

# **10th International Conference on Clustering Aspects of Nuclear Structure and Dynamics**

## **(CLUSTER'12)**

**Journal of Physics: Conference Series Volume 436**

**Debrecen, Hungary  
24-28 September 2012**

**ISBN: 978-1-62748-313-1  
ISSN: 1742-6588**

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2012) by the Institute of Physics  
All rights reserved.

Printed by Curran Associates, Inc. (2013)

For permission requests, please contact the Institute of Physics  
at the address below.

Institute of Physics  
Dirac House, Temple Back  
Bristol BS1 6BE UK

Phone: 44 1 17 929 7481  
Fax: 44 1 17 920 0979

[techtracking@iop.org](mailto:techtracking@iop.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2634  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

[10th International Conference on Clustering Aspects of Nuclear Structure and Dynamics \(CLUSTER'12\) – Preface](#) OPEN ACCESS R G Lovas, Zs Dombrádi, G G Kiss, A T Kruppa and G Lévai

[List of committees](#)

[Conference programme](#) OPEN ACCESS

## Introduction

- 1 [Opening address](#) OPEN ACCESS R G Lovas (on behalf of the organizers)
- 3 [Challenges to the field of nuclear clustering](#) M Freer
- 11 [Recent developments in nuclear cluster theory](#) H Horiuchi

## Alpha clustering

- 18 [Gas-like alpha-cluster states and condensates in nuclei](#) OPEN ACCESS Y Funaki, T Yamada, H Horiuchi, G Röpke, P Schuck and A Tohsaki
- 25 [Nonmicroscopic and microscopic descriptions of condensate states in the  \$^{12}\text{C}\$  and  \$^{16}\text{O}\$  nuclei](#) OPEN ACCESS M Dufour, R Lazauskas and P Descouvemont
- 32 [Nature of 10 MeV state in  \$^{12}\text{C}\$](#)  OPEN ACCESS M Itoh, H Akimune, M Fujiwara, U Garg, T Kawabata, K Kawase, T Murakami, K Nakanishi, Y Nakatsugawa, H Sakaguchi, S Terashima, M Uchida, Y Yasuda, M Yosoi and J Zenihiro
- 39 [The structure of the Hoyle state via a measurement of the 'Hoyle Rotational Band' in  \$^{12}\text{C}\$](#)  OPEN ACCESS M Gai (for the UConn-Yale-TUNL-Weizmann-PTB-UCL collaboration)
- 44 [Cluster structure and isoscalar monopole excitation in light nuclei](#) OPEN ACCESS T Yamada
- 50 [Search for alpha inelastic condensed state in  \$^{24}\text{Mg}\$](#)  OPEN ACCESS T Kawabata, T Adachi, M Fujiwara, K Hatanaka, Y Ishiguro, M Itoh, Y Maeda, H Matsubara, H Miyasako, Y Nozawa, T Saito, S Sakaguchi, Y Sasamoto, Y Shimizu, T Takahashi, A Tamii, S Terashima, H Tokieda, N Tomida, T Uesaka, M Uchida, Y Yasuda, N Yokota, H P Yoshida and J Zenihiro
- 55 [Alpha cluster structure in  \$^{56}\text{Ni}\$](#)  OPEN ACCESS H Akimune, M Fujiwara, J Gibelin, M N Harakeh, L Achouri, S Bagchi, B Bastin, K Boretzky, H Bouzomita, L Caceres, S Damoy, F Delaunay, B Fernández-Domínguez, M Caamano, U Garg, G F Grinyer, N Kalantar-Nayestanaki, O Kamalou, E Khan, A Krasznahorkay, G Lhoutellier, S Lukyanov, K Mazurek, M Najafi, J Pancin, Y Penionzkhevich, L Perrot, R Raabe, C E

Rigollet, T Roger, S Sambi, H Savajols, M Senoville, C Stodel, L Suen, J C Thomas, J van de Walle and M Vandebruck

60 [Alpha-cluster structure in the ground state of  \$^{40}\text{Ca}\$  displayed in a \(p,pa\) knockout reaction](#) OPEN ACCESS A A Cowley

