## CURRICULUM VITAE

## Ryan Edward Mitchell

Indiana University Physics Department Bloomington, IN 47405-7105 remitche@indiana.edu

EDUCATION	Ph.D. Physics, University of Tennessee, Knoxville, TN USA	1997 - 2003
	B.A. Physics and B.S. Mathematics, North Central College, Naperville, IL USA	1993 - 1997
SPECIALIZATION	Experimental Particle and Nuclear Physics	
APPOINTMENTS	Associate Scientist, Indiana University Chinese Academy of Sciences Fellowship, Institute of High Energy Physics, Beijing, China Assistant Scientist, Indiana University Research Associate, Indiana University Visiting Fellow, Wilson Laboratory, Cornell University Teaching Associate, Cornell University Postdoctoral Fellow, Indiana University Research Assistant, University of Tennessee Teaching Assistant, University of Tennessee INFN Fellowship, Milan, Italy	$\begin{array}{r} 2012-\text{present}\\ 2013,\ 2017\\ 2008-2012\\ 2007-2008\\ 2006-2008\\ 2007\\ 2004-2007\\ 2000-2003\\ 1997-2000,\ 2003\\ 2002 \end{array}$
RESEARCH HIGHLIGHTS	Member of the BESIII Collaboration member of the BESIII executive board (2017-present); convener of the charmonium group (2013-present); developed proposals to study heavy quark exotic mesons; participated in discoveries of new exotic XYZ mesons;	2009 - present
	extensive involvement in the analysis of data, including: $J/\psi$ radiative decays, new decays of the Y(4260), $e^+e^-$ cross sections, $dE/dx$ calibrations	
	extensive involvement in the analysis of data, including: $J/\psi$ radiative decays, new decays of the Y(4260),	$2015 - \mathrm{present}$
	<ul> <li>extensive involvement in the analysis of data, including: J/ψ radiative decays, new decays of the Y(4260), e<sup>+</sup>e<sup>-</sup> cross sections, dE/dx calibrations</li> <li>Member of the Particle Data Group (PDG) Meson Team encoding and maintaining current particle properties; co-author of the "Naming Scheme for Hadrons";</li> </ul>	2015 – present 2008 – present

