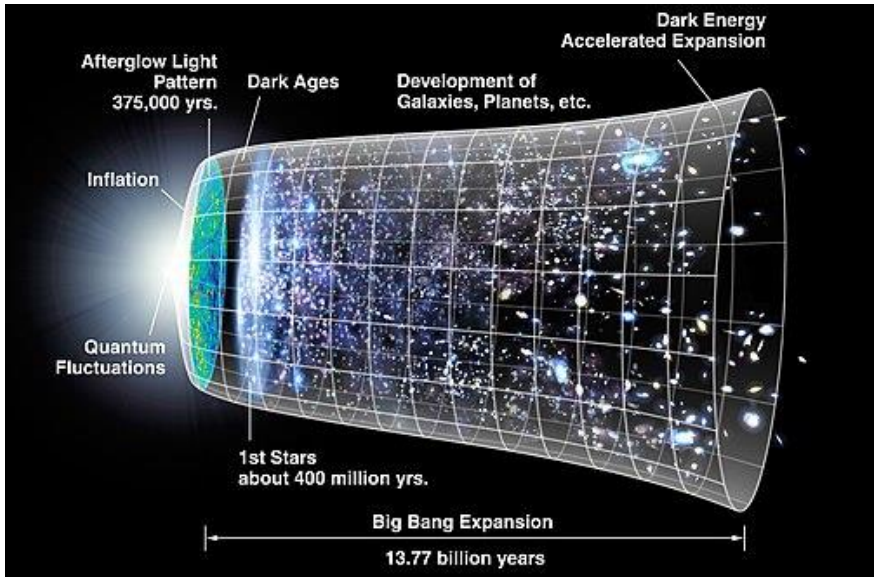
Nuclear and Particle Physics at BNL

https://www.bnl.gov/npp/

Exploring the building blocks of matter and the nature of space and time

Vibrant programs in experimental and theoretical research in nuclear and high-energy physics, accelerator design, and isotope production. Full mission statement





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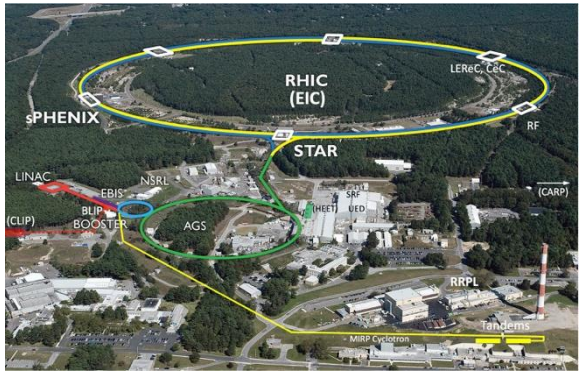
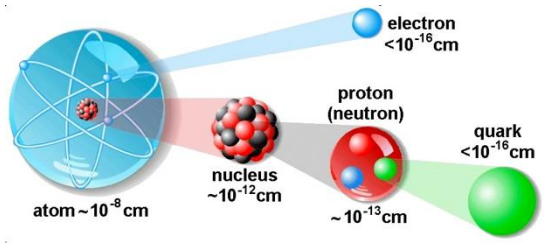
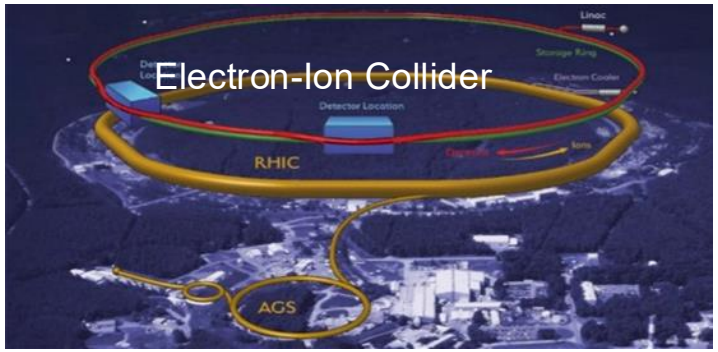
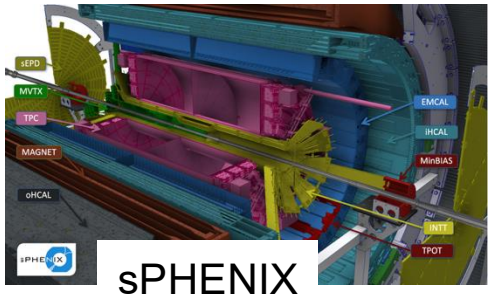
Frontier Science Programs in nuclear and particle physics, for decades to come.