63 [Large scale calculations for cluster structure of light nuclei with Skyrme interaction](#) OPEN ACCESS Y Fukuoka, Y Funaki, T Nakatsukasa and K Yabana

66 [Alpha-particle resonances and clusters in  \$^{32}\text{S}\$ ,  \$^{34}\text{S}\$ ,  \$^{36}\text{Ar}\$  and  \$^{40}\text{Ca}\$](#)  OPEN ACCESS M Norrby

### Cluster reactions

69 [Clustering effects in reactions induced by light nuclei](#) OPEN ACCESS C Beck

76 [Cluster structures observed in  \$^{40}\text{Ca}\$  from  \$^{12}\text{C}+^{28}\text{Si}\$  scattering](#) OPEN ACCESS E A Benjamim, A Lépine-Szily, J M Oliveira Jr, A C C Villari, R Lichtenthäler, L C Chamon, V Guimarães, W Sciani, R Y R Kuramoto, J A Alcantara, A Barioni, O Camargo Jr, R Z Denke, P N de Faria, G F Lima, D R Mendes Jr and K C C Pires

82 [Electromagnetic transitions as a probe of clustering in nuclei](#) OPEN ACCESS D Jenkins

87 [Absolute partial decay branching-ratios in  \$^{16}\text{O}\$](#)  OPEN ACCESS C Wheldon, N I Ashwood, M Barr, N Curtis, M Freer, Tz Kokalova, J D Malcolm, S J Spencer, V A Ziman, Th Faestermann, R Krücken, H-F Wirth, R Hertenberger, R Lutter and A Bergmaier

92 [Spatial correlations probed in direct two-nucleon removal reactions](#) OPEN ACCESS E C Simpson

95 [Di-neutron correlation in monopole pair transfer modes near the neutron-separation energy in Sn, Ni, Ca, Zr isotopes](#) OPEN ACCESS H Shimoyama and M Matsuo

98  [\$^{13}\text{C}+^4\text{He}\$  resonant elastic scattering on a thick gas target](#) OPEN ACCESS L Prepolec, M Freer, N I Ashwood, N Curtis, A Di Pietro, P Figuera, M Fisichella, L Grassi, D Jelavić Malenica, Tz Kokalova, T Mijatović, M Milin, V Scuderi, N Skukan, N Soić, S Szilner, V Tokić, D Torresi and C Wheldon

101 [Resonant elastic scattering of  \$\alpha\$  particles on  \$^9\text{Be}\$  and cluster states in  \$^{13}\text{C}\$](#)  OPEN ACCESS I Lombardo, L Campajola, E Rosato, G Spadaccini and M Vigilante 012022

104 [Complete fusion of weakly bound cluster-type nuclei near barrier energies](#) OPEN ACCESS M S Hussein, P R S Gomes, J Lubian, R Linares and L F Canto

## Few-body and *ab initio* approaches

- 108 [Symmetry-adapted \*ab initio\* no-core shell model calculations for  \$^{12}\text{C}\$](#)  OPEN  
ACCESS K D Launey, A C Dreyfuss, T Dytrych, J P Draayer, D Langr, P Maris, J P Vary and C Bahri
- 115 [Tensor force manifestations in \*ab initio\* study of the  \$^2\text{H}\(d, \gamma\)^4\text{He}\$ ,  \$^2\text{H}\(d, p\)^3\text{H}\$  and  \$^2\text{H}\(d, n\)^3\text{He}\$  reactions](#) OPEN ACCESS K Arai, S Aoyama, Y Suzuki, P Descouvemont and D Baye
- 120 [Excited states of  \$^4\text{He}\$](#)  OPEN ACCESS S Aoyama

