

**CURRICULUM VITAE****Mark Anthony Caprio**

Department of Physics  
 University of Notre Dame  
 225 Nieuwland Science Hall  
 Notre Dame, IN 46556-5670, USA

Phone: +1 574-631-2827  
 Fax: +1 574-631-5952  
 E-mail: mcaprio@nd.edu

**RESEARCH INTERESTS**

*Ab initio* nuclear theory. Collective nuclear structure. Group theoretical and computational methods for strongly-interacting quantum many-body systems.

**APPOINTMENTS**

<b>Associate Professor</b> , <i>Department of Physics, University of Notre Dame</i>	2013–
<b>Associate Chair &amp; Director of Graduate Studies</b> , 2016–.	
<b>Assistant Professor</b> , <i>Department of Physics, University of Notre Dame</i>	2007–2013
<b>Postdoctoral Associate</b> , <i>Physics Department, Yale University</i> (F. Iachello)	2003–2007

**EDUCATION**

<b>Ph.D.</b> , Physics. <i>Yale University</i> . With distinction. (R. F. Casten)	2003
<b>M.Phil.</b> , 1999. <b>M.S.</b> , 1998.	
<b>B.S.</b> , Physics, Mathematics. <i>Oglethorpe University</i> . With honors. <i>Summa cum laude</i> .	1994

**AWARDS**

<b>Shilts/Leonard Teaching Award</b> , <i>College of Science, University of Notre Dame</i>	2017
<b>Faculty Fellow</b> , <i>Kaneb Center for Teaching and Learning, University of Notre Dame</i>	2014
<b>Joyce Award for Excellence in Undergraduate Teaching</b> , <i>University of Notre Dame</i>	2014
<b>Cottrell Scholar Award</b> , <i>Research Corporation for Science Advancement</i>	2010

**PROFESSIONAL SERVICE**

Conference organizing and advisory committees:

Scientific Advisory Committee, *International Conference on Nuclear Theory in the Supercomputing Era*: Khabarovsk, Russia, September 2016; Khabarovsk, Russia, September 2014; Ames, Iowa, May 2013.

International Advisory Committee, *Nuclear Structure*: Knoxville, Tennessee, July 2016; Berkeley, California, August 2010.

Organizing Committee, *Horizons on Innovative Theories, Experiments, and Supercomputing in Nuclear Physics*: New Orleans, Louisiana, June 2012; coedited proceedings volume, *Journal of Physics: Conference Series*, Vol. 203 (IOP Publishing, London, 2012).

Summer school lecturer:

*Training in Advanced Low Energy Nuclear Theory (TALENT)* course “Theory for Exploring Nuclear Structure Experiments”, GANIL, Caen, France, August 2014.

*Balkan School on Nuclear Physics*, Adrasan, Turkey, September 2010.

Associate Editor, *European Physical Journal A: Hadrons and Nuclei* (2017–).

Referee articles for journals and proceedings (95 papers reviewed to date):

Annals of Physics, Canadian Journal of Physics, Computer Physics Communications, European Physical Journal A, Europhysics Letters, International Journal of Modern Physics E, Journal of Mathematical Physics, Journal of Physics A, Journal of Physics G, Molecular Physics, Nuclear Instruments and Methods in Physics Research A, Nuclear Physics A, Physica Scripta, Physical Review A, Physical Review C, Physical Review Letters, Physics Letters B, Physics Today, Reports on Progress in Physics, Journal of Physics Conference Series, and American Institute of Physics Conference Proceedings.

Review grant proposals for the US National Science Foundation and US Department of Energy.

Visiting Fellow, *European Centre for Theoretical Studies in Nuclear Physics and Related Areas* (ECT\*), Trento, Italy (Summers 2003–2007).

Created widely-used scientific figure preparation system for Mathematica (<http://scidraw.nd.edu>) and BibTeX style for Institute of Physics journal authors.

Professional society memberships: American Physical Society (APS), American Astronomical Society (AAS), Mathematical Association of America (MAA).

## **STUDENTS AND POSTDOCS SUPERVISED**

Undergraduate students:

Research Experiences for Undergraduates (REU) students: Anna E. McCoy (2009), Ke Cai (2010), James F. St. Germaine-Fuller (2014), Abraham R. Flores (2016), Julie Butler (2017).

Undergraduate theses: Mitch A. McNanna (2013–2015), Alexa I. Rakoski (2013–2015).

Supervised several additional undergraduate academic-year research projects.

Doctoral students:

Fengqiao Luo, 2014.

Weichuan Li, 2016 (coadvised with S. Frauendorf).

Chrysovalantis Constantinou, 2017.

Anna E. McCoy, 2018.

Patrick J. Fasano, in progress.

Veerle Hellemans, postdoc, *University of Notre Dame*, 2009–2010.

**DEPARTMENTAL AND UNIVERSITY SERVICE**

Director of Graduate Studies, Department of Physics (2016–).

Faculty Fellow, Kaneb Center for Teaching and Learning (2014–2015).

Member, Faculty Senate (2013–2016).

Class advisor, undergraduate physics majors of the class of '15 (2011–2015).

Service on departmental committees: Graduate Curriculum (chair, 2016–); Instructional & Course Offering (2015–); Graduate Recruitment (2007–2016; chair, 2013–2016); Undergraduate Curriculum (2012–2016); Colloquium (2008–2013); Computer (2007–2012); *ad hoc* nuclear graduate curriculum (2015); graduate student research committees and junior faculty mentoring committees.

