Status and perspectives of the GANIL Campaign

2016 ACC meeting - Venice
The physics case of AGATA@GANIL is the in-beam $\gamma$-ray spectroscopy of exotic nuclei populated by heavy-ions collisions at the Coulomb Barrier.
The GANIL Campaign organization

The GANIL campaign is organized in different sub-campaigns associated to a main setup

They are organized between the ACC, the GANIL management and the campaign manager (S. Lenzi from the University of Padova)

Each GANIL PAC has a “PrePac” workshop with a specific call: AGATA Collaboration Meeting

1st PAC in 2014 : VAMOS (10 experiments approved)

2nd PAC in 2015 : VAMOS || NEDA (10 experiments approved)

3rd PAC in 2016 : NEDA (6 experiments approved)
Recoils identification by the VAMOS++ magnetic spectrometer

Full reconstruction over the whole acceptance
Mass resolution $\sim 1/220$
$Z$ identification up to $Z=62$

M. Rejmund et al, NIM A 646 (2011) 184–191
M. Vandebrouck et al, NIM A 812 (2016) 112–117
Our strengths are:

- Recoils identifications (fission / MNT)
- Relatively high spins
- High Resolution
- Lifetimes measurements [fs to μs]
Lifetime measurement at AGATA@GANIL

Not simulation, Real in-beam data

To be completed by the FastTiming method with the use of LaBr3 and the continuous 2D DSAM**
Physics cases of the 1st run AGATA at GANIL: Nuclear structure in the vicinity of doubly magic nuclei

• \( p-n \), \( n-n \) correlations in the vicinity \( {}^{132}\text{Sn}, {}^{100}\text{Sn}, {}^{68}\text{Ni}, {}^{48}\text{Ca} \)
• Terra-incognita \( {}^{208}\text{Pb} \)
• Tensor force and monopole migration around \( {}^{78}\text{Ni} \)
• 3 body forces

C. Domingo-Pardo et al; \( 4^+, 2^+ \) lifetime in \( {}^{94}\text{Ru} \) and \( {}^{96}\text{Pd} \)

J. J. Valiente Dobon et al; \( 4^+, 2^+ \) lifetime in \( {}^{106,108}\text{Sn} \)

A. Navin et al; \( i_{13/2} \) single particle state in \( {}^{133}\text{Sn} \) and high spin in \( {}^{108}\text{Zr} \)

D. Verney et al; lifetime measurement in \( {}^{83}\text{Ge} \).

G. Duchêne et al; \( {}^{80}\text{Zn} \) and \( {}^{82}\text{Ge} \) highest spin structures

J. Ljungvall et al; \( 2^+, 4^+, 6^+ \) lifetime and \( g \)-factor in \( {}^{62,64,66}\text{Fe} \)

A. Lemasson et al; spectroscopy of \( {}^{39,41,43}\text{S} \)

S. Leoni et al; Lifetime in \( n \)-rich C and O isotopes: test of the three body forces

G. Georgiev et al; \( 2^+ \) lifetimes and \( g \) factor in \( {}^{204,206,208}\text{Hg} \) : 17th - 29th July

P. R. John et al; Shape transition in W isotopes: \( {}^{190}\text{W} \) and \( {}^{192}\text{W} \) spectroscopy and fast timing
PSA hits for 24 crystals

AGATA@GANIL – April 2015
Lifetme measurement in the $^{100}\text{Sn}$ region

Multinucleon-transfer reactions in the neutron-deficient side to populate the Sn/Ru isotopes and measure the lifetimes of the $2^+$ and $4^+$ states

$\Rightarrow$ See R. Perez-Vidal’s and M. Siciliano’s presentations

$^{208}\text{Pb}$ region: $\Rightarrow$ See D. Ralet’s talk
Spectroscopy in the $^{68-78}\text{Ni}$ region

See J. Lungvall’s and J. Dudouet’s presentations
Physics cases for the 2nd run (2016-2017): nuclear structure in the vicinity of doubly magic nuclei, \( N=Z \) nuclei, astrophysics and deformation

J. Nyberg et al.: Studies of excited states in \(^{102,103}\text{Sn}\) to deduce two-body neutron interactions, single-particle energies and \( N=Z=50 \) core excitations

M. Doncel et al.: Production test for spectroscopy and lifetime measurements in the \( A=78 \) isobaric triplet using multi-nucleon transfer reactions

S. Lenzi et al.: Effects of Isospin Symmetry Breaking in the \( A=63 \) mirror nuclei

A. Jungclauss et al.: Exploration of alpha-cluster structures in heavy nuclei: The unique case of \(^{212}\text{Po} (^{208}\text{Pb} + \alpha)\)

P. Regan et al.: Understanding Nuclear Collectivity Approaching the \( \pi-\nu \) Valence Maximum: Transition Quadrupole Moments in \(^{166,168}\text{Dy}\).

