

David Sperka

CONTACT INFORMATION

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PROFESSIONAL APPOINTMENTS

Assistant Professor, Boston University	July 2020 –
Research Assistant Professor, Boston University	July 2018 – June 2020
Postdoctoral Research Associate, University of Florida	June 2014 – June 2018
Graduate Research Assistant, Boston University	Sep. 2009 – May 2014

EDUCATION

Boston University, Boston, MA

Ph.D., Physics **May 2014**

- Thesis Title: *Search for a heavy resonance decaying to a top quark and a bottom quark with the CMS experiment*, [CERN-THESIS-2014-062](#)

University of Wisconsin, Madison, WI

B.Sc. in Physics, Astronomy, and Mathematics **May 2009**

- Thesis Title: *The Search for $B_{s(d)} \rightarrow \mu^+ \mu^-$ With 3.7 fb^{-1} of $p\bar{p}$ Collisions*

SELECTED RESEARCH ACHIEVEMENTS

CMS Experiment, CERN, Geneva, Switzerland **Sep. 2009 –**

Leadership Positions

- Co-convener of the CMS Code Modernization Working Group (2019–).
- Co-convener of the Exotic Higgs physics analysis subgroup (2018–2020).
- Co-convener of the Beyond the Standard Model Higgs working group of the LHC Higgs Cross Section Working group (2018–2020).
- Member of the CMS Statistics Committee (2018–).
- Co-convener of the Higgs Combination physics analysis subgroup (2016–2018).
- Co-convener of Higgs Trigger group (2015–2016).

Hardware, Software, and Operations

- Currently directing a working group tasked with modernizing CMS reconstruction and simulation software, such as making efficient use of hardware accelerators (e.g. GPUs and FPGAs) and new High Performance Computing centers, particularly those at research laboratories in the United States.
- Studying the design of the CMS L1 Trigger Menu and associated hardware for the HL-LHC upgrade. Co-editor of the Global Trigger Algorithms section of the L1 Trigger Technical Design report. Produced the first proof of concept implementation of a Deep Neural Network in the upgraded CMS Global Trigger.
- Developer for the “Higgs Combination Tool” software package, used by the large majority of CMS to perform statistical analysis.
- Expert on the online operation of the CMS High Level Trigger (HLT). Includes designing and maintaining trigger configurations for standard and special data taking conditions, monitoring the data quality of the detector, and providing 24/7 on-call support.

Physics Analysis

- Performed the first trigger level analysis with online-reconstructed muons to search for dark photons. The search sets the world's most stringent constraints on dark photons with masses larger than 30 GeV, and comparable constraints to LHCb for dark photons with masses greater than 11.5 GeV.
- Directed and led the effort to produce combined measurements of Higgs boson properties using all decay channels with 35.9 fb^{-1} of $\sqrt{s}=13 \text{ TeV}$ data. These studies led to the first observations of $t\bar{t}H$ production and the $H\rightarrow b\bar{b}$ decay.
- Conceived and performed the first dedicated search for a $L_\mu - L_\tau$ Z' gauge boson at the LHC. This search places unique constraints on models which attempt to explain the measured value of the muon anomalous magnetic moment and possible lepton flavor universality violation in $b\rightarrow s\mu\mu$ processes.
- Led the Higgs boson properties measurements in the ZZ decay channel with $\sqrt{s}=13 \text{ TeV}$ data through three public results and one journal publication, including the world's most precise determination of the Higgs boson mass.
- Published the first measurements by CMS of differential Higgs boson cross sections in the ZZ decay channel with $\sqrt{s}=7$ and 8 TeV data.
- Led the search for W' bosons decaying to top and bottom quarks in the lepton plus jets final state at $\sqrt{s}=8 \text{ TeV}$.

CDF Experiment, Fermilab, Batavia, Illinois USA

Jan. 2008 – Sep. 2009

- Performed a search for $B_{s(d)} \rightarrow \mu^+ \mu^-$ using CDF data.
- Studied the efficiency of the inner most layer of the silicon strip detector.

