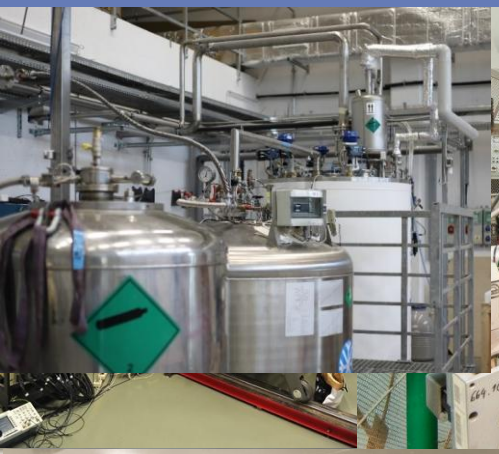
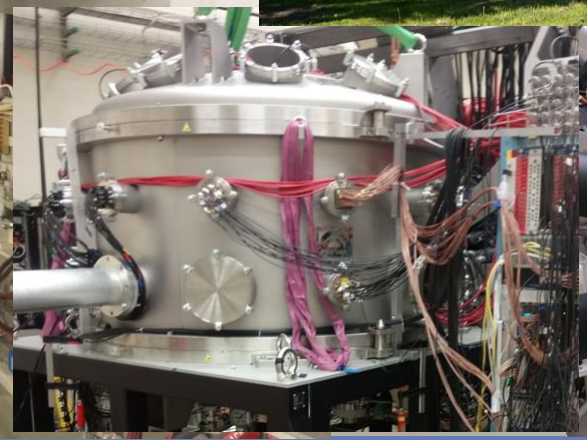
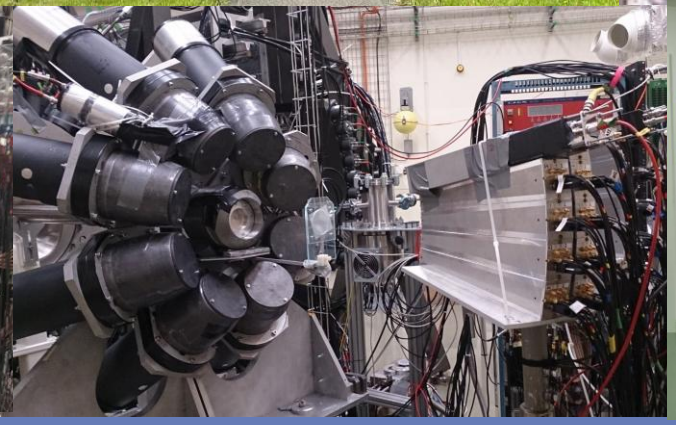
The Henryk Niewodniczański Institute of Nuclear Physics Polish Academy of Sciences (IFJ PAN)

basic information

Bogdan Fornal

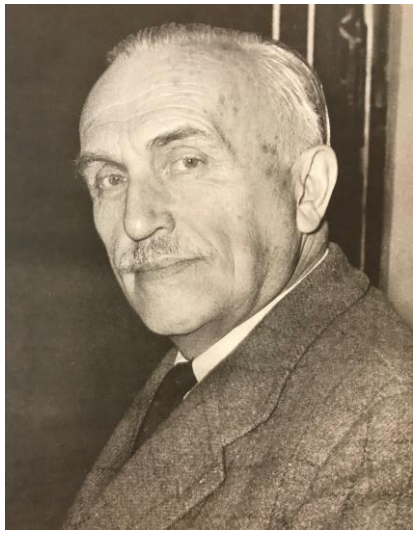


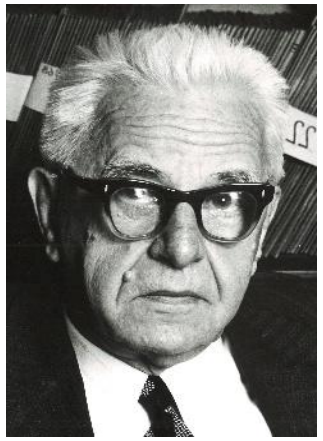

Genesis and History

1955 – founding of IFJ as the institute where the first cyclotron in Poland was located.

1960 – IFJ becomes an autonomous institution



Prof. Henryk Niewodniczański (1900-1968)



Prof. Marian Mięsowicz (1907-1992)

1970 – Particle physics joins

1988 – The IFJ is named after its founder – Prof. Henryk Niewodniczański

2003 – IFJ receives the status of a research institute of the Polish Academy of Sciences - **IFJ PAN**

2025 – 70 years of IFJ PAN

General Information

- ✓ **Personnel: 561:**
  - **Prof. 34**
  - **Assoc. Prof. 59**
  - **Ass. Prof. + Postdocs 94**
  - **engineers 117**

- ✓ **Status:**

highest category among research institutions in Poland A+

Instytut kategorii A+

EU distinction of "HR Excellence in Research"