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I. Celikovic et al.: Evolution of collectivity around \( N=40 \): lifetime measurements in \(^{73,75}\text{Ga}\)

C. Fransen et al.: Evolution of the shell structure in the region of neutron-rich Ti isotopes

W. Korten et al.: Shape coexistence and triaxiality in neutron-rich fission fragments in the mass \( A=100-120 \)

C. Michelagnoli et al.: The lifetime of the 7.786 MeV state in \(^{23}\text{Mg}\) as a probe for classical novae models

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C. Fransen et al.: Evolution of the shell structure in the region of neutron-rich Ti isotopes

P. Bednarczyk et al.: Investigation of a high spin structure in $^{44}$Ti

C. Michelagnoli et al.: The lifetime of the 7.786 MeV state in $^{23}$Mg as a probe for classical novae models

S. Leoni et al.: Lifetime in n-rich C and O isotopes: test of the three body forces
2016 run

- 10 Triple Clusters and 1 Double Cluster (32 caps ε~5% after tracking @1.3 MeV nominal)
- 32 channels operational with phase1 (ATCA) and advanced phase 1 (GGP) electronic chains + 1 spear (1184 hpGe Channels)
- DAQ infrastructure is running smoothly (last experiment ~40T)

\[ \Rightarrow \text{See A. Korichi’s talk} \]

\[ \Rightarrow \text{This is a great success of the AGATA collaboration} \]
C. Fransen et al.: Evolution of the shell structure in the region of neutron-rich Ti isotopes

✓ 29 capsules running (limited by the availability of FEBEE)
✓ Plunger target issues which has limited the beam intensity
✓ $^{50,52,54}$Ti lifetime measurement
2016 run

I. Celikovic et al.: Evolution of collectivity around N=40: lifetime measurements in $^{73,75}$Ga

- 29 caps running (ATC7 out)
- $^{76}$Ge, Plunger target issues which has limited the beam intensity
- $^{75}$Ga lifetime measurement

A. Navin et al.; $i_{13/2}$ single particle state in $^{133}$Sn and high spin in $^{108}$Zr

- 32 caps running
- Some issues with the 2$^{nd}$ arm
- Delayed gamma with EXOGAM at the focal plane
- Ran very smoothly and very promising on-line spectra

C. Michelagnoli et al.: The lifetime of the 7.786 MeV state in $^{23}$Mg as a probe for classical novae models

- 32 caps running
- Additionnal DSSD in the chamber
- DSAM
2017 run *LaBr3 campaign* – *VAMOS backlog*

**FATIMA-PARIS detectors coupled to AGATA and VAMOS (4 experiments)**

- Mechanical integration
- Electronic coupling
- Detailed simulations to evaluate the impact on AGATA performances'
- Magnetic shielding

Starting the integration in the cave in October
Be ready for March 2017

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E.Clément
2018 run *NEDA campaign*

8 experiments approved using AGATA+NEDA (+DIAMANT) (+LaBr3) (+plunger)

Design phase for the mechanical integration (STFC-IPNL-GANIL)
Electronic Development in progress
Detailed planning for the 2017 installation and 2018 to be clarified when GANIL schedule is clarified

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- S. Lenzi et al. : Effects of Isospin Symmetry Breaking in the A=63 mirror nuclei
- M. Bentley et al. : Prompt gamma/proton spectroscopy in $^{65}$As – isospin symmetry at the limits of proton-binding
- B. Cederwall et al. : Search for isoscalar pairing in the N=Z nucleus $^{88}$Ru
- B. Fornal et al. : Gamma decay from near-threshold states in $^{14}$C: a probe of clusterization phenomena in open quantum systems
- E. Clément et al : Shell evolution of neutron-deficient Xe isotopes: Octupole and Quadrupole Correlations above $^{100}$Sn
- A. Boso et al : Isospin Symmetry Breaking and Shape Coexistence in Mirror Nuclei $^{71}$Kr-$^{71}$Br
- M. Palacz et al : Purity of the $g_{9/2}$ configuration based on lifetime measurements and energies of excited states in $^{94}$Pd
2019-20XX run *MUGAST-GFM*

VAMOS in GFM for prompt spectroscopy of Heavy Elements

- Ch. Theisen’s talk

Nucleons transfer spectroscopy using SPIRAL1 ISOL beams

- F. Flavigny’s talk
✓ The AGATA collaboration is operating 32 capsules in the array at GANIL

✓ The second AGATA run at GANIL is almost completed

✓ The physics program is rich, ambitious and broad

✓ The AGATA campaign will keep us busy until 2019 (at least)

✓ 2017 : LaBr3 campaign
✓ 2018 : AGATA-NEDA campaign