FISSION 2026

Contribution ID: **4** Type: **not specified**

Dual Shape and Intruder evolution between 73Zn and 75Zn isotopes

Wednesday, 11 March 2026 18:40 (15 minutes)

G. Duchêne,1,* J. Dudouet,2 F. Didierjean,1 D.D. Dao,1 F. Nowacki,1 E. Clément,3 A. Lemasson,3 C. Andreoiu,4 G. de Angelis,5 A. Astier,6 C. Delafosse,7 I. Deloncle,6 B.Z. Dombradi,8 C. Ducoin,2 G. de France,3 A. Gadea,9 A. Gottardo,5 D. Guinet,2 B. Jacquot,3 P. Jones,10 T. Konstantinopoulos,6 A. Korichi,6 I. Kuti,8 F. Le Blanc,6,1 S.M. Lenzi,11,12 G. Li,13,14 C. Lizarazo,15 R. Lozeva,6,1 G. Maquart,2 C. Michelagnoli,16,3 B. Million,17 D.R. Napoli,5 A. Navin,3 R.M. Pérez-Vidal,9 C.M. Petrache,6 N. Pietralla,15 D. Ralet,18,15 M. Ramdhane,19 N. Redon,2 M. Rejmund,3 K. Rezynkina,11,1 O. Stezowski,2 C. Schmitt,1,3 D. Sohler,8 and D. Verney6
1 Université de Strasbourg, CNRS, IPHC UMR 7178, F-67000 Strasbourg, France
2 Universite Claude Bernard Lyon 1, CNRS/IN2P3,IP2I Lyon, UMR 5822, Villeurbanne, F-69100, France
3 GANIL, CEA/DRF-CNRS/IN2P3, BP 55027, 14076 Caen Cedex 5, France
4 Department of Chemistry, Simon Fraser University, Burnaby, British Columbia V5A 1S6, Canada
5 INFN, Laboratori Nazionali di Legnaro, Viale dell'Universtità 2, I-35020 Legnaro (PD), Italy
6 Université Paris-Saclay, CNRS/IN2P3, IJCLab, 91405 Orsay, France
7 ESRIG, University of Groningen, Zernikelaan 25, 9747 AA Groningen, The Netherlands
8 HUN-REN Institute for Nuclear Research (ATOMKI), Pf.51, H-4001, Debrecen, Hungary
9 Instituto de Física Corpuscular, CSIC-Universitat de València, E-46980 Valencia, Spain
10 iThemba LABS, National Research Foundation,P.O.Box 722, Somerset West,7129 South Africa
11 INFN Sezione di Padova, I-35131 Padova, Italy
12 Dipartimento di Fisica e Astronomia dell'Università di Padova, I-35131 Padova, Italy
13 GSI, Helmholtzzentrum für Schwerionenforschung GmbH, D-64291 Darmstadt, Germany
14 Institute of Modern Physics, Chinese Academy of Sciences, Lanzhou, 73000, China
15 Institut für Kernphysik, Technische Universität Darmstadt, D-64289 Darmstadt, Germany
16 Institut Laue-Langevin, 71 avenue des Martyrs, 38042 Grenoble Cedex 9, France
17 INFN, Sezione di Milano, I-20133 Milano, Italy
18 MIRION Technologies Canberra, 1 Chemin de la Roseraie, 67380 Lingolsheim, France
19 LPSC, Université Grenoble-Alpes, CNRS/IN2P3, 38026 Grenoble Cedex, France