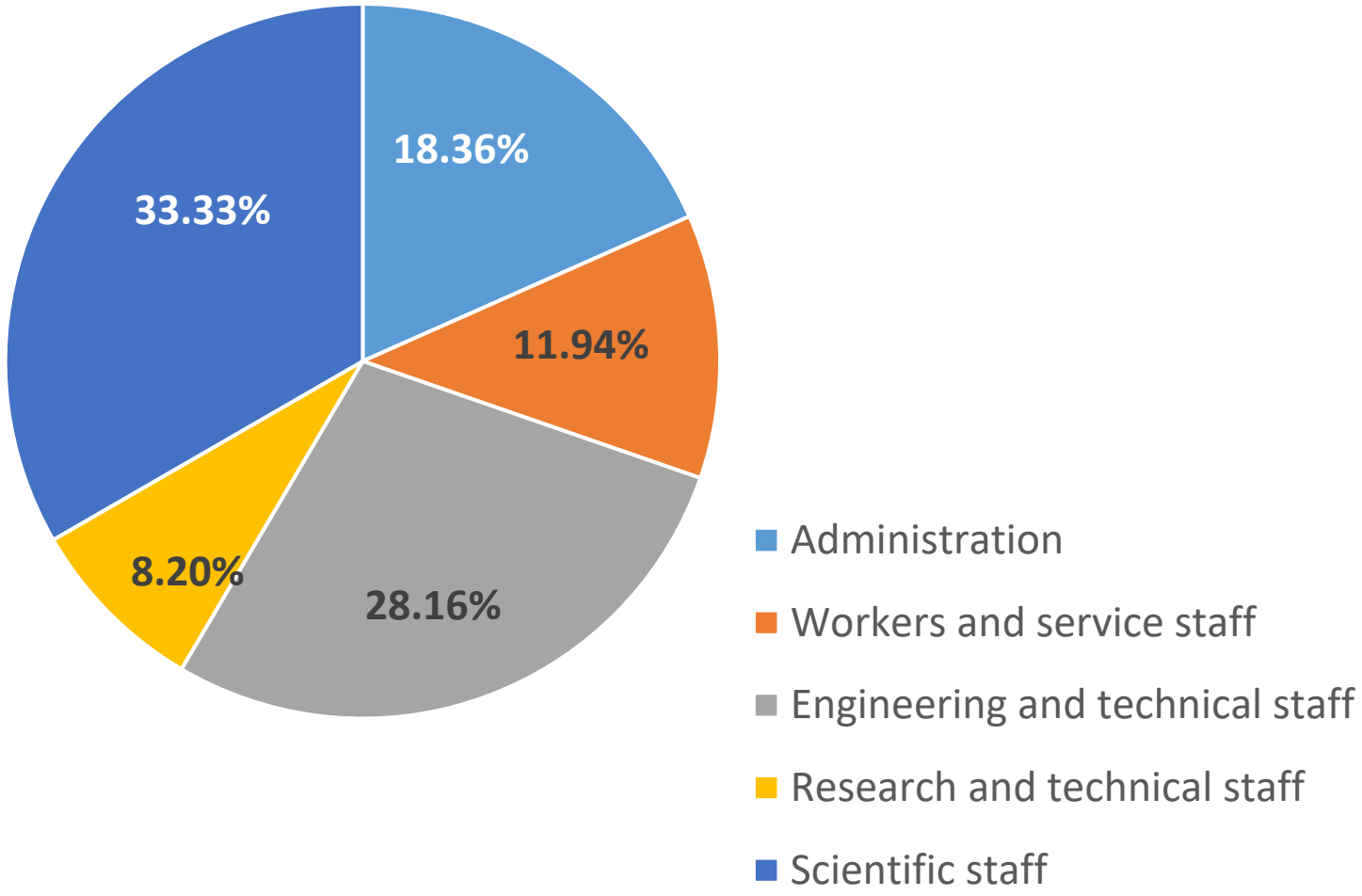
HR EXCELLENCE IN RESEARCH

World University Rankings 2023
Discover the world's top 2000 universities

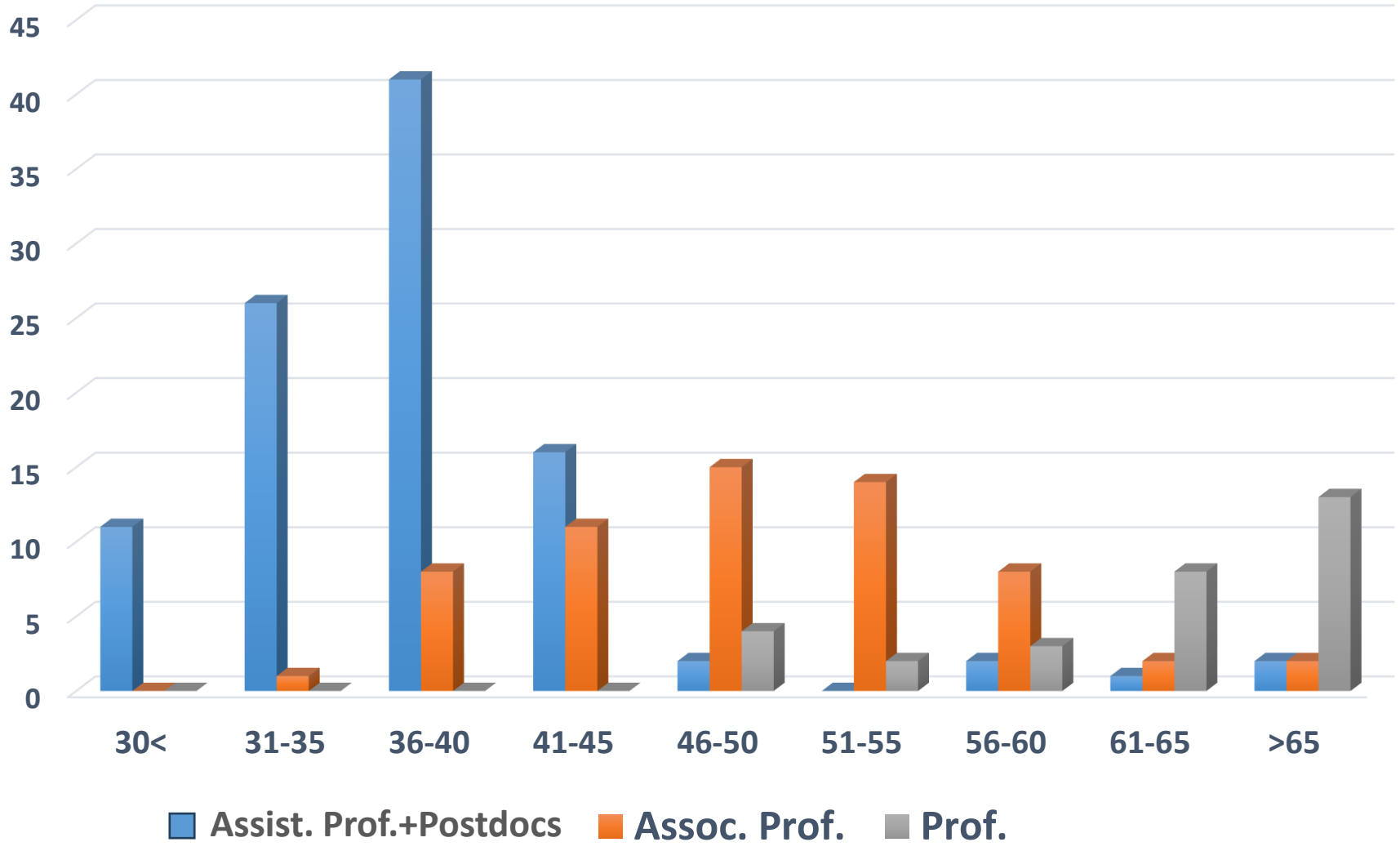
CWUR

Rank 775 (Top 3.7%)

Employment structure

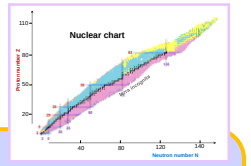


Age Profile of the Research Staff

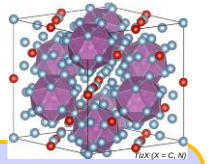


Organizational structure

Division of Particle and Astroparticle Physics

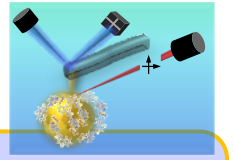


Division of Nuclear Physics and Strong Interactions



Division of Condensed Matter Physics

Division of Theoretical Physics



Division of Interdisciplinary Research

Division of Applications of Physics

Cyclotron Center Bronowice

Division of Scientific Equipment and Infrastructure Construction

4 Accredited Laboratories

Krakow School of Interdisciplinary PhD Studies

Staff: 56 + PhD students **21**

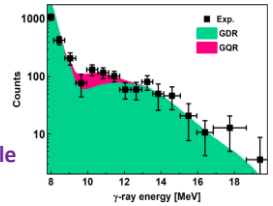
Major research topics:

- **The ATLAS experiment at LHC CERN**
- **The LHCb experiment at LHC CERN**