Developed courses Computational Methods in Physics (PHYS 20420) and Computational Laboratory in Quantum Mechanics (PHYS 31454). Coordinate graduate Physics Teaching Practicum (2014–). Initiated and coordinate departmental Pedagogy Coffees (2014–).

**EXTERNAL SUPPORT****Nuclear properties at extreme density, temperature, spin, and isospin**

US Department of Energy, Office of Science, Grant Number DE-FG02-95ER40934 (G. Mathews, S. Frauendorf, and M. A. Caprio), 2007–2010, renewed 2010–2013, renewed 2013–2016, renewed 2016–2018.

**Symmetries in the nuclear many-body problem: Conquering the computational scale explosion**

*Cottrell Scholar Award*, Research Corporation for Science Advancement, 2011–2014.

*The Cottrell Scholar Awards have been presented annually since 1994 by the Research Corporation for Science Advancement (RCSA), America's first foundation dedicated wholly to science. The awards honor outstanding early career scientists in the physical sciences for leadership in integrating science teaching and research at leading U.S. research universities. The Cottrell Scholar program is highly competitive, with an average award rate of 10%.*

**COMPUTING AWARDS*****Ab initio* nuclear structure**

Computing award, National Energy Research Scientific Computing Center (US Department of Energy), 50 000 CPU hours, 2015. 2 100 000 CPU hours, 2016. 5 900 000 CPU hours, 2017.

**PROGRAMMING LANGUAGES**

C/C++, Python, FORTRAN, Mathematica, Pascal, Intel 80x86 assembly language, BASIC, COBOL.

## PUBLICATIONS AND PRESENTATIONS

*Refereed articles:* 88 (42 experimental, 46 theoretical)

*Conference proceedings:* 33 (21 experimental, 12 theoretical)

*Invited talks:* 76

*Contributed talks:* 121 (not listed below)

### PROCEEDINGS VOLUME (EDITOR)

#### **Proceedings of the Conference on Horizons on Innovative Theories, Experiments, and Supercomputing in Nuclear Physics 2012**

K. D. Launey, **M. A. Caprio**, J. Escher, J. Hirsch, and C. W. Johnson, eds., Journal of Physics: Conference Series, Vol. 203 (IOP Publishing, London, 2012).

### ARTICLES (REFEREED)

*Publications are listed below separately as Experimental or Theoretical, based on the principal nature of my contribution.*

#### *(a) Experimental*

1.  **$B(E2)$  values and phase coexistence in  $^{152}\text{Sm}$**   
N. V. Zamfir, R. F. Casten, **M. A. Caprio**, C. W. Beausang, R. Krücken, J. R. Novak, J. R. Cooper, G. Cata-Danil, and C. J. Barton, Phys. Rev. C **60**, 054312 (1999).
2. **Evidence for superdeformation in  $^{149,150}\text{Dy}$ : Onset of the  $Z=66$  deformed shell closure?**  
D. E. Appelbe, C. W. Beausang, C. J. Barton, **M. A. Caprio**, R. F. Casten, J. Cederkäll, J. R. Cooper, R. Krücken, J. R. Novak, N. V. Zamfir, and Z. Wang, Phys. Rev. C **61**, 037303 (2000).
3. **The YRAST Ball array**  
C. W. Beausang, C. J. Barton, **M. A. Caprio**, R. F. Casten, J. R. Cooper, R. Krücken, B. Liu, J. R. Novak, Z. Wang, M. Wilhelm, A. N. Wilson, N. V. Zamfir, and A. Zilges, Nucl. Instrum. Meth. A **452**, 431 (2000).
4. **Nuclear structure of  $^{196}\text{Au}$ : More evidence for its supersymmetric description**  
J. Gröger, J. Jolie, R. Krücken, C. W. Beausang, **M. A. Caprio**, R. F. Casten, J. Cederkäll, J. R. Cooper, F. Corminboeuf, L. Genilloud, G. Graw, C. Günther, M. de Huu, A. I. Levon, A. Metz, J. R. Novak, N. Warr, and T. Wendel, Phys. Rev. C **62**, 064304 (2000).
5. **Chiral doublet structures in odd-odd  $N=75$  isotones: Chiral vibrations**  
K. Starosta, T. Koike, C. J. Chiara, D. B. Fossan, D. R. LaFosse, A. A. Hecht, C. W. Beausang, **M. A. Caprio**, J. R. Cooper, R. Krücken, J. R. Novak, N. V. Zamfir, K. E. Zyromski, D. J. Hartley, D. L. Balabanski, J.-Y. Zhang, S. Frauendorf, and V. I. Dimitrov, Phys. Rev. Lett. **86**, 971 (2001).
6. **Mass measurements of  $^{70}\text{Se}$ ,  $^{71}\text{Se}$ ,  $^{72}\text{Br}$ , and  $^{73}\text{Br}$**   
B. E. Tomlin, C. J. Barton, N. V. Zamfir, **M. A. Caprio**, R. L. Gill, R. Krücken, J. R. Novak, J. R. Cooper, K. E. Zyromski, G. Cata-Danil, C. W. Beausang, A. Wolf, N. A. Pietralla, H. Newman, J. Cederkäll, B. Liu, Z. Wang, R. F. Casten, and D. S. Brenner, Phys. Rev. C **63**, 034314 (2001).
7. **Evidence for chiral symmetry breaking in  $^{136}\text{Pm}$  and  $^{138}\text{Eu}$**   
A. A. Hecht, C. W. Beausang, K. E. Zyromski, D. L. Balabanski, C. J. Barton, **M. A. Caprio**, R. F. Casten, J. R. Cooper, D. J. Hartley, R. Krücken, D. Meyer, H. Newman, J. R. Novak, E. S. Paul, N. Pietralla, A. Wolf, N. V. Zamfir, J.-Y. Zhang, and F. Dönau, Phys. Rev. C **63**, 051302(R) (2001).