	elected member of the collaboration board (2011–2014); chair of the physics working group (2009–2012); development of analysis software; R&D for the forward calorimeter and the time-of-flight detector Member of the Quarkonium Working Group topic convener for spectroscopy (2012–present); liaison for the CLEO experiment (2011–2012); co-author of an extensive review of quarkonium	
	Member of the CLEO Collaboration $2006 - 2012$ deputy run manager (2007-2008); trigger expert (2006-2008); observation of an anomalously large rate for $e^+e^- \rightarrow \pi^+\pi^-h_c$ ; measurement of M1 radiative transitions from the $J/\psi$ and $\psi(2S)$	
	Analysis of Brookhaven E852 Data $2004 - 2006$ search for exotic mesons in $\pi p \to 3\pi p$	
	Member of the Fermilab E831 (Focus) Collaboration $1997 - 2004$ photoproduction of $K^+K^-$ and observation of $K^+K^-(1750)$	
	Member of the Fermilab BTeV Collaboration1997 - 2004simulations of charged-particle tracking and identification	
PUBLICATION HIGHLIGHTS	<ol> <li>M. Ablikim et al. [BESIII Collaboration], "Observation of e<sup>+</sup>e<sup>-</sup> → KKJ/ψ at center-of-mass energies from 4.189 to 4.600 GeV," Phys. Rev. D 97, 071101 (2018) [arXiv:1802.01216 [hep-ex]].</li> <li>→ Evidence is found for Y(4260) → KKJ/ψ, but there are unexplained differ- ences with Y(4260) → ππJ/ψ.</li> </ol>	
	<ul> <li>2. M. Ablikim et al. [BESIII Collaboration], "Evidence for e<sup>+</sup>e<sup>-</sup> → γη<sub>c</sub>(1S) at center-of-mass energies between 4.01 and 4.60 GeV," Phys. Rev. D 96, no. 5, 051101 (2017) [arXiv:1705.06853 [hep-ex]].</li> <li>→ The measurement of this radiative decay offers support for the hybrid meson interpretation of the Y(4260).</li> </ul>	
	<ul> <li>3. R. F. Lebed, R. E. Mitchell and E. S. Swanson, "Heavy-Quark QCD Exotica," Prog. Part. Nucl. Phys. 93, 143 (2017) [arXiv:1610.04528 [hep-ph]].</li> <li>→ A comprehensive review article covering both the theoretical and experimental status of exotic heavy quark hadrons.</li> </ul>	
	<ul> <li>4. C. Patrignani <i>et al.</i> [Particle Data Group], "Review of Particle Physics," Chin. Phys. C 40, no. 10, 100001 (2016).</li> <li>→ The definitive collection of particle properties, including timely review articles.</li> </ul>	
	<ul> <li>5. M. R. Shepherd, J. J. Dudek and R. E. Mitchell, "Searching for the rules that govern hadron construction," Nature 534, no. 7608, 487 (2016).</li> <li>→ An easily accessible overview of the goals of hadron spectroscopy.</li> </ul>	
	<ul> <li>6. R. A. Briere, F. A. Harris and R. E. Mitchell, "Physics Accomplishments and Future Prospects of the BES Experiments at the BEPC Collider," Annual Review of Nuclear and Particle Science 66, 143 (2016) [arXiv:1603.09431 [hep-ex]].</li> <li>→ A review article covering the history of the BES experiments, including BES, BESII, and BESIII.</li> </ul>	
	<ol> <li>R. A. Briceno <i>et al.</i>, "Issues and Opportunities in Exotic Hadrons," Chin. Phys. C 40, no. 4, 042001 (2016) [arXiv:1511.06779 [hep-ph]].</li> </ol>	

 $\rightarrow$  A white paper that resulted from a 2015 INT workshop I co-organized.

- 8. R. E. Mitchell, "The XYZ States of Charmonium and the BESIII Experiment," American Physical Society Topical Group on Hadron Physics Newsletter, September (2013).
  - $\rightarrow$  A summary of the first few months of exotic charmonium searches at BESIII.
- 9. M. Ablikim *et al.* [BESIII Collaboration], "Observation of a charged charmoniumlike structure in  $e^+e^- \rightarrow \pi^+\pi^- J/\psi$  at  $\sqrt{s} = 4.26$  GeV," Phys. Rev. Lett. **110**, 252001 (2013) [arXiv:1303.5949 [hep-ex]].

- 10. G. S. Adams *et al.* [CLEO Collaboration], "Amplitude analyses of the decays χ<sub>c1</sub> → ηπ<sup>+</sup>π<sup>-</sup> and χ<sub>c1</sub> → η'π<sup>+</sup>π<sup>-</sup>," Phys. Rev. D 84, 112009 (2011) [arXiv:1109.5843 [hep-ex]].
  → Includes the first observation of a state with exotic J<sup>PC</sup> in decays of charmo-
- 11. B. D. Schaefer, R. E. Mitchell, P. McChesney, M. R. Shepherd and J. M. Frye, "Radiation Damage of F8 Lead Glass with 20 MeV Electrons," Nucl. Instrum. Meth. B 274, 111 (2012) [arXiv:1107.3332 [physics.ins-det]].
  → Results from a test-beam carried out at the IU Cyclotron Facility.
- 12. T. K. Pedlar *et al.* [CLEO Collaboration], "Observation of the  $h_c(1P)$  using  $e^+e^-$  collisions above  $D\bar{D}$  threshold," Phys. Rev. Lett. **107**, 041803 (2011) [arXiv:1104.2025 [hep-ex]].  $\rightarrow A$  surprising observation of copious  $h_c(1P)$  production at high  $e^+e^-$  collision
- energy, which indirectly led to the discovery of the h<sub>b</sub>(1P).
  13. N. Brambilla et al., "Heavy quarkonium: progress, puzzles, and opportunities," Eur. Phys. J. C 71, 1534 (2011) [arXiv:1010.5827 [hep-ph]].
  - $\rightarrow$  A comprehensive review article on heavy quarkonium.

nium.