- **The Belle II experiment (KEK, Tsukuba, Japan)**
- **Cosmic Ray Research (PierreAuger, CREDO)**
- **Neutrino studies (T2K, P-ONE)**
- **High energy Gamma-Ray Astrophysics (HESS, HAWC, CTA)**
- **Involvement in other projects**
  - MUonE experiment at CERN
  - ATHENA experiment at future EIC
  - Physics feasibility studies for FCC
  - development of “Clould Computing” and GRID computing infrastructures

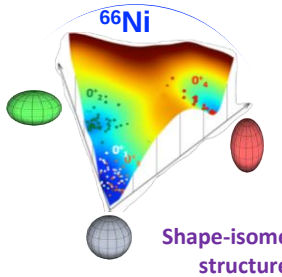
Staff: 38 + PhD Students 6

Major research areas:

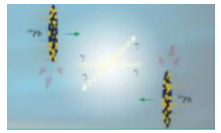
- Nuclear structure studies in function of temperature, spin and isospin **(AGATA, PARIS, EXOGAM, GALILEO…)**
- Nuclear reactions mechanisms and hadron collisions **(BINA, KRATTA, KATANA…)**
- Interactions of relativistic ions at LHC and SPS energies **(ALICE, NA61/SHINE)**
- Theoretical studies of the structure and dynamics of many-body systems - nuclear and hadron physics
- Research and development of new detection techniques for nuclear physics **(PARIS, AGATA, KATANA, KRAB….)**