8. **Two-phonon  $\gamma$ -vibrational strength in osmium nuclei**  
C. Y. Wu, D. Cline, A. B. Hayes, M. W. Simon, R. Krücken, J. R. Cooper, C. J. Barton, C. W. Beausang, C. Bialik, **M. A. Caprio**, R. F. Casten, A. A. Hecht, H. Newman, J. Novak, N. Pietralla, K. Zyromski, and N. V. Zamfir, Phys. Rev. C **64**, 014307 (2001).
9. **Lifetimes in neutron-rich fission fragments using the differential recoil distance method**  
R. Krücken, W.-T. Chou, J. R. Cooper, C. W. Beausang, C. J. Barton, **M. A. Caprio**, R. F. Casten, A. A. Hecht, J. R. Novak, N. Pietralla, A. Wolf, and N. V. Zamfir, Phys. Rev. C **64**, 017305 (2001).
10. **High-spin states in  $^{203}\text{Rn}$**   
H. Newman, J. R. Novak, C. W. Beausang, C. J. Barton, **M. A. Caprio**, R. F. Casten, J. R. Cooper, A. A. Hecht, R. Krücken, N. Pietralla, A. Wolf, N. V. Zamfir, J.-Y. Zhang, K. E. Zyromski, I. Birriel, and J. Saladin, Phys. Rev. C **64**, 027304 (2001).
11. **Coulomb excitation of the  $2_{\text{ms}}^+$  state of  $^{96}\text{Ru}$  in inverse kinematics**  
N. Pietralla, C. J. Barton, R. Krücken, C. W. Beausang, **M. A. Caprio**, R. F. Casten, J. R. Cooper, A. A. Hecht, H. Newman, J. R. Novak, and N. V. Zamfir, Phys. Rev. C **64**, 031301(R) (2001).
12. **Shape/phase coexistence in  $^{156}\text{Dy}$**   
**M. A. Caprio**, N. V. Zamfir, R. F. Casten, C. J. Barton, C. W. Beausang, J. R. Cooper, A. A. Hecht, R. Krücken, H. Newman, J. R. Novak, N. Pietralla, A. Wolf, and K. E. Zyromski, refereed proceedings, Rom. J. Phys. **46**, 41 (2001).
13. **Lifetimes of quasideuteron configurations in the odd-odd  $N=Z$  nucleus  $^{50}_{25}\text{Mn}_{25}$**   
N. Pietralla, R. Krücken, C. J. Barton, C. W. Beausang, **M. A. Caprio**, R. F. Casten, J. R. Cooper, A. A. Hecht, J. R. Novak, N. V. Zamfir, A. Lisetskiy, and A. Schmidt, Phys. Rev. C **65**, 024317 (2002).
14.  **$^{102}\text{Pd}$ : An E(5) nucleus?**  
N. V. Zamfir, **M. A. Caprio**, R. F. Casten, C. J. Barton, C. W. Beausang, Z. Berant, D. S. Brenner, W. T. Chou, J. R. Cooper, A. A. Hecht, R. Krücken, H. Newman, J. R. Novak, N. Pietralla, A. Wolf, and K. E. Zyromski, Phys. Rev. C **65**, 044325 (2002).
15. **Coulomb excitation of radioactive  $^{132,134,136}\text{Te}$  beams and the low  $B(E2)$  value of  $^{136}\text{Te}$**   
D. C. Radford, C. Baktash, J. R. Beene, B. Fuentes, A. Galindo-Uribarri, C. J. Gross, P. A. Hausladen, T. A. Lewis, P. E. Mueller, E. Padilla, D. Shapira, D. W. Stracener, C.-H. Yu, C. J. Barton, **M. A. Caprio**, L. Coraggio, A. Covello, A. Gargano, D. J. Hartley, and N. V. Zamfir, Phys. Rev. Lett. **88**, 222501 (2002).
16.  **$B(E2)$  values in  $^{150}\text{Nd}$  and the critical point symmetry X(5)**  
R. Krücken, B. Albanna, C. Bialik, R. F. Casten, J. R. Cooper, A. Dewald, N. V. Zamfir, C. J. Barton, C. W. Beausang, **M. A. Caprio**, A. A. Hecht, T. Klug, J. R. Novak, N. Pietralla, and P. von Brentano, Phys. Rev. Lett. **88**, 232501 (2002).
17. **Lifetime and  $B(E2)$  values for the  $3_1^+$  level in  $^{152}\text{Sm}$**   
N. V. Zamfir, H. G. Börner, N. Pietralla, R. F. Casten, Z. Berant, C. J. Barton, C. W. Beausang, D. S. Brenner, **M. A. Caprio**, J. R. Cooper, A. A. Hecht, M. Krtička, R. Krücken, P. Mutti, J. R. Novak, and A. Wolf, Phys. Rev. C **65**, 067305 (2002).
18. **Properties of the low-lying  $K^\pi = 0^+$  excitations in  $^{162}\text{Er}$**   
**M. A. Caprio**, N. V. Zamfir, R. F. Casten, G. C. Ball, K. P. Jackson, P.-A. Amaudruz, and J.-C. Thomas, Phys. Rev. C **66**, 014307 (2002).
19. **High- $j$  proton and neutron alignments in  $\gamma$ -soft  $^{101}\text{Ru}$**   
A. D. Yamamoto, P. H. Regan, C. W. Beausang, F. R. Xu, **M. A. Caprio**, R. F. Casten, G. Gürdal, A. A. Hecht, C. Hutter, R. Krücken, S. D. Langdown, D. Meyer, J. J. Ressler, and N. V. Zamfir, Phys. Rev. C **66**, 024302 (2002).