- 14. P. Guo, R. Mitchell and A. P. Szczepaniak, "The role of P-wave inelasticity in  $J/\psi$  to  $\pi^+\pi^-\pi^0$ ," Phys. Rev. D 82, 094002 (2010) [arXiv:1006.4371 [hep-ph]].  $\rightarrow$  An experiment-theory collaboration to attempt to understand the shape of the  $\rho$  meson in  $J/\psi \rightarrow \rho\pi$ .
- 15. R. E. Mitchell *et al.* [CLEO Collaboration], " $J/\psi$  and  $\psi(2S)$  Radiative Decays to  $\eta_c$ ," Phys. Rev. Lett. **102**, 011801 (2009) [Erratum-ibid. **106**, 159903 (2011)] [arXiv:0805.0252 [hep-ex]].
  - $\rightarrow$  Measurements of M1 radiative transitions, but with an unexpected observation of a distorted  $\eta_c(1S)$  line-shape.
- 16. A. R. Dzierba *et al.*, "A partial wave analysis of the  $\pi^-\pi^-\pi^+$  and  $\pi^-\pi^0\pi^0$  systems and the search for a  $J^{PC} = 1^{-+}$  meson," Phys. Rev. D **73**, 072001 (2006) [arXiv:hep-ex/0510068].
  - $\rightarrow$  A negative search for the  $J^{PC}$ -exotic  $\pi_1(1600)$ .
- 17. J. M. Link *et al.* [FOCUS Collaboration], "Observation of a 1750 MeV/ $c^2$  enhancement in the diffractive photoproduction of  $K^+K^-$ ," Phys. Lett. B **545**, 50 (2002) [arXiv:hep-ex/0208027].

OTHER	Member of the International Advisory Committee for the	
PROFESSIONAL	Super Tau/Charm Factory in Novosibirsk, Russia	2018 - present
ACTIVITIES	Member of the International Organizing Committee for Charm 2018	2018
	Organizer for the 2017 BESIII/GlueX Workshop on Common Topics	2017
	(held at the IU Gateway Office in Beijing, China)	

 $<sup>\</sup>rightarrow$  Discovery of the  $Z_c(3900)$ , an electrically charged particle that is a strong tetraquark candidate.

 $<sup>\</sup>rightarrow$  Doctoral work on photoproduction using data from the FOCUS Experiment.

	Organizer for an Institute of Nuclear Theory Workshop on Exotic H Organizer for the Jinan XYZ Workshop Reviewer for Physical Review Letters Reviewer for Physics Letters B Reviewer for Chinese Physics C Grant reviews for the Austrian Science Fund Grant reviews for DOE Nuclear Physics	$\begin{array}{rl} \text{Iadrons} & 2015 \\ 2015 \\ 2017 - \text{present} \\ 2012 - \text{present} \\ 2015 - \text{present} \\ 2014 \\ 2011, 2015, 2016 \\ \end{array}$
TEACHING EXPERIENCE	Supplemental Teaching, Indiana University Upper-Level Undergraduate Mechanics	Spring 2015
	Teaching Associate, Cornell University Intro Heat and Electromagnetism Lab	Spring 2007
	Experimental Techniques Seminar Course, Indiana University	Fall 2004
	Teaching Assistantships, University of Tennessee Intro Physics Lab I and II for Biology Majors (with recitation) Intro Physics Lab I and II for Engineers, Honors Physics Lab	
GRADUATE MENTORING	William Imoehl, Indiana University (primary advisor) Evidence for a new $X(3872)$ decay mode at BESIII.	2017 – present
	Manuel Lara, Indiana University (primary advisor) Analysis of $Y(4260) \rightarrow \gamma \eta_c$ decays at BESIII	2011 - 2016
	Dan Bennett, Indiana University (dissertation committee member) Analysis of $Y(4260) \rightarrow KKJ/\psi$ decays at BESIII	2010 - 2017
	Brad Schaefer, Indiana University (primary advisor) Radiation damage tests of the GlueX Forward Calorimeter; Analysis of $J/\psi$ and $\psi(2S)$ decays at BESIII	2008 - 2012
	Jake Bennett, Indiana University (dissertation committee member) Simulations of exotic mesons at GlueX; Analysis of $J/\psi$ radiative decays at BESIII	2009 - 2014
UNDER- GRADUATE	Tyler Smith, Indiana University Analysis of $\psi(3770)$ radiative transitions at CLEO	2009 - 2010
MENTORING	Jake Bennett, Cornell University REU program Analysis of $\chi_{cJ}$ radiative decays to light quarks in CLEO	Summer 2007
	Jonathan Dickey and Matt Mikels, Indiana University Analysis of $\eta$ and $\eta'$ mesons in Brookhaven's E852 experiment	Summer 2005
	Robert Koffie, Indiana University Measurements of properties of scintillator bars using lasers	Fall 2004
	Matt Mikels, Indiana University Particle identification algorithms in the GlueX detector	Summer 2004

