Heavy Ion Laboratory, University of Warsaw

Krzysztof Rusek
First Nuclear Physics Lab in Poland
Hoża 69, prof. A. Sołtan (1937)

deuterons 0.4 MeV, I up to 200 µA
Nuclear Facilities in Poland

INP PAS
Proton cyclotron

Swierk
Reaktor Maria

HIL UW
Heavy ion cyclotron

Szczecin

Katowice

INP PAS
Proton cyclotron

Warszawa

Lodz

Kraków

Lublin
Campus Ochota

Zwirki i Wigury str.

HIL

Airport

Banacha str.
Heavy Ion Laboratory UW

Staff:

- Scientists – 15
- PhD students – 7
- Technicians – 35
- Administration – 8
- ~ 100 ext. users/year

Projects:

- SPIRAL2 PP (7FP UE) – 100 Keuro
- ECR – 1000 Keuro (new ion source)
- RPRC – 5000 Keuro (med. isotopes)
- EAGLE – 700 Keuro (new spectrometer)
- ICARE – 100 Keuro (scatt. Chamber)
Energies $2 \div 10$ MeV/A
Ions $^{10}\text{B} \div ^{40}\text{Ar}$
Nuclear reactions

- Interactions of exotic nuclei
- Tunneling through the barrier
A complete set of E2 matrix elements, including relative signs, between Coulomb excited states can be extracted.

If it is rich and precise enough, quadrupole deformation parameters $<Q^2>$ and $<Q^3 \cos3\delta>$ can be derived for each state individually, using the Quadrupole Sum Rules method.
GOSIA Code

- Standard tool for Coulomb excitation data analysis
- Used worldwide, maintained and developed at HIL
- GOSIA Workshop – organised at HIL in April 2008

**ISOLDE (MINIBALL), CERN:**
- J. Cederkäll, A. Ekström – ¹⁰⁸,¹¹⁰Sn, ¹⁰⁸In
- J. Iwanicki – ⁸⁸Kr, ⁹²Kr
- A. Hurst – ⁷⁰Se
- I. Stefanescu – ⁶⁸Cu, ⁷⁰Cu
- J. Van de Walle – ⁷⁴Zn
- E. Clément – ⁹⁶Sr
- A. Pells, N. Bree – ¹⁰²,¹⁰⁴,¹⁰⁶,¹⁰⁰Hg

**JYVÄSKYLÄ, FINLAND:**
- F. Becker – ⁷⁸Kr
- M. Hackstein – ¹²⁸Xe

**ANL (Gammasphere), USA:**
- A. Hayes – ¹⁷⁸Hf

**GANIL (EXOGAM), FRANCE:**
- E. Bouchez – ⁷⁶Kr
- E. Clément – ⁷⁴, ⁷⁶Kr
- M. Zielińska – ⁴⁴Ar

**JAERA, TOKAI, JAPAN:**
- M. Koizumi – ⁶⁶Zn, ⁶⁸Zn
- T. Hayakawa – ⁷⁶Se
- A. Osa – ⁶⁴Kr
- Y. Toh – ⁷⁰Ge
- M. Zielińska – ⁹⁶,⁹⁸Mo

**HIL, WARSAW, POLAND:**
- J. Iwanicki – ¹⁶⁵Ho
- M. Zielińska – ⁹⁶,⁹⁸Mo
- K. Wrzosek-Lipska – ¹⁰⁰Mo

**Upcoming experiments – GOSIA used for simulations**

**ISOLDE (MINIBALL), CERN:**
- B. Bastin – ¹⁹⁸,²⁰²Po
- M. Scheck – ²²⁰,²²²Rn, ²²²Ra

**HIL, WARSAW, POLAND:**
- M. Scheck – ⁹⁶Zr (Mar 2010)
- M. Zielińska – ¹⁰⁴Pd (May 2010)
Experimental study of the nuclear chirality

three perpendicular angular momenta can form right- or left-handed systems

for $A \approx 130$ triaxial core, proton particle, neutron hole

search for such subsystems in atomic nuclei about 15 cases in odd-odd nuclei can indicate such features:
two partner bands: levels with the same $I^\pi$ nearly the same energy
new gamma spectrometer at the Heavy Ion Laboratory in Warsaw

- up to 30 gamma detectors coupled to:
  - internal conversion electron spectrometer
  - scattering chamber of 5 cm radius, containing 110 Si detectors
  - Silicon Ball - compact chamber with 30 Si detectors
  - multiplicity filter (60 BaF₂)
  - Köln-Bucharest plunger
- Trans-lead nuclear isomers investigated by isotope separation on-line

Applications: biology
UJK + UW + ICHTJ + IPJ

Survival of irradiated cells

Cel: określenie przeżycia komórek po zaabsorbowaniu dawek promieniowania

Metoda

Frakcję komórek przeżywających po zaabsorbowaniu różnych dawek:

SF = liczba kolonii / (liczba komórek posianych * wydajność)

Gasińska A. Biologiczne podstawy radioterapii (2001)
Education
One-week workshop for undergrad. students

Środowiskowe Laboratorium Ciężkich Jonów, Uniwersytet Warszawski.

Warszawa, 20 - 25 April 2009 r.
ECR source, ready in May 2010
SUPERNANOGAN - PANTECHNIK (1000 Keuro)

Present ECR ion source
Radiofarmaceutical Prod. & Res. Centre (5000 Keuro)

p / d cyclotron
16/8 MeV
(General Electric)

> 75 μA p
> 60 μA d

Ready in autumn 2010
Nuclear Cogeneration
towards nuclear - coal synergy
Assoc. Prof. Ludwik Pieńskowski

Applications of High Temperature Nuclear Reactor in industry:

coal $\rightarrow$ gas, petrol. ......

Collaboration with AGH Cracow
European programme launched in September 2009

Main task:
- EUROPAIRS should aim at initiating an international consensus on the conditions for **industrial emergence of nuclear cogeneration**

Additional task:
- R&D strategy for hydrogen production, **nuclear coal synergy**

**Heat**
- $T \geq 750^\circ C$

**Reactor**
- HTR

**Cogeneration**
- Electricity
- Process heat

**Industrial Complex**
- Electric power
- Steam
Future

HIL → National Cyclotron Laboratory, joint project with Institute of Nuclear Physics, Cracow

Funded by Min. of Science, application in preparation