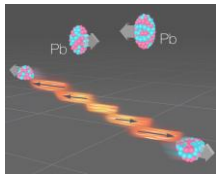


Giant Quadrupole Resonance

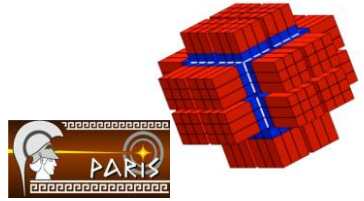


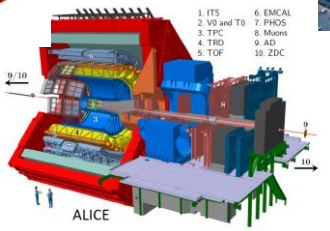
Shape-isomer-like structures


Scattering of light on light

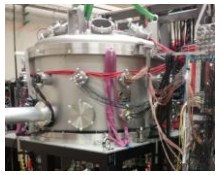


Fire streaks





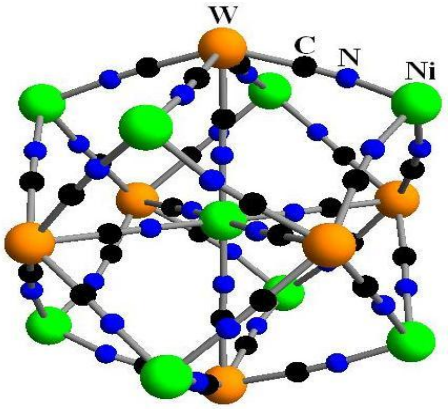
ALICE


scattering chamber at CCB

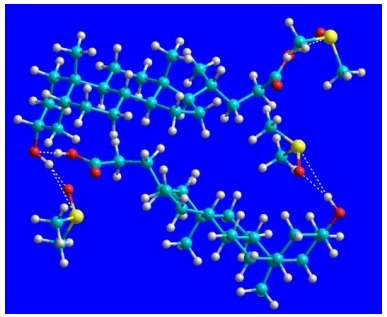
KRAB detector

Staff: 51 + PhD Students 9

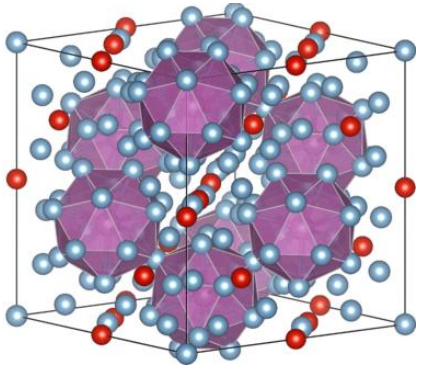
Classical and molecular magnetism



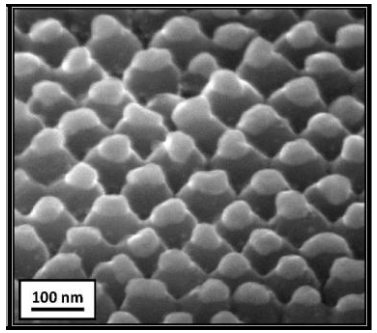
Soft matter



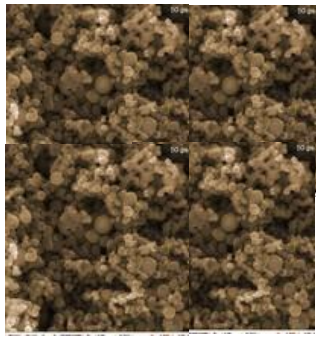
Superconducting materials



Low-dimensional systems

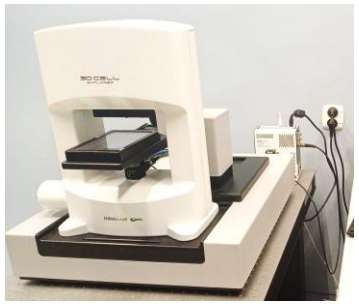


Molecular materials and nanomaterials



Liquid crystals

SQUID Magnetometer



Holotomographic microscope

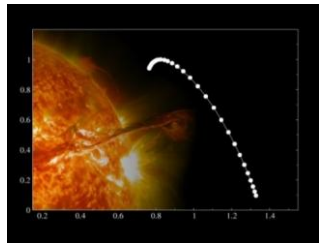
Infrared spectrometer

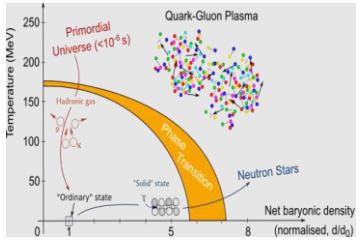
Scanning electron microscope

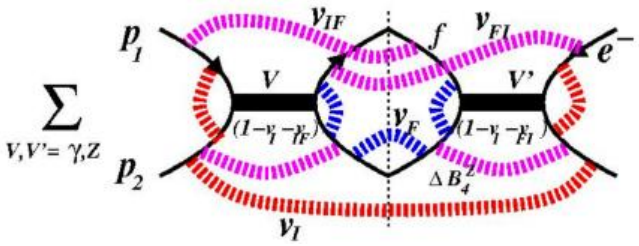
Staff: 19 + PhD Students 7

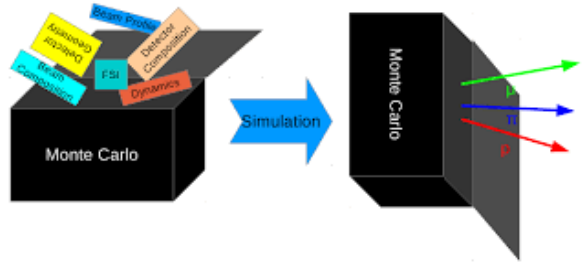
Major research topics:

- theory of structure of matter
- particle theory
- theory of complex systems
- mathematical physics









Staff: 29 + PhD Students 3

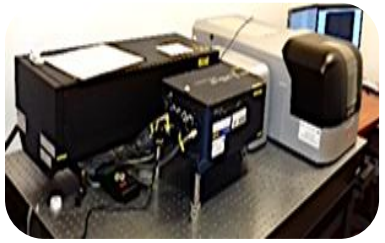
Major research topics:

Characterization of biological structures using vibrational micro- and nanospectroscopy techniques