SELECT SERVICE ACTIVITIES	Member of the IU Graduate Admissions Committee2015 – presentRoom coordinator at the IU Science Open House2014, 2017Outstanding Junior Scientist Judge (Indiana Junior Academy of Science)2014Judge at the Science Olympiad State Tournament2014, 2015Co-advisor for the IU Physics Club2011 – 2012Member of the Graduate Recruiting Committee, IU2009 – 2012, 2015Member of the Outreach Committee, IU2010Abstract Judge for the Indiana Junior Academy of Science2009
TALKS (Conferences, Seminars, Colloquia)	<ol> <li>"Open Questions in Spectroscopy at BESIII," Exotic Hadrons Workshop (Stony Brook, NY), May 29, 2018.</li> </ol>
	2. "Prospects for Charm Physics at a Super $\tau$ -charm Factory," Charm 2018 Satellite Workshop (Novosibirsk, Russia), May 26, 2018.
	<ol> <li>"Quarks in China," Indiana University History and Philosophy of Science Collo- quium (Bloomington, IN), March 29, 2018.</li> </ol>
	<ol> <li>"Spectroscopy at BESIII: Open Questions," Joint BESIII-LHCb Workshop (Bei- jing, China), February 9, 2018.</li> </ol>
	<ol> <li>"Highlights from Hadron Physics at the BESIII Experiment," Reimei Workshop on Hadronic Resonances and Dense Nuclear Matter (Tokai, Japan), December 12, 2017.</li> </ol>
	<ol> <li>"Experimental Aspects of Heavy Quark Exotica: A Tour of the XYZ," Hadron 2017 (Salamanca, Spain), September 28, 2017.</li> </ol>
	7. "Puzzles in Hadron Physics at the BESIII Experiment," The Seventh Asia-Pacific Conference on Few-Body Problems (Guilin, China), August 26, 2017.
	8. "Introduction to the Workshop," BESIII/GlueX: A Workshop on Common Topics (Beijing, China), August 17, 2017.
	9. "The Experimental Status of Heavy Hadrons," The Charm and Beauty of Strong Interactions (ECT <sup>*</sup> ) (Trento, Italy), July 19, 2017.
	<ol> <li>"Exploring Charmonium with the BESIII Experiment," IU Reaction Theory Summer School (Bloomington, IN), June 22, 2017.</li> </ol>
	<ol> <li>"Quarks in China: A Review of Physics at BESIII," Indiana University HEP Seminar (Bloomington, IN), April 17, 2017.</li> </ol>
	12. "Results from $e^+e^-$ Collisions at BESIII," 38th International Conference of High Energy Physics (ICHEP) (Chicago, IL), August 4, 2016.
	<ol> <li>"Future Opportunities at BESIII," 2016 Quarkonium Working Group Workshop (Richland, WA), June 10, 2016.</li> </ol>
	<ol> <li>"Quarks in China: Past, Present, Future," University of Hawaii Physics Collo- quium (Honolulu, HI), March 31, 2016.</li> </ol>
	<ol> <li>"An Overview of the Z States," The Power of Spectroscopy in QCD (ECT*) (Trento, Italy), February 10, 2016.</li> </ol>
	<ol> <li>"An Overview of the XYZ Mesons: Experimental Issues," Institute of Nuclear Theory Workshop on Exotic Hadrons (Seattle, WA), November 2, 2015.</li> </ol>
	17. "Notes on $e^+e^-$ Cross Sections: a brief review of where we are," Jinan XYZ Workshop (Jinan, China), June 8, 2015.
	<ol> <li>"Experimental Status of the XYZ Mesons: Connections and Complexities," Con- ference at the Intersections of Particle and Nuclear Physics (Vail, CO), May 22, 2015.</li> </ol>