REFEREED
JOURNAL
PUBLICATIONS

I am an author of more than 980 refereed publications. The full list is available using the search “find a sperka, d AND collection:citeable AND date > 2009” at [INSPIRE](#). I have been the lead author of or directly involved in these publications:

The CMS Collaboration, **Measurements of production cross sections of the Higgs boson in the four-lepton final state in proton-proton collisions at $\sqrt{s}=13 \text{ TeV}$** , [arXiv:2103.04956](#), Submitted to *Eur. Phys. J C*

The CMS Collaboration, **Search for a narrow resonance lighter than 200 GeV decaying to a pair of muons in proton-proton collisions at $\sqrt{s}=13 \text{ TeV}$** , *Phys. Rev. Lett.* 124 (2020) 131802 (2020) [arXiv:1912.04776](#), 10+ citations

The CMS Collaboration, **Combined measurements of Higgs boson couplings in proton-proton collisions at $\sqrt{s}=13 \text{ TeV}$** , *Eur. Phys. J. C* 79 (2019) 421 [arXiv:1809.10733](#), 330+ citations

The CMS Collaboration, **Search for an $L_\mu - L_\tau$ gauge boson using $Z\rightarrow 4\mu$ events in proton-proton collisions at $\sqrt{s}=13 \text{ TeV}$** , *Phys. Lett. B* 792 (2019) 345 [arXiv:1808.03684](#), 49+ citations

The CMS Collaboration, **Measurement and interpretation of differential cross sections for Higgs boson production at $\sqrt{s}=13 \text{ TeV}$** , *Phys. Lett. B* 792 (2019) 369 [arXiv:1812.06504](#), 55+ citations

The CMS Collaboration, **Observation of $t\bar{t}H$ production**, Phys. Rev. Lett **120** (2018) 231801 (Editor's Suggestion), [arXiv:1804.02610](#), 330+ citations

The CMS Collaboration, **Measurements of properties of the Higgs boson decaying into the four-lepton final state in pp collisions at $\sqrt{s} = 13$ TeV**, J. High Energ. Phys. **11** (2017) 047, [arXiv:1706.09936](#), 310+ citations

The CMS Collaboration, **The CMS trigger system**, Journal of Instrumentation **12** (2017) P01020, [arXiv:1609.02366](#), 665+ citations

The CMS Collaboration, **Measurement of differential and integrated fiducial cross sections for Higgs boson production in the four-lepton decay channel in pp collisions at $\sqrt{s} = 7$ and 8 TeV**, J. High Energ. Phys. **04** (2016) 005, [arXiv:1512.08377](#), 89+ citations

The CMS Collaboration, **Search for W' to tb decays in the lepton+jets final state in pp collisions at $\sqrt{s} = 8$ TeV**, J. High Energ. Phys. **05** (2014) 108, [arXiv:1402.2176](#), 80+ citations

The CMS Collaboration, **Search for a W' boson decaying to a bottom quark and a top quark in pp collisions at $\sqrt{s} = 7$ TeV**, Phys. Lett. B **718** (2013) 122, [arXiv:1208.0956](#), 60+ citations

The CMS Collaboration, **Performance of CMS muon reconstruction in pp collisions at $\sqrt{s} = 7$ TeV**, Journal of Instrumentation **7** (2012) P10002, [arXiv:1206.4071](#), 1100+ citations

The CDF Collaboration, **The Search for $B_{s(d)} \rightarrow \mu^+\mu^-$ With 7 fb $^{-1}$ of $p\bar{p}$ Collisions**, Phys. Rev. Lett. **107** (2011) 191801, [arXiv:1107.2304](#), 180+ citations

The CMS Collaboration, **Search for a W' boson decaying to a muon and a neutrino in pp collisions at $\sqrt{s} = 7$ TeV**, Phys. Lett. B **701** (2011) 160, [arXiv:1103.0030](#), 55+ citations

OTHER
PUBLICATIONS

The CMS Collaboration, **Search for a low-mass dilepton resonance in Higgs boson decays to four-lepton final states at $\sqrt{s} = 13$ TeV**, CMS Physics Analysis Summary HIG-19-007

The CMS Collaboration, **The Phase-2 Upgrade of the CMS Level-1 Trigger**, CMS Technical Design Report CMS-TDR-021

D. de Florian, et. al. **Handbook of LHC Higgs Cross Sections: 4. Deciphering the Nature of the Higgs Sector**, [arXiv:1610.07922](#)

The CMS Collaboration, **Summary results of high mass BSM Higgs searches using CMS Run-I data**, CMS Physics Analysis Summary HIG-16-007

The CMS Collaboration, **Projected performance of Higgs Analyses at the HL-LHC for ECFA 2016**, CMS Physics Analysis Summary FTR-16-002

SEMINARS

Present and Future of Higgs Couplings Measurements at the LHC (in CMS)