To understand sub-atomic world deeper and deeper

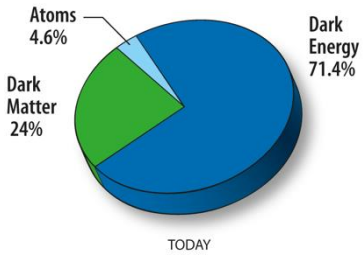


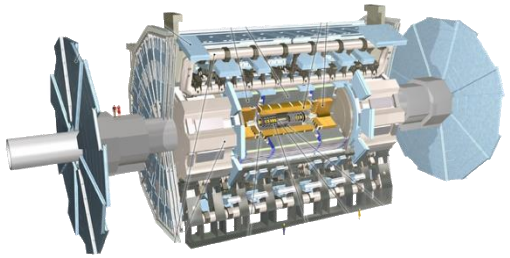




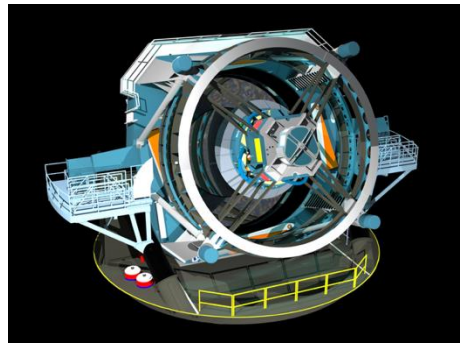


sPHENIX

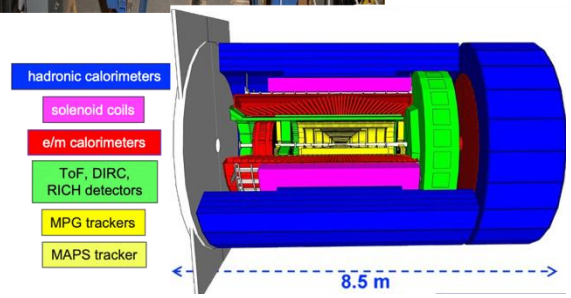




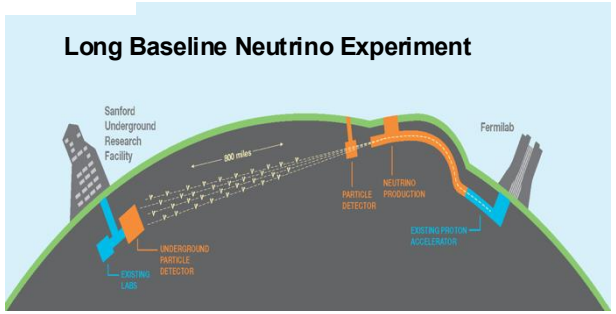
ATLAS @ LHC



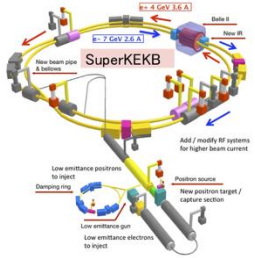
Rubin Observatory

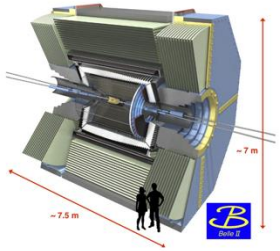


ePIC

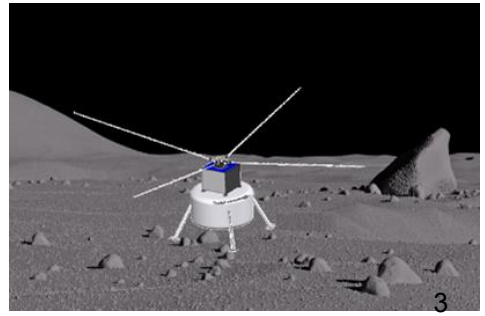


DUNE at FNAL





Belle II at SuperKEKB



LuSEE-Night mission

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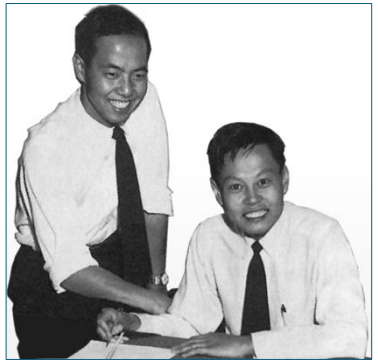
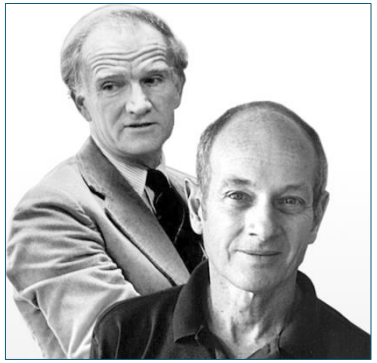
High-energy and Nuclear Theory groups; Software group
RIKEN-BNL Research Center (RBRC); Center for Frontiers in Nuclear Science (CFNS)

Nobel Prizes in Physics for discoveries at BNL

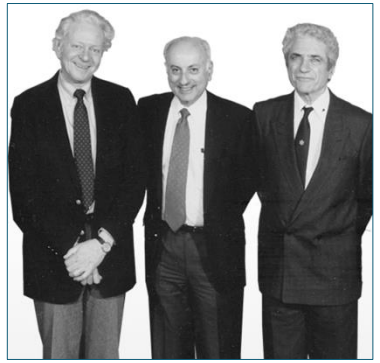


1957 Physics: Lee (Columbia) and Yang (BNL) for parity violation

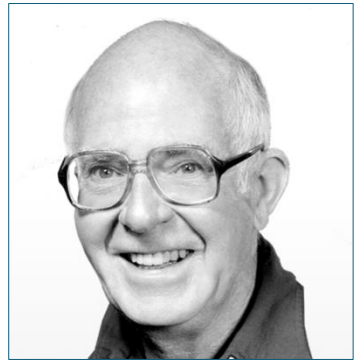
1976 Physics: Ting (MIT) for discovery of the J/Ψ particle



1980 Physics: Cronin and Fitch(Princeton) for CP Violation



1988 Physics: Lederman, Schwartz, Steinberger (Columbia) for discovery of the muon-neutrino



2002 Physics: Davis (BNL) for detection of solar neutrino and its deficit

Completing the RHIC Mission

A Smashing Success: Relativistic Heavy Ion Collider Wraps up Final Collisions

Milestone caps a quarter century of groundbreaking discoveries — with more to come from final run's largest-ever dataset — plus technological advances in accelerators, detectors, and computing

February 6, 2026

RHIC Completed its operation 2000-2026

- Study of the properties of Quark Gluon Plasma and its phase transition
- Understanding of the origin of proton spin

Major Accomplishments:

- Discovery of the strongly coupled quark-gluon plasma
- Jet quenching and parton energy loss
- Gluon's contributions to proton spin
- Mapping the QCD phase diagram
- Initial-state gluon physics and cold nuclear matter
- Heavy-flavor probes of QCD matter

More data to analyze, especially with sPHENIX

- Precision determination of QGP properties
- Definitive exploitation of Beam Energy Scan II
- Baseline measurements for the EIC
- AI/ML and archival reanalysis