- "Experiments in Charmonium," University of Hawaii Colloquium (Honolulu, HI), February 26, 2015.
- "Analysis Opportunities in Charmonium," Future Directions in Spectroscopy Workshop (Newport News, VA), November 19, 2014.
- 21. "Connecting the XYZ States at BESIII," University of Hawaii Seminar (Honolulu, HI), October 14, 2014.
- 22. "Connecting the XYZ at BESIII," APS-DNP Hawaii Meeting (Waikoloa, HI), October 7, 2014.
- "Studying QCD with Charmonium and Bottomonium," NSAC Town Hall Meeting (Philadelphia, PA), September 14, 2014.
- 24. "Connecting the XYZ States at BESIII," Ohio University Seminar (Athens, OH), February 25, 2014.
- 25. "Connecting the XYZ at BESIII," Bormio 2014 (Bormio, Italy), January 31, 2014.
- 26. "Charmonium Spectroscopy and the Role of BESIII," HIC4FAIR Colloquium (Giessen, Germany), January 23, 2014.
- 27. "Connecting the XYZ at BESIII," Hadron 2013 (Nara, Japan), November 4, 2013.
- "Charmonium Spectroscopy, the XYZ States, and the Role of BESIII," SLAC Seminar (Stanford, CA), October 15, 2013.
- 29. "Charmonium Spectroscopy, the XYZ States, and the Role of BESIII," LBNL Seminar (Berkeley, CA), October 10, 2013.
- "Charmonium Spectroscopy, the XYZ States, and the Role of BESIII," University of Science and Technology of China (USTC) Seminar (Hefei, China), September 13, 2013.
- "The Experimental Foundations of Quarks," Nankai University Lecture (Tianjin, China), July 11, 2013.
- 32. "Charmonium Spectroscopy, the XYZ States, and the Role of BESIII," Nankai University Seminar (Tianjin, China), July 11, 2013.
- "Prospects for Future Studies of the XYZ: Belle II, BESIII, PANDA, GlueX," APS Meeting (Denver, CO), April 13, 2013.
- "Charmonium Spectroscopy and the Role of BESIII," IHEP Press Conference (Beijing, China), March 27, 2013.
- 35. "Charmonium Spectroscopy and the Role of BESIII," Miami 2012 (Fort Lauderdale, FL), December 17, 2012.
- 36. "A Quick Overview of the IU AmpTools Framework," Joint Theory-Experiment Workshop on Amplitude Analyses (Jefferson Lab, VA), December 10, 2012.
- "Beyond the Quark Model of Charmonium: Studying the XYZ at BESIII," University of Minnesota High Energy Physics Seminar (Minneapolis, MN), November 6, 2012.
- 38. "Beyond the Quark Model of Charmonium: Studying the XYZ at BESIII," Indiana University Nuclear Physics Seminar (Bloomington, IN), November 2, 2012.
- "Practically Incorporating Theoretical Innovations into Experimental Amplitude Analyses," Workshop on Analysis Tools for next generation Hadron Spectroscopy, ATHOS 2012 (Camogli, Italy), June 21, 2012.
- 40. "A Review of  $\chi_{cJ}(1P)$  Decays at BESIII and CLEO-c," Charm 2012 (Honolulu, HI), May 14, 2012.