Studies of biological materials with atomic force microscopy

Investigations using X-ray spectroscopy at free-electron-laser facilities

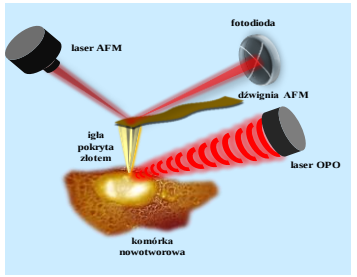
Research employing NMR tomography



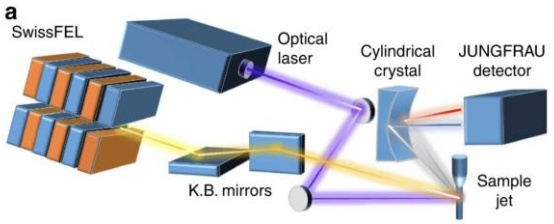
AFM-IR „NanoIR”

Raman Spectrometer

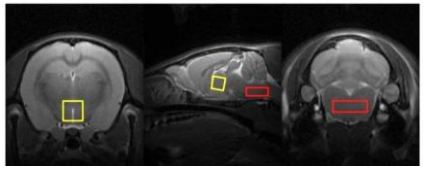
Atomic Force Microscope (AFM)



AFM-IR technique



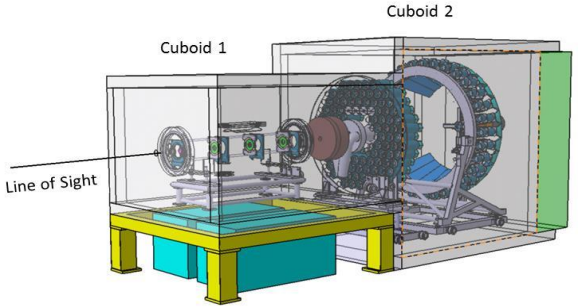
9.4 T MRI system



Staff: 57 + PhD Students 6

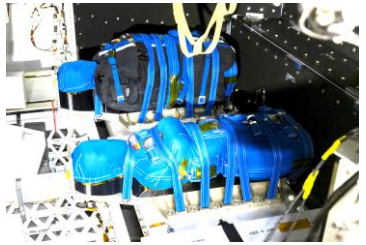
Major research topics:

- neutron and ion diagnostics for tokamaks and stellarators
- medical physics for proton therapy
- space dosimetry, thermo- and optically stimulated luminescence, retrospective dosimetry
- low-level radioactivity measurements in environment: α, β, γ spectroscopy
- mass spectrometry (Arctic, glaciers, etc.)

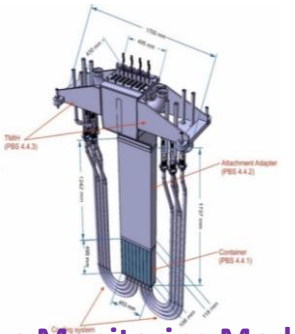


HRNS (High Resolution Neutron Spectrometer) for ITER

Cyclotron AIC-144



Studies of cosmic rays exposition of astronauts (on the Moon's orbit)



Start-up Monitoring Module for IFMIF-DONES

Mass spectrometer ICP-MS/MS

Cyclotron Centre Bronowice (CCB)