The area of the nuclear chart from Ni to Se and from N=40 to 50 is known to be transitional with shape evolution from spherical to axial or triaxial on the one hand, developing shape coexistence on the other hand [1-7]. Part of these nuclei are situated along the r-process path contributing to the first peak around A~85-90 [8]. The present study concentrates on neutron-rich Zn isotopes which are located at the border of this intriguing region.
The spectroscopy of the N=41-49 Zn isotopes was performed using AGATA coupled to VAMOS++ at GANIL. The isotopes were produced using the 238U (@6.2 MeV/u) + 9Be fusion-fission reaction. The gamma rays were detected in AGATA and the light fission fragments were identified in VAMOS++. As from these data Zn is the lowest Z chemical element for which gamma-ray spectra could be generated, the statistics is low. The isotopes from mass 73 to 79 could be studied.
In this talk, we focus on 73Zn and 75 Zn isotopes. A detailed analysis of the data enables us to propose 73Zn and 75Zn level schemes extended towards larger spins than known so far. Large-scale shell-model calculations were performed using the LNPS-U interaction. In a previous study, shape coexistence has been evidenced in the even-even 74Zn nucleus [7]. In the present work, the structures observed have been interpreted as due to the coupling of one neutron hole (73Zn) or one neutron particle (75Zn) to both the ground-state band and the excited 0+ and 2+ bands of 74Zn taken as a core. Our results evidence also a transition from triaxial intruder configurations in 73,74Zn to axial natural configuration in 75Zn whose features emerge naturally from underlying dynamical Nilsson-SU3 symmetries.

[1] S. Suchyta et al., Phys. Rev. C 89, 021301 (2014)
[2] R. Taniuchi et al., Nature 569, 53 (2019)
[3] M. Niikura et al., Phys. Rev. C 85, 054321 (2012)
[4] A. Illiana et al., Phys. Rev. C 108, 044305 (2023)
[5] A. D. Ayangeakaa et al., Phys. Rev. C 107, 044314 (2023)
[6] K. Rezynkina et al., Phys. Rev. C 106, 014320 (2022)
[7] M. Rocchini et al., Phys. Rev. Lett. 130, 122502 (2023)
[8] M.P. Reiter et al., Phys. Rev. C 101, 025803 (2020)

* gilbert.duchene@iphc.cnrs.fr

G. Duchêne,1,* J. Dudouet,2 F. Didierjean,1 D.D. Dao,1 F. Nowacki,1 E. Clément,3 A. Lemasson,3 C. Andreoiu,4 G. de Angelis,5 A. Astier,6 C. Delafosse,7 I. Deloncle,6 B.Z. Dombradi,8 C. Ducoin,2 G. de France,3 A. Gadea,9 A. Gottardo,5 D. Guinet,2 B. Jacquot,3 P. Jones,10 T. Konstantinopoulos,6 A. Korichi,6 I. Kuti,8 F. Le Blanc,6,1 S.M. Lenzi,11,12 G. Li,13,14 C. Lizarazo,15 R. Lozeva,6,1 G. Maquart,2 C. Michelagnoli,16,3 B. Million,17 D.R. Napoli,5 A. Navin,3 R.M. Pérez-Vidal,9 C.M. Petrache,6 N. Pietralla,15 D. Ralet,18,15 M. Ramdhane,19 N. Redon,2 M. Rejmund,3 K. Rezynkina,11,1 O. Stezowski,2 C. Schmitt,1,3 D. Sohler,8 and D. Verney6