## Microscopic approach to cluster structure and reactions

- 125 [Multi-cluster problems: resonances, scattering and condensed states](#) OPEN  
ACCESS K Katō, T Myo, Y Kikuchi and T Yoshida
- 133 [Studies of light neutron-excess systems from bound states to continuum](#) OPEN  
ACCESS M Ito and H Otsu
- 138 [Cluster-shell competition in systems with a few alpha particles and valence neutrons](#) OPEN  
ACCESS H Masui and N Itagaki
- 142 [Role of the tensor force in light nuclei with the tensor-optimized shell model](#) OPEN  
ACCESS T Myo, A Umeya, H Toki and K Ikeda
- 145 [Microscopic description of  \$\alpha + \alpha\$  bremsstrahlung from a realistic nucleon-nucleon interaction](#) OPEN ACCESS J Dohet-Eraly, D Baye and P Descouvemont
- 148 [Cluster structure in light nuclei studied with few-body models](#) OPEN ACCESS W Horiuchi and Y Suzuki
- 151 [Two-body Coulomb scattering and complex scaling](#) OPEN ACCESS I Hornyák

## Algebraic cluster models

- 154 [The geometric interpretation of the semimicroscopic algebraic cluster model and the role of the Pauli principle](#) OPEN ACCESS H Yépez-Martínez, P O Hess and G Lévai
- 159 [Multicluster solutions of the Elliott SU\(3\) nucleonic Hamiltonian and alpha-cluster level density](#) OPEN ACCESS I A Gnilozub, S D Kurgalin and Yu M Tchuvi'l'sky

162 [Algebraic approach for  \$\alpha\$ -cluster structure in  \$^{12}\text{C}\$  and  \$^{16}\text{O}\$](#)  OPEN ACCESS T Yoshida, N Itagaki and K Katō

165 [Comparing the group theoretical approaches to the description of dipole and quadrupole collectivity in nuclei](#) OPEN ACCESS A I Georgieva

### Structure and reactions of exotic nuclei

169 [Cluster correlation in light nuclei](#) OPEN ACCESS Y Kanada-En'yo, F Kobayashi and T Suhara

176 [Core excitations in exotic nuclei](#) OPEN ACCESS P Descouvemont, M Dufour and N Timofeyuk

183 [Clustering aspects in highly excited states and in neutron-rich nuclei](#) OPEN ACCESS M Kimura

190 [Mechanisms of direct reactions with halo nuclei](#) OPEN ACCESS P Capel, F M Nunes, H Esbensen and R C Johnson

195 [Clustering in A=10 nuclei](#) OPEN ACCESS G V Rogachev, L Baby, J Belarge, J C Blackmon, V Z Goldberg, E D Johnson, E Koshchiy, A N Kuchera, J Lai, L Linhardt, K Macon, M Matos, D Santiago-Gonzalez and I Wiedenhöver

198 [Two novel cluster states in  \$^{10}\text{Be}\$](#)  OPEN ACCESS F Kobayashi and Y Kanada-En'yo

201 [Cluster structures of excited states in  \$^{11}\text{B}\$](#)  OPEN ACCESS T Suhara and Y Kanada-En'yo

204 [States in  \$^{10}\text{Be}\$  populated in  \$^{6,7}\text{Li}\(^{7}\text{Li}, ^{3,4}\text{He}\)^{10}\text{Be}^\*\$  reactions at 30 and 52 MeV](#) OPEN ACCESS M Uroić, M Milin, A Di Pietro, P Figuera, I Martel, M Fisichella, M Lattuada, Đ Miljanić, M G Pellegriti, L Prepolec, A M Sanchez Benitez, V Scuderi, N Soić, E Strano and D Torresi

207 [Breakup of  \$^{11}\text{Li}\$  in a three-cluster model](#) OPEN ACCESS E Pinilla, P Descouvemont and D Baye

210 [Mechanisms of Coulomb breakup reactions of  \$^6\text{He}\$  and  \$^{11}\text{Li}\$](#)  OPEN ACCESS Y Kikuchi, T Myo, K Katō and K Ikeda

213 [Breakup reactions of neutron drip-line nuclei near  \$N = 20, 28\$](#)  OPEN ACCESS N Kobayashi, T Nakamura, Y Kondo, Y Satou and the RIBF-55 Collaboration