20. **Structure of low-lying states in  $^{128}\text{Ba}$  from  $\gamma$ - $\gamma$  angular correlations and polarization measurements**  
A. Wolf, N. V. Zamfir, **M. A. Caprio**, Z. Berant, D. S. Brenner, N. Pietralla, R. L. Gill, R. F. Casten, C. W. Beausang, R. Krücken, K. E. Zyranski, C. J. Barton, J. R. Cooper, A. A. Hecht, H. Newman, J. R. Novak, and J. Cederkäll, Phys. Rev. C **66**, 024323 (2002).
21. **Low-spin structure of  $^{156}\text{Dy}$  through  $\gamma$ -ray spectroscopy**  
**M. A. Caprio**, N. V. Zamfir, R. F. Casten, C. J. Barton, C. W. Beausang, J. R. Cooper, A. A. Hecht, R. Krücken, H. Newman, J. R. Novak, N. Pietralla, A. Wolf, and K. E. Zyranski, Phys. Rev. C **66**, 054310 (2002).
22.  **$B(E2)$  values from low-energy Coulomb excitation at an ISOL facility: The  $N = 80, 82$  Te isotopes**  
C. J. Barton, **M. A. Caprio**, D. Shapira, N. V. Zamfir, D. S. Brenner, R. L. Gill, T. A. Lewis, J. R. Cooper, R. F. Casten, C. W. Beausang, R. Krücken, and J. R. Novak, Phys. Lett. B **551**, 269 (2003).
23. **Measurement of  $2_1^+$  level lifetimes in  $^{162}\text{Yb}$  and  $^{162}\text{Er}$  by fast electronic scintillation timing**  
**M. A. Caprio**, N. V. Zamfir, E. A. McCutchan, R. F. Casten, Z. Berant, H. Amro, C. J. Barton, C. W. Beausang, D. S. Brenner, J. R. Cooper, R. L. Gill, G. Gürdal, A. A. Hecht, C. Hutter, R. Krücken, D. A. Meyer, J. R. Novak, N. Pietralla, P. H. Regan, and J. J. Ressler, Eur. Phys. J. A **16**, 177 (2003).
24. **Detailed  $\gamma$ -ray spectroscopy of  $^{55}\text{Cr}$  and  $^{56}\text{Cr}$ : Confirmation of the subshell closure at  $N=32$**   
D. E. Appelbe, C. J. Barton, M. H. Muikku, J. Simpson, D. D. Warner, C. W. Beausang, **M. A. Caprio**, J. R. Cooper, J. R. Novak, N. V. Zamfir, R. A. E. Austin, J. A. Cameron, C. Malcolmson, J. C. Waddington, and F. R. Xu, Phys. Rev. C **67**, 034309 (2003).
25. **Mass measurement of  $^{80}\text{Y}$  by  $\beta$ - $\gamma$  coincidence spectroscopy**  
C. J. Barton, D. S. Brenner, N. V. Zamfir, **M. A. Caprio**, A. Aprahamian, M. C. Wiescher, C. W. Beausang, Z. Berant, R. F. Casten, J. R. Cooper, R. L. Gill, R. Krücken, J. R. Novak, N. Pietralla, M. Shawcross, A. Teymurazyan, and A. Wolf, Phys. Rev. C **67**, 034310 (2003).
26. **Competing core and single particle excitations in the  $2_1^+$  state in  $^{44}\text{Ca}$**   
M. J. Taylor, N. Benczer-Koller, G. Kumbartzki, T. J. Mertzimekis, S. J. Q. Robinson, Y. Y. Sharon, L. Zamick, A. E. Stuchbery, C. Hutter, C. W. Beausang, J. J. Ressler, and **M. A. Caprio**, Phys. Lett. B **559**, 187 (2003).
27. **Signature for vibrational to rotational evolution along the yrast line**  
P. H. Regan, C. W. Beausang, N. V. Zamfir, R. F. Casten, J.-Y. Zhang, A. D. Yamamoto, **M. A. Caprio**, G. Gürdal, A. A. Hecht, C. Hutter, R. Krücken, S. D. Langdown, D. A. Meyer, and J. J. Ressler, Phys. Rev. Lett. **90**, 152502 (2003).
28.  **$B(E2)$  values and the search for the critical point symmetry X(5) in  $^{104}\text{Mo}$  and  $^{106}\text{Mo}$**   
C. Hutter, R. Krücken, A. Aprahamian, C. J. Barton, C. W. Beausang, **M. A. Caprio**, R. F. Casten, W.-T. Chou, R. M. Clark, D. Cline, J. R. Cooper, M. Cromaz, A. A. Hecht, A. O. Macchiavelli, N. Pietralla, M. Shawcross, M. A. Stoyer, C. Y. Wu, and N. V. Zamfir, Phys. Rev. C **67**, 054315 (2003).
29. **Collectivity at high spins in  $^{156}\text{Dy}$**   
P. Petkov, A. Dewald, O. Möller, B. Saha, A. Fitzler, K. Jessen, D. Tonev, T. Klug, S. Heinze, J. Jolie, P. von Brentano, D. Bazzacco, C. Ur, E. Farnea, M. Axiotis, S. Lunardi, C. Rossi-Alvarez, G. de Angelis, D. R. Napoli, N. Marginean, T. Martinez, **M. A. Caprio**, and R. F. Casten, Phys. Rev. C **68**, 034328 (2003).
30. **Evidence for chiral symmetry breaking in  $^{140}\text{Eu}$ ?**  
A. A. Hecht, C. W. Beausang, H. Amro, C. J. Barton, Z. Berant, **M. A. Caprio**, R. F. Casten, J. R. Cooper, D. J. Hartley, R. Krücken, D. A. Meyer, H. Newman, J. R. Novak, N. Pietralla, J. J. Ressler, A. Wolf, N. V. Zamfir, J.-Y. Zhang, and K. E. Zyranski, Phys. Rev. C **68**, 054310 (2003).
31. **Low spin states in  $^{162}\text{Yb}$  and the X(5) critical point symmetry**  
E. A. McCutchan, N. V. Zamfir, **M. A. Caprio**, R. F. Casten, H. Amro, C. W. Beausang, D. S. Brenner, A. A. Hecht, C. Hutter, S. D. Langdown, D. A. Meyer, P. H. Regan, J. J. Ressler, and A. D. Yamamoto, Phys. Rev. C **69**, 024308 (2004).