1 Université de Strasbourg, CNRS, IPHC UMR 7178, F-67000 Strasbourg, France
2 Universite Claude Bernard Lyon 1, CNRS/IN2P3,IP2I Lyon, UMR 5822, Villeurbanne, F-69100, France
3 GANIL, CEA/DRF-CNRS/IN2P3, BP 55027, 14076 Caen Cedex 5, France
4 Department of Chemistry, Simon Fraser University, Burnaby, British Columbia V5A 1S6, Canada
5 INFN, Laboratori Nazionali di Legnaro, Viale dell'Universtità 2, I-35020 Legnaro (PD), Italy
6 Université Paris-Saclay, CNRS/IN2P3, IJCLab, 91405 Orsay, France
7 ESRIG, University of Groningen, Zernikelaan 25, 9747 AA Groningen, The Netherlands
8 HUN-REN Institute for Nuclear Research (ATOMKI), Pf.51, H-4001, Debrecen, Hungary
9 Instituto de Física Corpuscular, CSIC-Universitat de València, E-46980 Valencia, Spain
10 iThemba LABS, National Research Foundation,P.O.Box 722, Somerset West,7129 South Africa
11 INFN Sezione di Padova, I-35131 Padova, Italy
12 Dipartimento di Fisica e Astronomia dell'Università di Padova, I-35131 Padova, Italy
13 GSI, Helmholtzzentrum für Schwerionenforschung GmbH, D-64291 Darmstadt, Germany
14 Institute of Modern Physics, Chinese Academy of Sciences, Lanzhou, 73000, China
15 Institut für Kernphysik, Technische Universität Darmstadt, D-64289 Darmstadt, Germany
16 Institut Laue-Langevin, 71 avenue des Martyrs, 38042 Grenoble Cedex 9, France
17 INFN, Sezione di Milano, I-20133 Milano, Italy
18 MIRION Technologies Canberra, 1 Chemin de la Roseraie, 67380 Lingolsheim, France
19 LPSC, Université Grenoble-Alpes, CNRS/IN2P3, 38026 Grenoble Cedex, France

The area of the nuclear chart from Ni to Se and from N=40 to 50 is known to be transitional with shape evolution from spherical to axial or triaxial on the one hand, developing shape coexistence on the other hand [1-7]. Part of these nuclei are situated along the r-process path contributing to the first peak around A~85-90 [8]. The present study concentrates on neutron-rich Zn isotopes which are located at the border of this intriguing region.
The spectroscopy of the N=41-49 Zn isotopes was performed using AGATA coupled to VAMOS++ at GANIL. The isotopes were produced using the 238U (@6.2 MeV/u) + 9Be fusion-fission reaction. The gamma rays were detected in AGATA and the light fission fragments were identified in VAMOS++. As from these data Zn is the lowest Z chemical element for which gamma-ray spectra could be generated, the statistics is low. The isotopes from mass 73 to 79 could be studied.
In this talk, we focus on 73Zn and 75 Zn isotopes. A detailed analysis of the data enables us to propose 73Zn and 75Zn level schemes extended towards larger spins than known so far. Large-scale shell-model calculations were performed using the LNPS-U interaction. In a previous study, shape coexistence has been evidenced in the even-even 74Zn nucleus [7]. In the present work, the structures observed have been interpreted as due to the coupling of one neutron hole (73Zn) or one neutron particle (75Zn) to both the ground-state band and the excited 0+ and 2+ bands of 74Zn taken as a core. Our results evidence also a transition from triaxial intruder configurations in 73,74Zn to axial natural configuration in 75Zn whose features emerge naturally from underlying dynamical Nilsson-SU3 symmetries.

[1] S. Suchyta et al., Phys. Rev. C 89, 021301 (2014)
[2] R. Taniuchi et al., Nature 569, 53 (2019)
[3] M. Niikura et al., Phys. Rev. C 85, 054321 (2012)
[4] A. Illiana et al., Phys. Rev. C 108, 044305 (2023)
[5] A. D. Ayangeakaa et al., Phys. Rev. C 107, 044314 (2023)
[6] K. Rezynkina et al., Phys. Rev. C 106, 014320 (2022)
[7] M. Rocchini et al., Phys. Rev. Lett. 130, 122502 (2023)
[8] M.P. Reiter et al., Phys. Rev. C 101, 025803 (2020)

* gilbert.duchene@iphc.cnrs.fr

Primary author: Mr DUDOUET, Jérémie (IP2I Lyon)

Co-author: Mr DUCHENE, Gilbert (IPHC-CNRS-Université de Strasbourg)

Presenter: Mr DUCHENE, Gilbert (IPHC-CNRS-Université de Strasbourg)

Session Classification: session 10 (Chair: C. Simenel)