216  [\$^8\text{He}\$  cluster structure studied by recoil proton tagged knockout reaction](#) OPEN ACCESS Y Ye, Z Cao, J Xiao, D Jiang, T Zheng, H Hua, Y Ge, X Li, J Lou, Q Li, L Lv, R Qiao, H You, R Chen, H Sakurai, H Otsu, Z Li, M Nishimura, S Sakaguchi, H Baba, Y

Togano, K Yoneda, C Li, S Wang, H Wang, K Li, Y Nakayama, Y Kondo, S Deguchi, Y Sato and K Tshoo

## Nuclear molecules

- 219 [Mystery of resonances in heavier systems](#) OPEN ACCESS E Uegaki
- 226 [Cluster and molecular structures observed in reactions of light nuclei](#) OPEN ACCESS M Milin
- 233 [Electromagnetic decay of molecular states](#) OPEN ACCESS S Courtin, A Goasduff and F Haas
- 240 [Power series expansion method for determining collective quantities](#) OPEN ACCESS Y Iwata
- 243 [Wobbling excitation of triaxial nuclear molecule  \$^{28}\text{Si} - {^{28}\text{Si}}\$](#)  OPEN ACCESS E Uegaki and Y Abe
- 246 [Clustering effects in  \$^{48}\text{Cr}\$  composite nucleus produced via the reaction  \$^{24}\text{Mg} + {^{24}\text{Mg}}\$  at the excitation energy of 60 MeV](#) OPEN ACCESS E Vardaci, A Di Nitto, P Nadtochy, A Brondi, G La Rana, R Moro, A Vanzanella, M Cinausero, G Prete and N Gelli

## Elongated states, dacay and fission; superheavy elements

- 249 [Cluster correlations in largely deformed states](#) OPEN ACCESS Y Taniguchi
- 256 [Heavy-particle radioactivity](#) OPEN ACCESS D N Poenaru, R A Gherghescu and W Greiner
- 263 [Two-proton radioactivity: 10 years of experimental progresses](#) OPEN ACCESS J Giovinazzo, P Ascher, L Audirac, B Blank, C Borcea, G Canel, C E Demonchy, C Dossat, S Grvy, S Leblanc, I Matea, F de Oliveira-Santos, J L Pedroza, L Perrot, J Pibernat, L Serani, C Stodel and J C Thomas
- 269 [Microscopic description of induced fission](#) OPEN ACCESS N Schunck
- 274 [Cluster aspects of binary fission](#) OPEN ACCESS A V Andreev, G G Adamian and N V Antonenko
- 280 [Formation of strongly deformed states in entrance channels](#) OPEN ACCESS A S Zubov, V V Sargsyan, G G Adamian, N V Antonenko and W Scheid
- 286 [Complex-energy shell model description of alpha decay](#) OPEN ACCESS R Id Betan

- 291 [Population and properties of superdeformed bands in  \$A \sim 150\$  region](#) OPEN  
ACCESS A S Zubov, V V Sargsyan, G G Adamian and N V Antonenko
- 294 [Charge distribution in disintegration of uranium isotopes](#) OPEN ACCESS N Eren, N Buyukcizmeci and R Ogul
- 297 [Alpha-decay quantum-tunnelling calculations based on a folded Woods-Saxon potential](#) OPEN ACCESS F R Xu, S M Wang, Z J Lin and J C Pei

### Clustering in nuclear matter

- 302 [Alpha-particle condensation in nuclear systems: present status and perspectives](#) OPEN ACCESS P Schuck
- 309 [Nuclear matter and surface clustering](#) OPEN ACCESS Q N Usmani, N Abdullah, K Anwar and Z Sauli
- 314 [Dynamical description of exotic structures at subnuclear densities](#) OPEN ACCESS V de la Mota, F Sébille, M Novak and Ph Eudes
- 321 [Nuclear matter properties in fragmentation reactions](#) OPEN ACCESS A Ono
- 326 [A new step of microscopic cluster model: The present status of the THSR wave function](#) OPEN ACCESS A Tohsaki
- 328 [Quantum statistical calculation of cluster abundances in hot dense matter](#) OPEN ACCESS G Röpke