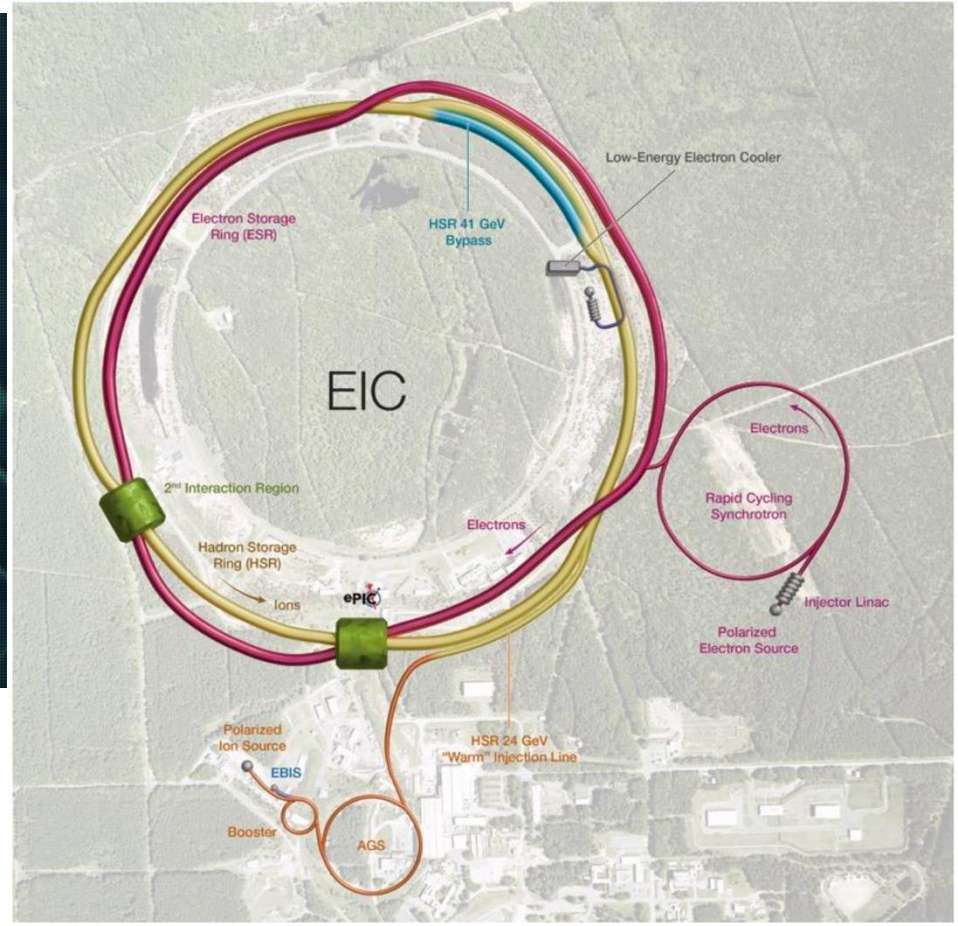
Completing the RHIC Science Program remains a priority

https://www.bnl.gov/eic/

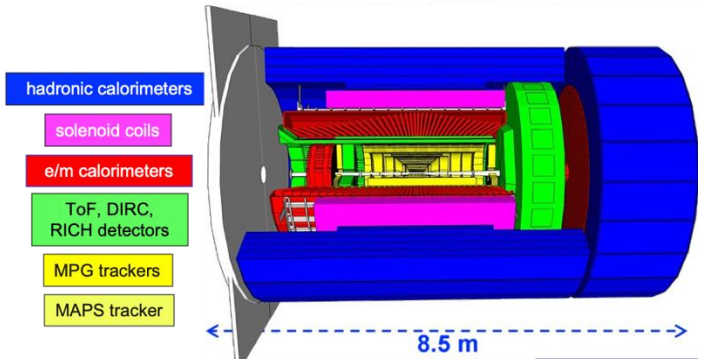
The Electron-Ion Collider

A machine that will unlock the secrets of the strongest force in Nature

- Discovery machine will allow scientists to look inside protons and neutrons and unlock mysteries of the strong force that binds nature's building blocks: quarks and gluons
- Research and development for the EIC will lead to advanced technology and useful applications
- The EIC is being built through a partnership with DOE, Brookhaven, and Thomas Jefferson National Accelerator Facility with additional support from New York State
- The EIC also benefits from participation among international collaborators



- How does the **mass** of the nucleon arise?
- How does the **spin** of the nucleon arise?
- What are the emergent properties of dense systems of gluons?