32. **Transition from the seniority regime to collective motion**  
J. J. Ressler, R. F. Casten, N. V. Zamfir, C. W. Beausang, R. B. Cakirli, H. Ai, H. Amro, **M. A. Caprio**, A. A. Hecht, A. Heinz, S. D. Langdown, E. A. McCutchan, D. A. Meyer, C. Plettner, P. H. Regan, M. J. S. Sciacchitano, and A. D. Yamamoto, *Phys. Rev. C* **69**, 034317 (2004).
33.  **$g$  factor of the  $2_1^+$  state of  $^{164}\text{Yb}$**   
Z. Berant, A. Wolf, N. V. Zamfir, **M. A. Caprio**, D. S. Brenner, N. Pietralla, R. L. Gill, R. F. Casten, C. W. Beausang, R. Krücken, C. J. Barton, J. R. Cooper, A. A. Hecht, D. M. Johnson, J. R. Novak, H. Cheng, B. F. Albanna, and G. Gürdal, *Phys. Rev. C* **69**, 034320 (2004).
34. **Isomer decay tagging in the heavy nuclei:  $^{210}\text{Ra}$  and  $^{209}\text{Ra}$**   
J. J. Ressler, C. W. Beausang, H. Ai, H. Amro, **M. A. Caprio**, R. F. Casten, A. A. Hecht, S. D. Langdown, E. A. McCutchan, D. A. Meyer, P. H. Regan, M. J. S. Sciacchitano, A. Yamamoto, and N. V. Zamfir, *Phys. Rev. C* **69**, 034331 (2004).
35. **Test of calculations with single-particle density dependent pairing in  $^{132}\text{Te}$**   
R. O. Hughes, N. V. Zamfir, R. F. Casten, D. C. Radford, C. J. Barton, C. Baktash, **M. A. Caprio**, A. Galindo-Uribarri, C. J. Gross, P. A. Hausladen, E. A. McCutchan, J. J. Ressler, D. Shapira, D. W. Stracener, and C.-H. Yu, *Phys. Rev. C* **69**, 051303(R) (2004).
36. **Possible assignment of chiral twin bands in  $^{188}\text{Ir}$**   
D. L. Balabanski, M. Danchev, D. J. Hartley, L. L. Riedinger, O. Zeidan, J.-Y. Zhang, C. J. Barton, C. W. Beausang, **M. A. Caprio**, R. F. Casten, J. R. Cooper, A. A. Hecht, R. Krücken, J. R. Novak, N. V. Zamfir, and K. E. Zyromski, *Phys. Rev. C* **70**, 044305 (2004).
37.  **$\gamma$ -ray spectroscopy of  $^{166}\text{Hf}$ : X(5) in  $N > 90$ ?**  
E. A. McCutchan, N. V. Zamfir, R. F. Casten, **M. A. Caprio**, H. Ai, H. Amro, C. W. Beausang, A. A. Hecht, D. A. Meyer, and J. J. Ressler, *Phys. Rev. C* **71**, 024309 (2005).
38.  **$\gamma$ -ray spectroscopy of  $^{132}\text{Te}$  through  $\beta$  decay of a  $^{132}\text{Sb}$  radioactive beam**  
R. O. Hughes, N. V. Zamfir, D. C. Radford, C. J. Gross, C. J. Barton, C. Baktash, **M. A. Caprio**, R. F. Casten, A. Galindo-Uribarri, P. A. Hausladen, E. A. McCutchan, J. J. Ressler, D. Shapira, D. W. Stracener, and C.-H. Yu, *Phys. Rev. C* **71**, 044311 (2005).
39. **Electromagnetic transition strengths in  $^{156}\text{Dy}$**   
O. Möller, A. Dewald, P. Petkov, B. Saha, A. Fitzler, K. Jessen, D. Tonev, T. Klug, S. Heinze, J. Jolie, P. von Brentano, D. Bazzacco, C. A. Ur, E. Farnea, M. Axiotis, S. Lunardi, G. de Angelis, D. R. Napoli, N. Marginean, T. Martinez, **M. A. Caprio**, and R. F. Casten, *Phys. Rev. C* **74**, 024313 (2006).
40. **Lifetimes and electromagnetic transition strengths in  $^{155}\text{Dy}$**   
P. Petkov, M. S. Yavahchova, O. Möller, A. Dewald, D. Tonev, B. Saha, A. Fitzler, K. Jessen, T. Klug, S. Heinze, J. Jolie, P. von Brentano, N. Goutev, D. Bazzacco, C. A. Ur, E. Farnea, M. Axiotis, S. Lunardi, G. de Angelis, D. R. Napoli, N. Marginean, T. Martinez, and **M. A. Caprio**, *Phys. Rev. C* **88**, 034323 (2013).
41. **Low-lying bands with different quadrupole deformation in  $^{155}\text{Dy}$**   
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29. **Nuclear structure and triaxiality with the algebraic collective model**  
M. A. Caprio, D. J. Rowe, and T. A. Welsh, in *Capture Gamma-Ray Spectroscopy and Related Topics*, ed. A. Blazhev, J. Jolie, N. Warr, and A. Zilges, AIP Conf. Proc. No. 1090 (AIP, Melville, New York, 2009), p. 534.
30. **Generalized seniority in a major shell with realistic interactions**  
M. A. Caprio, F. Q. Luo, K. Cai, Ch. Constantinou, and V. Hellemans, in *Beauty in Physics: Theory and Experiment*, ed. R. Bijker *et al.*, AIP Conf. Proc. No. 1488 (AIP, Melville, New York, 2012), p. 212.
31. **Tidal wave in  $^{102}\text{Pd}$ : Rotating condensate of up to seven  $d$ -bosons**  
S. Frauendorf, M. A. Caprio, and J. Sun, in *Capture Gamma-Ray Spectroscopy and Related Topics*, ed. P. E. Garrett and B. Hadinia (World Scientific, Singapore, 2013), p. 158.
32. **Halo nuclei with the Coulomb-Sturmian basis**  
M. A. Caprio, P. Maris, and J. P. Vary, in *Proceedings of the International Conference Nuclear Theory in the Supercomputing Era 2013*, ed. A. M. Shirokov and A. I. Mazur (Pacific National University, Khabarovsk, Russia, 2014), p. 325.
33. ***Ab initio* no core shell model — Recent results and further prospects**  
J. P. Vary, P. Maris, H. Potter, M. A. Caprio, R. Smith, S. Binder, A. Calci, J. Langhammer, R. Roth, H. M. Aktulga, E. Ng, C. Yang, D. Oryspayev, M. Sosonkina, and U. Catalyurek, in *Proceedings of the International Conference Nuclear Theory in the Supercomputing Era 2014* (Pacific National University, Khabarovsk, Russia, 2016), p. 154.