- "Meson Spectroscopy at the BESIII Experiment," Miami 2011 (Fort Lauderdale, FL), December 17, 2011.
- 42. "Observation of  $e^+e^- \rightarrow \pi^+\pi^-h_c(1P)$  (and Other Highlights from the CLEO Experiment)," 8th International Workshop on Heavy Quarkonium (GSI, Germany), October 5, 2011.
- "Opportunities to Study Light Hadron Spectroscopy in Charmonium Decays," Jefferson Lab Amplitude Analysis Workshop (Jefferson National Laboratory), June 25, 2011.
- 44. "An Overview of the GlueX Experiment," Hirschegg 2011 (Hirschegg, Austria), January 18, 2011.
- 45. "An Overview of the BESIII Experiment," Hirschegg 2011 (Hirschegg, Austria), January 17, 2011.
- 46. "Recent Results from the BESIII Experiment," Miami 2010 (Fort Lauderdale, FL), December 16, 2010.
- 47. "Recent Results on Charmonium Decays at CLEO-c," 4th International Workshop on Charm Physics (Charm) (Beijing, China), October 23, 2010.
- "Recent Results from CLEO," 12th International Conference on Meson-Nucleon Physics and the Structure of the Nucleon (MENU) (Williamsburg, VA), June 1, 2010.
- "Radiative Transitions in Charmonia at CLEO," 7th International Workshop on Heavy Quarkonium (Fermilab), May 19, 2010.
- 50. "The GlueX Experiment (and its Context)," High Energy Physics Seminar (Indiana University), April 19, 2010.
- 51. "Amplitude Analysis Tools: Development of a Collaborative Analysis Toolkit," Institute for Nuclear Theory Workshop (Seattle, WA), November 13, 2009.
- 52. "Searches for Exotic Mesons: The GlueX Experiment," The Third Workshop of the APS Topical Group in Hadron Physics (Denver, CO), April 19, 2009.
- 53. "Status and Prospects for Meson Spectroscopy: An Experimentalist's Perspective," Lattice QCD and Experiment: Revealing the Structure of Hadrons (Jefferson National Laboratory), November 21, 2008.
- 54. "Analysis on the Grid: Development of a Collaborative Analysis Toolkit," Physics and Methods in Meson Spectroscopy (Munich, Germany), October 23, 2008.
- 55. "Charmonium: An Experimental Review," 34th International Conference of High Energy Physics (ICHEP) (Philadelphia, PA), August 2008.
- 56. "The Transition  $\psi(2S) \to \gamma \eta_c$  at CLEO-c," International Workshop on Heavy Quarkonium 2007 (Hamburg, Germany), October 17, 2007.
- 57. "Bottomonium and Charmonium at CLEO," 42nd Rencontres de Moriond on QCD and Hadronic Interactions (La Thuile, Italy), March 18, 2007.
- 58. "A PWA of  $3\pi$  Final States and a Search for the  $\pi_1(1600)$ ," Hadron 2005 (Rio de Janeiro, Brazil), August 22, 2005.
- "Searches for Mesons with Gluonic Degrees of Freedom," High Energy Physics Seminar (Indiana University), April 11, 2005.
- 60. "Observation of a 1750 MeV/ $c^2$  State in the Diffractive Photoproduction of  $K^+K^-$ ," CIPANP 2003 (New York City, New York), May 24, 2003.
- 61. "Observation of a 1750  $\text{MeV}/c^2$  State in the Diffractive Photoproduction of  $K^+K^-$ ," Photon 2003 (Frascati, Italy), April 9, 2003.