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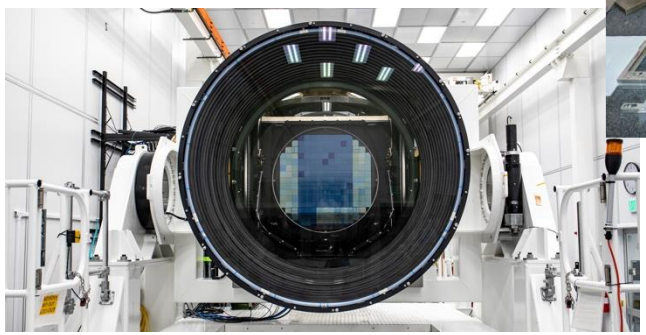
ePIC

High Energy Physics Program in Physics Department

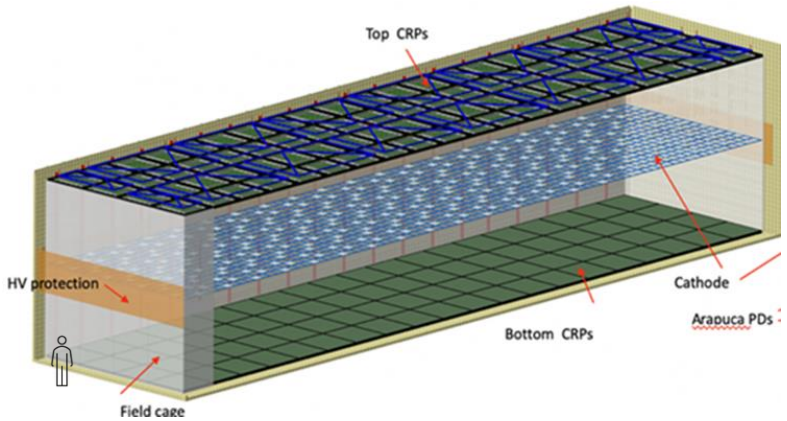
- **Energy Frontier**
  - BNL is the US Host lab for ATLAS at CERN
  - Completing Run 3 operations in June, 500 papers on Run 2
  - Leading US contributions to HL-LHC ATLAS upgrade
- **Intensity Frontier**
  - Short-Baseline Neutrino Program in operation
  - Major contributions to DUNE experiment in construction
  - US host lab for Belle II at KEK in Japan, CP violation in B
- **Cosmic Frontier**
  - Getting ready to analyze Rubin Observatory data
  - Building LuSEE-Night mission to the far side of the moon
- **Leading Technologies Developments for Particle Physics**
  - Computing and software
  - Detectors and electronics
  - AI/ML and Quantum Information Science
- **Actively participating in developing long term future**
  - Higgs Factory, DUNE Phase 2 upgrade, Muon collider

ATLAS silicon assembly at BNL

LSST Camera



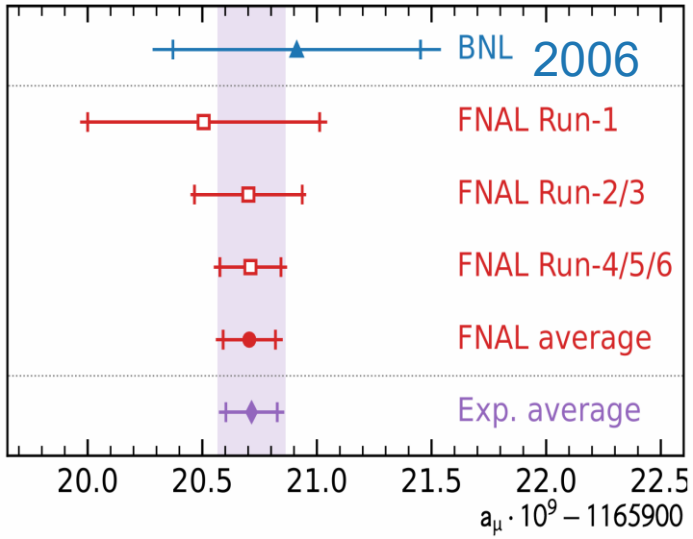
DUNE Vertical Drift Module design



Muon g-2 Experiment Pioneers Win Breakthrough Prize in Fundamental Physics

Recognition honors experiments and scientific collaborations at three institutions that explored the subtle wobble of a subatomic particle