Staff: 59 + PhD Students 1

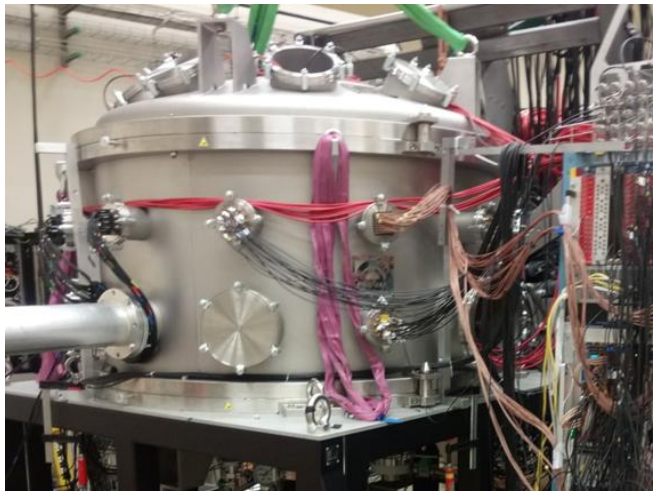
Proton cancer therapy


Scanning gantry

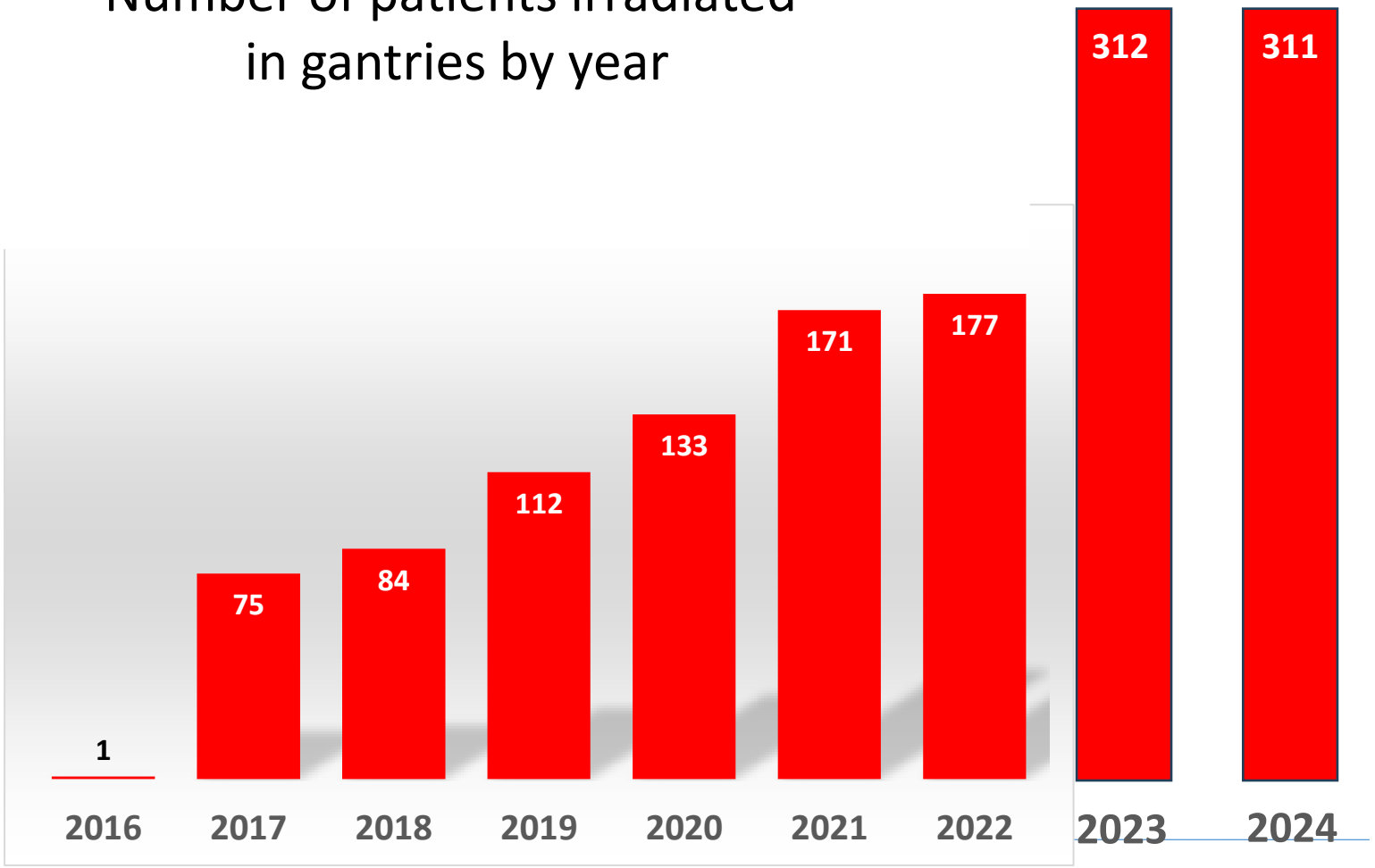

Cyclotron C-230

proton beam
70-230 MeV

Fundamental research
in nuclear physics



Number of patients irradiated in gantries by year



Division of Scientific Equipment and Infrastructure Construction

Staff: specialists/engineers/technicians: **38**

PhD/assoc. prof.: **5**

Constructions of large external research infrastructures
and
advanced plans of local research base
(cryogenics, vacuum, precise mechanics, quality aspects,
test of magnets, RF systems installations and tests,…)

Last decade engagements: 536 FTE (person-years)

Experience example	FTE
E-XFEL – DESY, Hamburg, Niemcy	~165
ITER – Cadarache, France	~15
LHC – Long Shutdown 2	~47
European Spallation Source (ESS) – Lund, Sweden	~130

Present activities

- Tests for ITER
- ESS: SRF and cryogenics support
- Contribution to LHC
- SSD detector for Pierre Auger
- **Local infrastructure: test stand for S.C. wires and magnets**
- Installation of SIS100 (GSI-FAIR)

Accredited Laboratories

Laboratory of Individual and Environmental Dosimetry (LADIS) in 2024

- Measurements of individual and environmental doses by thermoluminescence method
- **250 000** measurements
- **11 000** institutions in Poland and Europe
- **50 000** radiation workers/measurement points under dosimetric supervision
- **620** installations of Roentgen radiography under supervision

Laboratory of Calibration of Radiation Protection Instruments in 2024

- Calibration of up to **1400** survey meters (γ-rays, α, β surface emission)

Accredited Laboratories

Laboratory of Radiometric Expertise in 2024

- **~1000** measurements and expert opinions for external customers (materials, terrains, buildings, soil, water etc, …)

Laboratory of Radioactivity Analyses in in 2024

- Member of the expert network “ALMERA” (Analytical Laboratories for the Measurement of Environmental Radioactivity, IAEA)
- **~60** commercial measurements of concentration of ^{40}K, ^{228}Th, ^{226}Ra, ^{238}, $^{239+240}Pu$, $^{134,137}Cs$, ^{99}Tc, ^{131}I, ….

Krakow School of Interdisciplinary PhD Studies (established in 2019)

KISD
KRAKOWSKA INTERDYSCYPLINARNA SZKOŁA DOKTORSKA

1. The Henryk Niewodniczański Institute of Nuclear Physics PAN
2. Jerzy Haber Institute of Catalysis and Surface Chemistry PAN
3. Jerzy Maj Institute of Pharmacology PAN
4. Mineral and Energy Economy Research Institute PAN
5. Strata Mechanics Research Institute PAN
6. Institute of Metallurgy and Materials Science PAN
7. Faculty of Materials Science and Ceramics AGH
8. Faculty of Physics and Applied Computer Science AGH

At IFJ PAN, the KISD PhD students are involved in research in the following areas:

- Particle physics and astrophysics
- Nuclear physics and strong interactions
- Solid state physics
- Interdisciplinary research:
  - medical physics
  - physics in biological systems,
  - radiation protection,
  - environmental protection,
  - new energy sources.