### Nuclear reactions for astrophysics

- 333 [Role of clusters in nuclear astrophysics with Cluster Nucleosynthesis Diagram \(CND\)](#) OPEN ACCESS S Kubono, D N Binh, S Hayakawa, H Hashimoto, D Kahl, H Yamaguchi, Y Wakabayashi, T Teranishi, N Iwasa, T Komatsubara, S Kato, A Chen, S Cherubini, S H Choi, I S Hahn, J J He, L H Khiem, C S Lee, Y K Kwon, S Wanajo and H-T Janka
- 340  [\$^{12}\text{C}\$  and the triple- \$\alpha\$  reaction rate](#) OPEN ACCESS O S Kirsebom
- 345 [Low-energy d+d fusion via the Trojan Horse Method](#) OPEN ACCESS A Tumino, C Spitaleri, A M Mukhamedzhanov, S Typel, M Aliotta, V Burjan, M Gimenez del Santo, G G Kiss, V Kroha, Z Hons, M La Cognata, L Lamia, J Mrazek, R G Pizzone, S Piskor, G G Rapisarda, S Romano, M L Sergi and R Spartà
- 350 [Study of  \$^{24}\text{Mg}\$  resonances relevant to carbon burning nucleosynthesis](#) OPEN ACCESS V Tokić, N Soić, S Blagus, S Fazinić, D Jelavić-Malenica, Đ Miljanić, L Prepolec, N Skukan, S Szilner, M Uroić, M Milin, A Di Pietro, P Figuera, M Fisichella,

M Lattuada, V Scuderi, E Strano, D Torresi, N Ashwood, N Curtis, M Freer, V Ziman, I Martel, A M Sánchez-Benítez and L Acosta

353 [Electron screening effects in  \$\(p,\alpha\)\$  reactions induced on boron isotopes studied via the Trojan Horse Method](#) OPEN ACCESS L Lamia, C Spitaleri, N Carlin, S Cherubini, M Gameiro Munhoz, M Gimenez Del Santo, M Gulino, G G Kiss, V Kroha, S Kubono, M La Cognata, C Li, A Mukhamedzhanov, R G Pizzone, S M R Puglia, Q Wen, G G Rapisarda, S Romano, M L Sergi, E Somorjai, F A Souza, A Szanto de Toledo, A Tumino, Y Wakabayashi and H Yamaguchi

### **High-energy and multifragmentation reactions**

356 [Nuclear \(multi-\)fragmentation](#) OPEN ACCESS Ad R Raduta

363 [Collective and thermal signatures in  \$\pi^4\text{He}\$  interaction in the  \$\Delta\$  excitation energy region](#) OPEN ACCESS I Gnesi

368 [Nuclear symmetry energy in charge and isotopic distributions](#) OPEN ACCESS H Imal, N Buyukcizmeci and R Ogul

371 [Pseudo-critical clusterization in nuclear multi-fragmentation](#) OPEN ACCESS D Gruyer, J D Frankland, R Botet, M Płoszajczak, E Bonnet, A Chbihi, P Marini (for the INDRA collaboration)

### **Hypernuclei and quark clusters**

374 [Four- and five-body cluster structure of hypernuclei](#) OPEN ACCESS E Hiyama

381 [Few-nucleon systems interacting via non-local quark-model baryon-baryon interaction](#) OPEN ACCESS Y Fujiwara and K Fukukawa

388 [Structure of Be hyper isotopes](#) OPEN ACCESS M Isaka, H Homma and M Kimura

### **Application of cluster theory and clustered nuclei**

391 [Some interesting and exotic applications of carbon-14 dating by accelerator mass spectrometry](#) OPEN ACCESS A J T Jull

399 [Interaction of electromagnetic fields and atomic clusters](#) OPEN ACCESS S Bubin, A G Russakoff and K Varga

### **Closing**

407 [Conference summary: an experimental perspective](#) OPEN ACCESS W N Catford

414 [Summary talk – from a theoretical point of view](#) OPEN ACCESS Y Suzuki

**List of participants**

420 [List of participants](#)