April 18, 2026



2025

A precise measurement of muon anomalous magnetic moment to a precision of 127 parts per billion

2026 Breakthrough Prize in Fundamental Physics
CERN, **Brookhaven National Laboratory**, **Fermilab**

Brookhaven National Laboratory

Interesting lectures this summer

Mon, June 8

1:15 PM → 1:30 PM **Welcome Remarks** — 15m — Large Seminar Room and Zoom
Hosted by: Rachid Nouicer
Speaker: Hong Ma (BNL)

1:30 PM → 2:30 PM **Introduction to QCD and spin physics** — 1h — Large Seminar Room and Zoom
Hosted by: Peter Petreczky
Speaker: Yoshitaka Hatta (BNL)

Mon, June 15

1:15 PM → 2:15 PM **The Electron Ion Collider - the next QCD frontier : Understanding the Glue That Binds Us All** — 1h — Large Seminar Room and ...
Hosted by: Rachid Nouicer
Speaker: Prof. Abhay Deshpande (Stony Brook University & BNL)

Mon, June 22

1:15 PM → 2:15 PM **Particle Accelerators: What are they, how do they work and why are they important to us?** — 1h — Large Seminar Room and ...
Hosted by: Rachid Nouicer
Speaker: Wolfram Fischer (BNL)

Mon, June 29

1:15 PM → 2:15 PM **The Standard Model and Beyond** — 1h — Large Seminar Room and Zoom
Hosted by: Robert Szafron
Speaker: Sally Dawson (BNL)

Mon, July 6

1:15 PM → 2:15 PM **What is the Higgs boson and how was it discovered at the Large Hadron Collider (LHC)?** — 1h — Large Seminar Room and Z...
Hosted by: Chris Rasmussen
Speaker: Elizabeth Brost (Brookhaven National Laboratory)

Mon, July 13

1:15 PM → 2:15 PM **Re-Engineering the Big Bang: The Physics of Heavy Ion Collisions** — 1h — Large Seminar Room and Zoom
Hosted by: Rachid Nouicer
Speaker: James Dunlop (Brookhaven National Laboratory)

Mon, July 20

1:15 PM → 2:15 PM **Neutrinos: How to Catch a Ghost Particle** — 1h — Large Seminar Room and Zoom
Hosted by: Vladimir Tishchenko
Speaker: Jay Hyun Jo (Brookhaven National Laboratory)

Mon, July 27

12:00 PM → 1:00 PM **Pizza Party** — 1h — Small Seminar Room & North ...

1:15 PM → 2:15 PM **Introduction to AI in Physics** — 1h — Large Seminar Room and Zoom
Hosted by: Rachid Nouicer
Confirmed
Speaker: Yeonju Go (Brookhaven National Laboratory)

Thu, July 30

1:30 PM → 2:30 PM **Sambamurti Lecture** — 1h — Large Seminar Room and zoom
Hosted by: Peter Steinberg
Speaker: Blair Seidlitz (Columbia University)

Training the next generation scientists

Summer internship provides great opportunities for students to gain experience in working in a research lab and in large facilities

Summer lecture series introduces the latest research in nuclear and particle physics being pursued at Brookhaven Lab at a level appropriate for advanced undergraduate STEM students and beginning graduate students.

Enjoy the summer at BNL!

Many thanks to the lecture committee:
Rachid Nouicer (Chair), Peter Petreczky, Chris Rasmussen, Robert Szafron, Vladimir Tishchenko
and all the lecturers!