Fermilab Topic of the Week Seminar, *Batavia, IL*, Nov. 2018

Boston University HEE Seminar, *Boston, MA*, Oct. 2018

Recent Higgs Results at 13 TeV from the CMS Collaboration

Boston University HEE Seminar, *Boston, MA*, May. 2017

CONFERENCE PRESENTATIONS

Trigger Level Analysis in CMS During Run 2 and Beyond, Joint Meeting of the HEP Software Foundation, Open Science Grid, and World-wide LHC Computing Grid, *Newport News, VA, USA*, Mar. 2019

Measurements of the BEH Scalar Mass and Other Couplings in ATLAS and CMS, Plenary Talk, Les Rencontres de Moriond 2018; Electroweak, *La Thuile, Italy*, Mar. 2018

ATLAS and CMS Perspectives on Monte Carlo for SM Higgs Physics, Plenary Talk, ATLAS-CMS Monte Carlo Generators Workshop 2017, *Geneva, Switzerland*, May 2017

“Standard Model Higgs” Results from CMS and ATLAS at 13 TeV, Plenary Talk, 12th LHC Higgs Cross Section Working Group Workshop, *Geneva, Switzerland*, Oct. 2016

CMS Outlook for Higgs Physics in Run 2 and Beyond, Plenary Talk, Higgs Hunting 2016, *Paris, France*, Aug. 2016

Recent Higgs Results from CMS, Plenary Talk, Les Rencontres de Moriond 2016; QCD, *La Thuile, Italy*, Mar. 2016

CMS Diboson Higgs Results, Plenary Talk, Higgs Hunting 2015, *Orsay, France*, Aug. 2015

Search for W' to $t\bar{b}$ decays with the CMS experiment, Large Hadron Collider Physics, *New York, NY, USA*, June 2014

Search for W' bosons that decay to $top+bottom$, U.S. LHC Users Organization Annual Meeting, *Madison, WI, USA*, Nov. 2013

The search for $t\bar{b}$ resonances with the CMS experiment, LHC Council Student Poster Session, *Geneva, Switzerland*, Mar. 2013

Search for $t\bar{b}$ resonances with the CMS experiment, Plenary Talk, Les Rencontres de Physique de la Vallée d'Aoste, *La Thuile, Italy*, Feb. 2013

PEER REVIEW

External Review

Physics Letters B (Referee)

European Physical Journal C (Referee)

CMS Analysis Review Committee (Internal Review)

The CMS Collaboration, **Search for dark matter produced in association with a leptonically decaying Z boson in proton-proton collisions at $\sqrt{s}=13$ TeV**, Submitted to EPJC [arXiv:2008.04735](#)

The CMS Collaboration, **Combination of searches for Higgs boson pair production in proton-proton collisions at $\sqrt{s}=13$ TeV**, Phys. Rev. Lett. 122, 121803 (2019) [arXiv:1811.09689](#)

The CMS Collaboration, **Search for pair production of excited top quarks in the lepton+jets final state**, Phys. Lett. B 778 (2018) 349, [arXiv:1711.10949](#)

CONFERENCE AND WORKSHOP ORGANIZATION

17th Workshop of the LHC Higgs Cross Section Working Group, *Organizer*, Nov. 2020

16th Workshop of the LHC Higgs Cross Section Working Group, *Organizer*, Oct. 2019

Meeting of the Division of Particles & Fields of the American Physical Society, Higgs and Electroweak Working Group Organizing Committee, Jul. 2019

15th Workshop of the LHC Higgs Cross Section Working Group, *Organizer*, Dec. 2018

Higgs Combine Tool Workshop at the LPC, *Organizer and Instructor*, Oct. 2018

CMS Statistics Committee Workshop, *Organizer and Instructor*, Nov. 2017

CMS Statistics Committee Workshop, *Organizer and Instructor*, Nov. 2016

AWARDS

CMS Students and Post-Docs Achievement Award, December 2011

Boston University Physics Graduate Student Prize, April 2011

Boston University Dean's Fellowship, September 2009

Dr. Maritza Irene Stapanian Crabtree Scholarship, April 2008

TEACHING EXPERIENCE

Boston University, *Professor*

Physics 106 "Introductory Physics 2", Spring 2021

Physics 105 "Introductory Physics 1", Fall 2020

CMS Data Analysis School @ Bari, *Instructor*

"Exercise on Higgs Boson Measurements in the ZZ Decay Channel", Jan. 2015

Boston University, *Teaching Assistant*

Physics 241 "Physics for Life Science Majors", Fall 2010

Physics 211 "Physics for Engineers", Spring 2011

OUTREACH

“Particles and Collisions”, Interactive Lecture, LERNet Physics Day at Boston University, May 2010

“The Wonders of Physics”, Lecture and Demonstrations, University of Wisconsin, Feb. 2007