**INVITED TALKS**

*at conferences, professional society meetings, universities, national laboratories, and schools*

1. **Experiments on critical point nuclei**  
Seminar, *Argonne National Laboratory (ANL)*, Argonne, Illinois, March 2002.
2. **Experiments on critical point nuclei**  
*International Conference on Nuclear Structure*, Moran, Wyoming, May 2002.
3. **Softness to deformation in transitional nuclear structure**  
Seminar, *European Centre for Theoretical Studies in Nuclear Physics and Related Areas (ECT\*)*, Villazzano (Trento), Italy, July 2003.
4. **Quantum phase transitions in two-fluid systems**  
*Workshop on Nuclei and Mesoscopic Physics*, East Lansing, Michigan, October 2004.
5. **Phase structure of the proton-neutron system**  
Seminar, *State University of New York at Stony Brook*, Stony Brook, New York, February 2005.
6. **Dynamical symmetries in proton-neutron systems**  
*Gordon Research Conference on Nuclear Chemistry*, New London, New Hampshire, June/July 2005.
7. **Phase structure of the proton-neutron system**  
*Symmetries and Low-Energy Phase Transitions in Nuclear Structure Physics*, Camerino, Italy, October 2005.
8. **Phase structure of the proton-neutron system**  
Seminar, *Institute for Nuclear Theory, University of Washington*, Seattle, Washington, January 2006.
9. **Phase structure of a two-fluid bosonic system**  
Seminar, *Rutgers University*, Piscataway, New Jersey, January 2006.
10. **Proton-neutron asymmetry in nuclei**  
Seminar, *University of Notre Dame*, Notre Dame, Indiana, March 2006.
11. **Collective nuclear structure and proton-neutron asymmetry**  
Colloquium, *Saint Mary's University*, Halifax, Nova Scotia, Canada, May 2006.
12. **Proton-neutron asymmetry in exotic nuclei**  
*Rare Isotope Accelerator Theory Meeting*, Argonne, Illinois, April 2006.
13. **Proton-neutron asymmetry in nuclear structure**  
Seminar, *University of York*, Heslington, York, United Kingdom, June 2006.
14. **Excited state quantum phase transitions: Level density singularity and finite size scaling**  
*Workshop on Shape Phase Transitions and Critical Point Phenomena in Nuclei*, Athens, Greece, November 2006.
15. **Nuclei, quantum phase transitions, and mesoscopic systems**  
Colloquium, *University of Notre Dame*, Notre Dame, Indiana, November 2006.
16. **Nuclear quantum phase transitions**  
*Excellence in Basic and Applied Nuclear Science*, Monterey, California, June 2007.
17. **Excited state quantum phase transitions in pairing systems**  
*New Approaches in Nuclear Many-Body Theory (INT-07-3)*, Seattle, Washington, October 2007.
18. **Excited state quantum phase transitions in mesoscopic systems**  
Mesoscopic Theory Lecture, *Michigan State University*, East Lansing, Michigan, November 2007.