- "Light Quark Vectors and Photoproduction," Noon Particle Physics Seminar (University of Tennessee), January, 2003.
- 63. "Light Quark Vectors and Photoproduction," Seminar at the Laboratori Nazionali di Frascati (LNF) (Frascati, Italy), October 17, 2002.
- 64. "Properties of the 1750  $\text{MeV}/c^2$  Photoproduced Enhancement in  $K^+K^-$ ," 5th International Conference on Quark Confinement (Gargnano, Italy), September 13, 2002.
- 65. "Why We Believe in Quarks: Philosophical and Sociological Underpinnings," Philosophy Department Klatch (University of Tennessee), July, 2002.
- 66. "Properties of the 1750 MeV/ $c^2$  Photoproduced Enhancement in  $K^+K^-$ ," Talk at DPF (Williamsburg, Virginia), May 27, 2002.
- 67. "Why We Believe in Quarks: Experimental Foundations," Particle Physics Seminar (University of Tennessee), April 3, 2002.

FULL LIST OF PUBLICATIONS (Primary or Significant Contributing Author)

- 1. M. Ablikim *et al.* [BESIII Collaboration], "Observation of  $e^+e^- \rightarrow K\bar{K}J/\psi$  at center-of-mass energies from 4.189 to 4.600 GeV," Phys. Rev. D **97**, 071101 (2018) [arXiv:1802.01216 [hep-ex]].
- 2. M. Ablikim *et al.* [BESIII Collaboration], "Evidence for  $e^+e^- \rightarrow \gamma \eta_c(1S)$  at center-of-mass energies between 4.01 and 4.60 GeV," Phys. Rev. D **96**, no. 5, 051101 (2017) [arXiv:1705.06853 [hep-ex]].
- 3. R. E. Mitchell [BESIII Collaboration], "Results from Electron-Positron Collisions at BESIII," Proceedings of the International Conference of High Energy Physics, Chicago, IL, PoS ICHEP **2016**, 600 (2016) [arXiv:1611.04669 [hep-ex]].
- R. F. Lebed, R. E. Mitchell and E. S. Swanson, "Heavy-Quark QCD Exotica," Prog. Part. Nucl. Phys. 93, 143 (2017) [arXiv:1610.04528 [hep-ph]].
- 5. C. Patrignani *et al.* [Particle Data Group], "Review of Particle Physics," Chin. Phys. C 40, no. 10, 100001 (2016).
- 6. M. R. Shepherd, J. J. Dudek and R. E. Mitchell, "Searching for the rules that govern hadron construction," Nature **534**, no. 7608, 487 (2016).
- R. A. Briere, F. A. Harris and R. E. Mitchell, "Physics Accomplishments and Future Prospects of the BES Experiments at the BEPC Collider," Annual Review of Nuclear and Particle Science 66, 143 (2016) [arXiv:1603.09431 [hep-ex]].
- R. A. Briceno *et al.*, "Issues and Opportunities in Exotic Hadrons," Chin. Phys. C 40, no. 4, 042001 (2016) [arXiv:1511.06779 [hep-ph]].
- 9. M. Ablikim *et al.* [BESIII Collaboration], "Amplitude analysis of the  $\pi^0 \pi^0$  system produced in radiative  $J/\psi$  decays," Phys. Rev. D **92**, no. 5, 052003 (2015) [arXiv:1506.00546 [hep-ex]].
- M. Battaglieri *et al.*, "Analysis Tools for Next-Generation Hadron Spectroscopy Experiments," Acta Phys. Polon. B 46, 257 (2015) [arXiv:1412.6393 [hep-ph]].
- R. E. Mitchell, "Connecting the XYZ States at BESIII," Proceedings of Bormio 2014, PoS Bormio 2014, 056 (2014).
- 12. M. Ablikim *et al.* [BESIII Collaboration], "Observation of  $e^+e^- \rightarrow \gamma X(3872)$  at BESIII," Phys. Rev. Lett. **112**, no. 9, 092001 (2014) [arXiv:1310.4101 [hep-ex]].
- 13. M. Ablikim *et al.* [BESIII Collaboration], "Observation of a charged charmoniumlike structure  $Z_c(4020)$  and search for the  $Z_c(3900)$  in  $e^+e^-$  to  $\pi^+\pi^-h_c$ ," Phys. Rev. Lett. **111**, 242001 (2013) [arXiv:1309.1896 [hep-ex]].