The whole School: 109 students (29 foreigners)

at IFJ PAN: 48 students (20 foreigners)

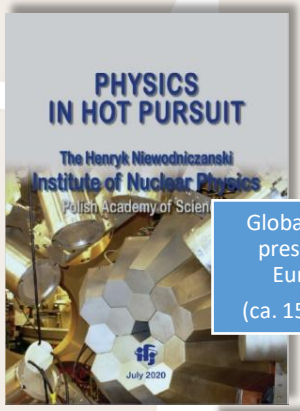
Outreach Activities – Promotion and Education in Science

Małopolska Researchers' Night

"Physics Couch" discussion series

Shows "Fascinating Physics" for children and teenagers

Musical spectacle "At the intersection of two infinities"



Global scientific press service: EurekAlert

(ca. 15 per year)

Festival of Science and Art in Krakow

Scientific Picnic of the Polish Radio and Copernicus Science Centre

Scientific Picnic of the Polish Academy of Sciences

Visits of high school students to laboratories at IFJ PAN

IFJ PAN Open Day for students

Małopolski Festival of Innovation

QuickPhysX and QuizFiz contests

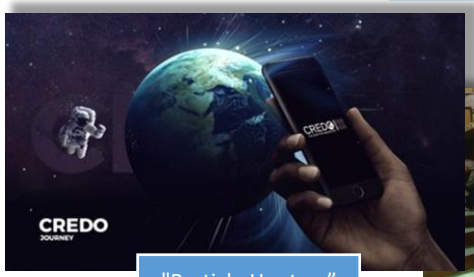
Silesian Science Festival in Katowice

Particle Physics Summer Student Program at IFJ PAN

Int. Masterclasses - Hands on Particle Physics for high school students

Making popular science movies on research carried out at IFJ PAN

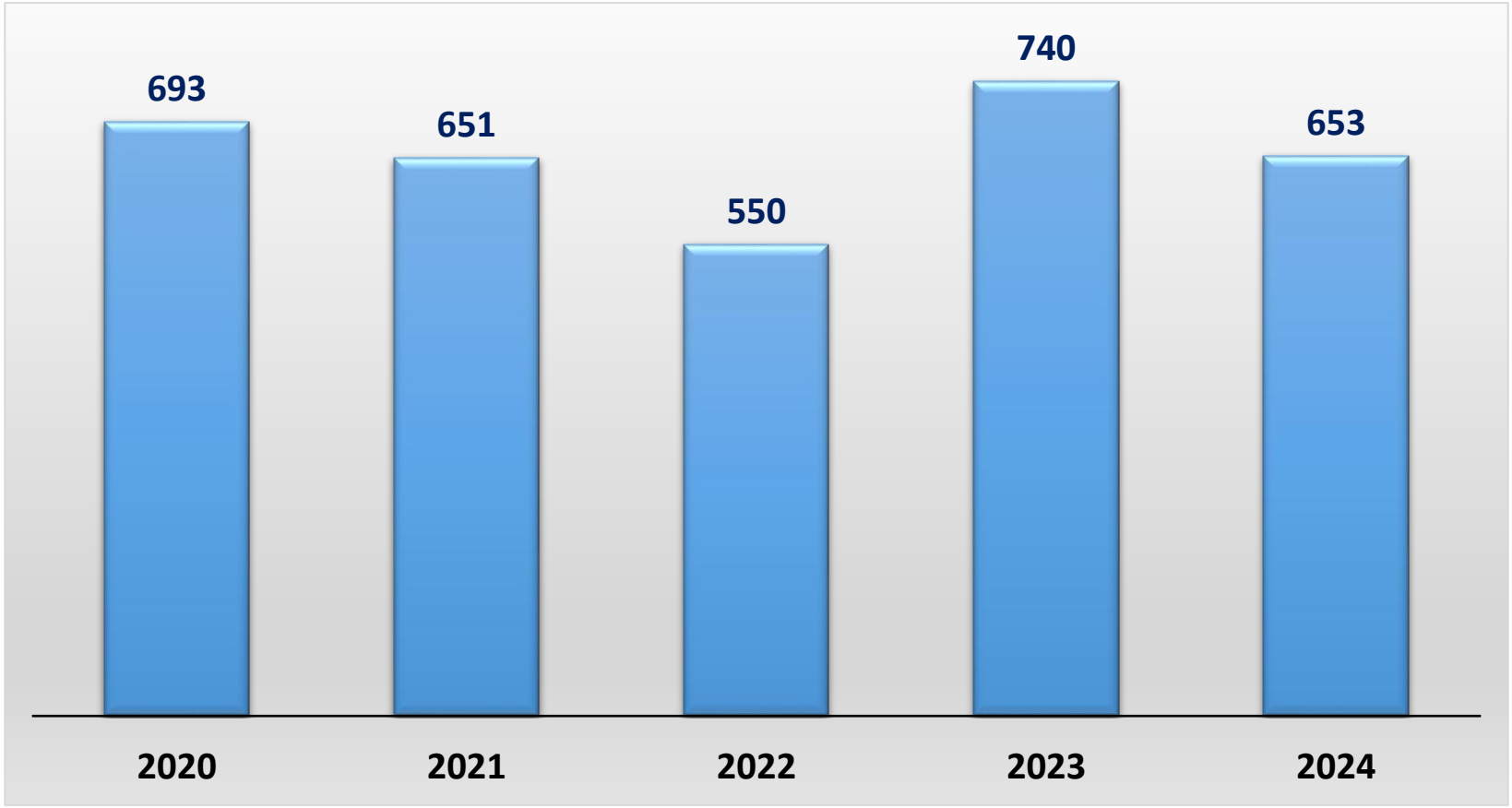
Activity in social media: Facebook, Twitter and YouTube