19. **Excited state quantum phase transitions**  
Seminar, *Argonne National Laboratory* (ANL), Argonne, Illinois, December 2007.
20. **Quantum phase transitions in finite many-body systems**  
*American Chemical Society*, New Orleans, Louisiana, April 2008.
21. **Modern trends in physics education**  
Panel, *Today's Physics for Tomorrow's World* (Yale Physics Alumni Conference), New Haven, Connecticut, November 2008.
22. **Algebraic methods for the Bohr Hamiltonian**  
Seminar, *Università degli Studi di Padova*, Padova, Italy, May 2009.
23. **Nuclear structure with the algebraic collective model**  
Seminar, *University of York*, Heslington, York, United Kingdom, May 2009.
24. **Phonon and multiphonon excitations by exact diagonalization of the Bohr Hamiltonian**  
*Gordon Research Conference on Nuclear Chemistry*, New London, New Hampshire, June 2009.
25. **Coupling coefficients for SO(5) with applications to nuclear physics**  
*International Symposium Symmetries in Science XIV*, Bregenz, Austria, July 2009.
26. **Geometric models: New results, opportunities, and challenges**  
*Workshop on Shape Phase Transitions and Critical Point Phenomena in Nuclei*, İstanbul, Turkey, September 2009.
27. **Algebraic methods for the geometric Hamiltonian**  
Seminar, *Yale University*, New Haven, Connecticut, October 2009.
28. **Algebraic methods for the nuclear geometric description**  
*Joint Meeting of the American Physical Society and American Association of Physics Teachers*, Washington, District of Columbia, February 2010.
29. **Symmetries in nuclei: Methods and applications**  
Seminar, *Lawrence Livermore National Laboratory* (LLNL), Livermore, California, August 2010.
30. **Symmetries and the geometric description of nuclear structure. I. The geometric description**  
Lecture, *The Seventh International Balkan School on Nuclear Physics: Nuclear Structure Challenges with Radioactive Beams*, Adrasan, Turkey, September 2010.
31. **Symmetries and the geometric description of nuclear structure. II. Symmetries in the nuclear problem**  
Lecture, *The Seventh International Balkan School on Nuclear Physics: Nuclear Structure Challenges with Radioactive Beams*, Adrasan, Turkey, September 2010.
32. **Symmetries in nuclei: New methods and applications**  
Seminar, *Michigan State University*, East Lansing, Michigan, November 2010.
33. **Coupling coefficients for general subgroup chains**  
Seminar, *Louisiana State University*, Baton Rouge, Louisiana, January 2011.
34. **Symmetry methods for the nuclear shell model**  
Seminar, *University of Wisconsin*, Madison, Wisconsin, March 2011.
35. **Symmetry methods for the nuclear many-body problem**  
Seminar, *University of Iowa*, Iowa City, Iowa, March 2011.
36. **Symmetry methods for the nuclear shell model**  
Seminar, *Iowa State University*, Ames, Iowa, March 2011.