- 14. K. Moriya, J. P. Leckey, M. R. Shepherd, K. Bauer, D. Bennett, H. Egiyan, J. Frye and J. Gonzalez *et al.*, "A measurement of the energy and timing resolution of the GlueX Forward Calorimeter using an electron beam," Nucl. Instrum. Meth. A **726**, 60 (2013).
- 15. R. E. Mitchell, "The XYZ States of Charmonium and the BESIII Experiment," American Physical Society Topical Group on Hadron Physics Newsletter, September (2013).
- 16. M. Ablikim *et al.* [BESIII Collaboration], "Observation of a charged charmoniumlike structure in  $e^+e^- \rightarrow \pi^+\pi^- J/\psi$  at  $\sqrt{s} = 4.26$  GeV," Phys. Rev. Lett. **110**, 252001 (2013) [arXiv:1303.5949 [hep-ex]].
- R. E. Mitchell, "Connecting the XYZ at BESIII," Proceedings of Hadron 2013, PoS Hadron 2013, 038 (2013).
- 18. R. E. Mitchell, "A Review of  $\chi_{cJ}$  Decays at BESIII and CLEO-c," Proceedings of CHARM 2012, arXiv:1208.6542 [hep-ex].
- 19. P. Guo, R. Mitchell, M. Shepherd and A. P. Szczepaniak, "Amplitudes for the analysis of the decay  $J/\psi \rightarrow K^+ K^- \pi^0$ ," Phys. Rev. D 85, 056003 (2012) [arXiv:1112.3284 [hep-ph]].
- R. E. Mitchell, "Recent results from CLEO," Proceedings of MENU 2010, AIP Conf. Proc. 1374, 127 (2011).
- 21. G. S. Adams *et al.* [CLEO Collaboration], "Amplitude analyses of the decays  $\chi_{c1} \rightarrow \eta \pi^+ \pi^-$  and  $\chi_{c1} \rightarrow \eta' \pi^+ \pi^-$ ," Phys. Rev. D 84, 112009 (2011) [arXiv:1109.5843 [hep-ex]].
- 22. B. D. Schaefer, R. E. Mitchell, P. McChesney, M. R. Shepherd and J. M. Frye, "Radiation Damage of F8 Lead Glass with 20 MeV Electrons," Nucl. Instrum. Meth. B 274, 111 (2012) [arXiv:1107.3332 [physics.ins-det]].
- 23. T. K. Pedlar *et al.* [CLEO Collaboration], "Observation of the  $h_c(1P)$  using  $e^+e^-$  collisions above  $D\bar{D}$  threshold," Phys. Rev. Lett. **107**, 041803 (2011) [arXiv:1104.2025 [hep-ex]].
- R. E. Mitchell, "Recent Results on Charmonium Decays at CLEO-c," Proceedings of CHARM 2010, Int. J. Mod. Phys. Conf. Ser. 02, 204 (2011) [arXiv:1102.3424 [hep-ex]].
- N. Brambilla *et al.*, "Heavy quarkonium: progress, puzzles, and opportunities," Eur. Phys. J. C **71**, 1534 (2011) [arXiv:1010.5827 [hep-ph]].
- 26. P. Guo, R. Mitchell and A. P. Szczepaniak, "The role of P-wave inelasticity in  $J/\psi$  to  $\pi^+\pi^-\pi^0$ ," Phys. Rev. D 82, 094002 (2010) [arXiv:1006.4371 [hep-ph]].
- 27. P. U. E. Onyisi *et al.* [CLEO Collaboration], "Branching fractions for  $\chi_{cJ} \rightarrow p\bar{p}\pi^{0}, p\bar{p}\eta$ , and  $p\bar{p}\omega$ ," Phys. Rev. D 82, 011103 (2010) [arXiv:1005.5374 [hep-ex]].
- R. E. Mitchell, "An Experimental Review of Charmonium," Proceedings of the 34th International Conference of High Energy Physics, Philadelphia, PA (2008) [arXiv:0810.3231 [hep-ex]].
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