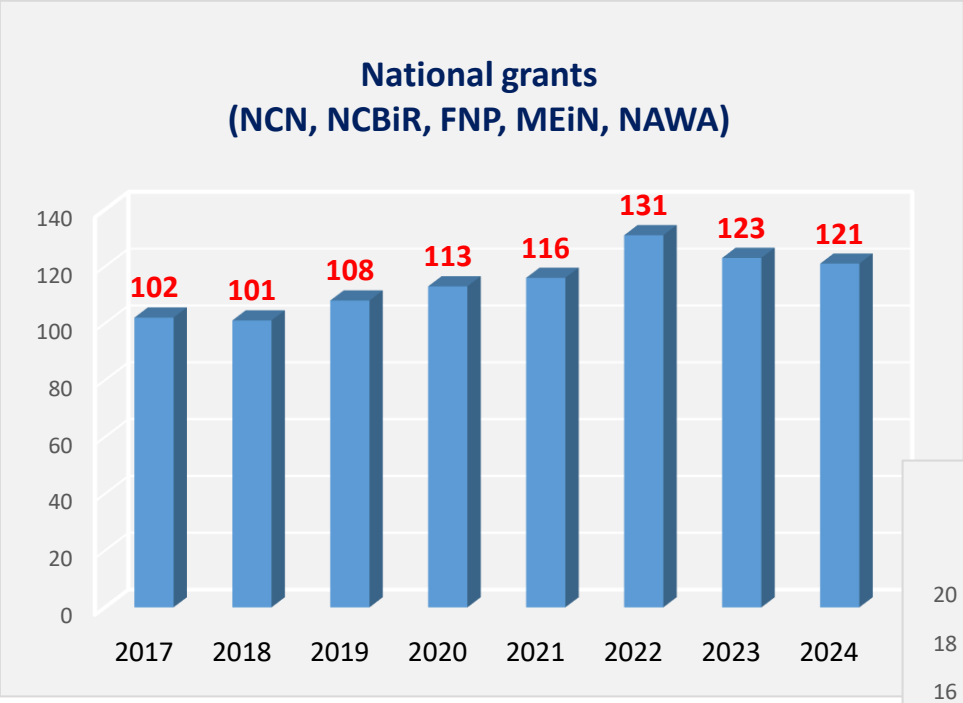
"Particle Hunters" contest with the CREDO Detector application

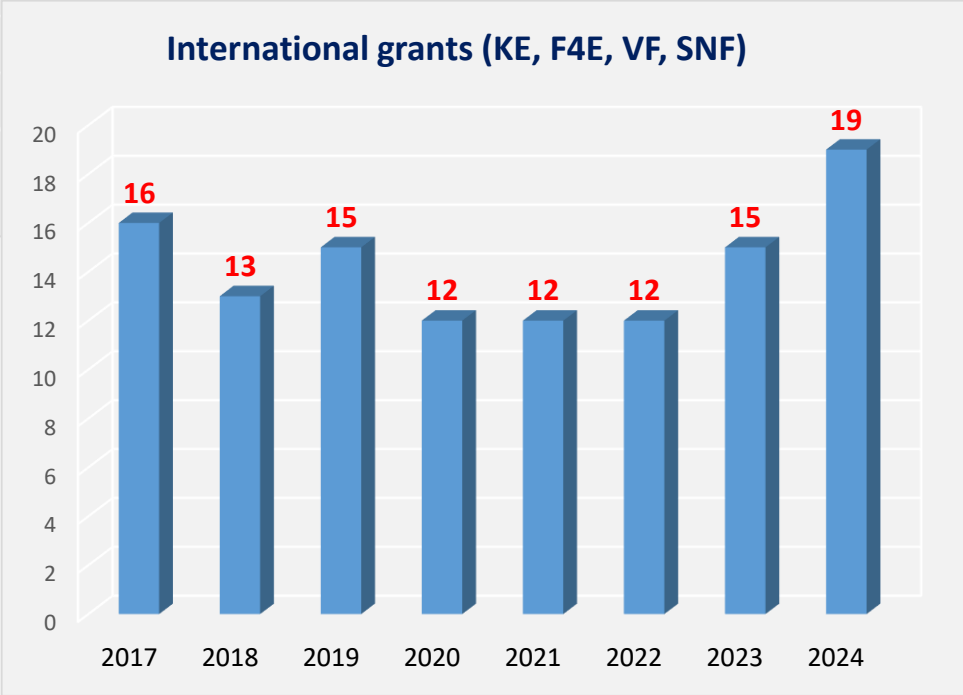
Children's Day at IFJ PAN

Scientific Publications in JRC Journals



International and Polish Grants





Projects on the Polish Roadmap coordinated by IFJ PAN

State research centres:

- **CCB - The Cyclotron Centre Bronowice (interdisciplinary research)**
- **Centre of Engineering of Cryogenic Materials and Research Equipment**

Polish contribution to international projects of the ESFRI Roadmap:

- **SPIRAL2 (physical science-physics)**
- **ESS - European Spallation Source (interdisciplinary research)**

Participation in an international research infrastructure project:

- **Research in particle physics using the infrastructure of CERN**

Thank you for your attention