37. **Symmetries in nuclei: From isospin to rotations in five dimensions**  
Seminar, *Grinnell College*, Grinnell, Iowa, April 2011.
38. **Taming the nucleus: Symmetries and the computational scale explosion**  
Colloquium, *Dartmouth College*, Hanover, New Hampshire, April 2011.
39. **Symmetries in nuclei: New methods and applications**  
*APS April Meeting*, Garden Grove, California, April/May 2011.
40. **Quantum phase transitions in algebraic models**  
*Gordon Research Conference on Nuclear Chemistry*, New London, New Hampshire, June 2011.
41. **Computational problem solving in the undergraduate physics major**  
*Cottrell Scholar Conference*, Tucson, AZ, July 2011.
42. **Taming the computational scale explosion in the nuclear many-body problem**  
Seminar, *University of Notre Dame*, Notre Dame, Indiana, May 2012.
43. **Generalized seniority in a major shell with realistic interactions**  
*Beauty in Physics: Theory and Experiment*, Cocoyoc, Mexico, May 2012.
44. **The no-core shell model with general radial bases**  
*Horizons of Innovative Theories, Experiments, and Supercomputing in Nuclear Physics*, New Orleans, Louisiana, June 2012.
45. **The Coulomb-Sturmian basis for the nuclear many-body problem**  
Seminar, *Lawrence Livermore National Laboratory (LLNL)*, Livermore, California, July 2012.
46. **The no-core shell model with general radial bases**  
Seminar, *Lawrence Berkeley National Laboratory (LBNL)*, Berkeley, California, July 2012.
47. **The Coulomb-Sturmian basis for the nuclear many-body problem**  
Seminar, *Yale University*, New Haven, Connecticut, November 2012.
48. **The no-core shell model with general radial bases**  
Seminar, *Rutgers University*, Piscataway, New Jersey, December 2012.
49. **Convergence of NCCI calculations for light  $p$ -shell nuclei with the Coulomb-Sturmian basis**  
*International Conference on Nuclear Theory in the Supercomputing Era*, Ames, IA, May 2013.
50. **Halo nuclei with the Coulomb-Sturmian basis**  
Seminar, *Lawrence Livermore National Laboratory (LLNL)*, Livermore, California, August 2013.
51. **The Coulomb-Sturmian basis in *ab initio* no-core configuration interaction calculations**  
Seminar, *Lawrence Berkeley National Laboratory (LBNL)*, Berkeley, California, August 2013.
52. ***Ab initio* emergence of rotational nuclear structure**  
Seminar, *Lawrence Berkeley National Laboratory (LBNL)*, Berkeley, California, July 2014.
53. **Emergence of rotation in *ab initio* no-core configuration interaction calculations**  
Seminar, *Lawrence Livermore National Laboratory (LLNL)*, Livermore, California, July 2014.
54. **Geometric collective models**  
Lecture, *TALENT Course: Theory for Exploring Nuclear Structure Experiments*, Caen, France, August 2014.
55. **Emergence of collective behavior from *ab initio* methods**  
Lecture, *TALENT Course: Theory for Exploring Nuclear Structure Experiments*, Caen, France, August 2014.



56. ***Ab initio* emergence of rotational nuclear structure**  
General Seminar, *Institutul Național de Fizică și Inginerie Nucleară Horia Hulubei (IFIN-HH)*, București-Măgurele, Romania, August 2014.
57. **Emergence of rotational collectivity in *ab initio* no-core configuration interaction calculations**  
*Advanced Many-Body and Statistical Methods in Mesoscopic Systems II*, Brașov, Romania, September 2014.
58. **The emergence of nuclear rotational excitations**  
Colloquium, *University of Oklahoma*, Norman, Oklahoma, November 2014.
59. **Emergence of nuclear rotation in *ab initio* calculations**  
Seminar, *Yale University*, New Haven, Connecticut, December 2014.
60. ***Ab initio* emergence of rotational nuclear structure**  
Seminar, *Michigan State University*, East Lansing, Michigan, March 2015.
61. ***Ab initio* emergence of rotation in nuclei**  
Seminar, *Peking University*, Beijing, China, July 2015.
62. ***Ab initio* emergence of rotation in nuclei**  
Seminar, *Huzhou University*, Huzhou, China, July 2015.
63. ***Ab initio* emergence of rotation in nuclei**  
Seminar, *Shandong University*, Weihai, China, July 2015.
64. **Nuclear rotation in *ab initio* no-core configuration interaction calculations**  
*Advances in computations of nuclear structure and nuclear forces*, Beijing, China, August 2015.
65. ***Ab initio* emergence of rotation in the Be isotopes**  
*Properties of exotic nuclei and asymmetric nuclear matter*, Lanzhou, China, August 2015.
66. ***Ab initio* emergence of rotation in light nuclei**  
Seminar, *Lawrence Livermore National Laboratory (LLNL)*, Livermore, California, October 2015.
67. ***Ab initio* emergence of rotation in light nuclei**  
Seminar, *Ohio State University*, Columbus, Ohio, November 2015.
68. ***Ab initio* emergence of rotation in light nuclei**  
Seminar, *Ohio University*, Athens, Ohio, November 2015.
69. **Nuclei from scratch: *Ab initio* calculations and the emergence of rotation**  
Colloquium, *Illinois State University*, Normal, Illinois, November 2015.
70. ***Ab initio* structure of light nuclei with a natural orbital basis**  
Seminar, *Nuclear Physics Institute, Czech Academy of Sciences*, Řež, Czech Republic, September 2016.
71. **Natural orbitals for *ab initio* calculations of light nuclei**  
Seminar, *Institut für Kernphysik, Technische Universität Darmstadt*, Darmstadt, Germany, September 2016.
72. **Natural orbitals for *ab initio* calculations**  
*CUSTIPEN-IMP-PKU Workshop on Physics of Exotic Nuclei*, Huizhou, China, December 2016.
73. **Symplectic no-core configuration interaction framework for *ab initio* nuclear structure**  
*Advanced many-body and statistical methods in mesoscopic systems*, Bușteni, Romania, September 2017.
74. **Nuclei from scratch: *Ab initio* nuclear structure and emergent symmetries**  
Seminar, *Vietnam National University, University of Science*, Hà Nội, Vietnam, October 2017.
75. **Symplectic no-core configuration interaction framework for *ab initio* nuclear structure**  
Seminar, *TRIUMF*, Vancouver, British Columbia, October 2017.

76. **Symplectic no-core configuration interaction framework for *ab initio* nuclear structure**  
Seminar, *Michigan State University*, East Lansing, Michigan, November 2017.