R-H. Standard model and new physics

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Physics analyses and theoretical work. — The group has contributed to bringing an inclusive search for supersymmetry with boosted objects to publication stage using proton-proton collision data that corresponded to an integrated luminosity of 35.9 fb^{-1}, taken prior to 2017. Exclusion limits on the gluino mass were extended to 2 TeV, while on the stop quark mass to 1.14 TeV. Profiting from the opportunity that the LHC has gone into a more than two-year long shutdown, we have started to reprocess the data we took with the new pixel detector in the last two years using improved calibration and detector description models for further analysis in order to approximately double the analysis sensitivity. We provided a member for the Publication Committee of the CMS Experiment at CERN and played an important role in publishing CMS results of low-x Quantum Chromodynamics (QCD) studies. We hold leadership positions, a group convenor and a deputy project manager, in the CMS Tracker project.

The stable operation of the T2_HU_Budapest grid site continued in 2018. Our site is used extensively by the entire CMS collaboration including our group for reconstructing collision data in physics analyses. The disk capacity committed to CMS has increased to 1 PB.

We proposed a general concept of bosonic operator orderings and generalized Wick's theorem transforming any ordering into any other one. We pointed out how Planckian scale challenges the validity of the massive body Schrödinger equation.

Work on instrumentation. – The group created a test setup for developing the CMS Phase 2 Upgrade Inner Tracker data-acquisition system, and started to develop firmware in order to calibrate and read out the new sensors that are being designed for the upgraded detector. We have constructed a test-beam telescope to be used for the high rate tests of the new Phase 2 Tracker chips; commissioned the telescope and took the first data using the Phase 2 Outer Tracker chip prototypes at the Super Proton Synchrotron (SPS) at CERN.

The SPS Diffuser designed and constructed by our group was successfully installed and tested in the CERN SPS accelerator, and delivered the expected performance in terms of loss reduction. The conceptual design of a high-field extraction septum magnet for the Future Circular Collider was completed, which uses the combination of a superconducting magnet and a passive superconducting shield.

Outreach. – An education program was organized by Wigner RCP at CERN with the leadership of our group: the annual Hungarian Teachers Programme (18-25 August 2018) for 21 physics teachers. For the teachers we organized a meeting on December 8 at Wigner RCP with the lecturers. We also participated in the organization of the annual Hands-on Particle Physics Master-classes on two occasions with 22 high-school students attending each session. We have also participated in the organization of two scientific seminars on particle physics for the

Celebration of Hungarian Science on particle physics at the Hungarian Academy of Sciences and at the Roland Eötvös University. In addition to conference talks and university teaching, many popular lectures were given by our group.

Grants

NKFIH K-124850 Consortional assoc.: The Standard Model and beyond: Searching for New Physics with the CERN LHC CMS experiment (V. Veszprémi, Cs. Hajdu, D. Horváth, T. Vámi, 2017-2021)

NKFIH K-124945 Research and development of novel technologies for particle accelerators (D. Barna, 2017-2021)

Pallas Athene Foundations HTP-2018 (D. Horváth)

FQXi-MGA-1707 Gravity related modifications of non-relativistic quantum theory (L. Diósi, 2017)

International cooperation

CMS Collaboration (over 200 institutes)

University of Tokyo, Japan

RIKEN, Wako, Japan

Max-Planck-Institut für Quantenoptik, Germany

Università di Brescia & Istituto Nazionale di Fisica Nucleare, Italy

Publications

Articles

1. Diósi L: Wick theorem for all orderings of canonical operators. ***J PHYS A-MATH THEOR*** **51**:36 365201/1-6 (2018)
2. Diósi L: Fundamental irreversibility: Planckian or Schrödinger-Newton? ***ENTROPY*** **20**:7 1-5 (2018)
3. Giunchi G, Barna D, Bajas H, Brunner K, Nemet A, Petrone C: Relaxation phenomena in a long MgB_2 tube subjected to transverse magnetic field, at 4.2 K. **IEEE T APPL SUPERCON 28**:4 1-5 (2018)

Others

4. Horváth D: Új felfedezések a CERN Nagy Hadronütköztetőjénél: furcsa részecskék (New inventions at the LHC of CERN: strange particles, in Hungarian). ***FIZIKAI SZEMLE*** **68**:7-8 219-224 (2018)
5. Horváth D, Trócsányi Z: Müon: mi az és mire jó? (Muon: what is it and what good is it?, in Hungarian) ***FIZIKAI SZEMLE*** **68**:5 147-153 (2018)
6. Horváth D: Magyar tanárok és diákok részecskefizikai oktatása a Cern-ben (Hungarian teachers and students learn particle physics at CERN, in Hungarian). ***FIZIKAI SZEMLE*** **68**:4 124-130 (2018)

ATLAS collaboration

Due to the vast number of publications of the large collaborations in which the research group participated in 2018, here we list only a short selection of appearances in journals with the highest impact factor. Wigner author in the collaboration is József Tóth.

1. Aaboud M et al. (ATLAS Collaboration) [2892 authors]: Search for low-mass dijet resonances using trigger-level jets with the ATLAS detector in pp collisions at $\sqrt{s}$ = 13 TeV. ***PHYS REV LETT*** **121**:8 081801/1-20 (2018)
2. Aaboud M et al. (ATLAS Collaboration) [2886 authors]: Measurement of the soft-drop jet mass in *pp* collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector. ***PHYS REV LETT*** **121**:9 092001/1-21 (2018)
3. Aaboud M et al. (ATLAS Collaboration) [2870 authors]: Search for the decay of the Higgs boson to charm quarks with the ATLAS experiment. ***PHYS REV LETT*** **120**:21 211802/1-20 (2018)
4. Aaboud M et al. (ATLAS Collaboration) [2887 authors]: Search for a structure in the $B_s^0\pi^\pm$ invariant mass spectrum with the ATLAS experiment. ***PHYS REV LETT*** **120**:20 202007/1-19 (2018)
5. Aaboud M et al. (ATLAS Collaboration) [authors]: Search for high-mass resonances decaying to $\tau\nu$ in *pp* collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector. ***PHYS REV LETT*** **120**:16 161802/1-20 (2018)
6. Aaboud M. et al. (ATLAS Collaboration) [2929 authors]: Combination of the searches for pair-produced vectorlike partners of the third-generation quarks at $\sqrt{s}$ = 13 TeV with the ATLAS detector. ***PHYS REV LETT*** **121**:21 211801/1-20 (2018)
7. Aaboud M. et al. (ATLAS Collaboration) [2924 authors]: Search for resonant and nonresonant Higgs boson pair production in the $b\bar{b}\tau^+\tau^-$ decay channel in *pp* collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector. ***PHYS REV LETT*** **121**:19 191801/1-24 (2018)
8. Aaboud et al. (ATLAS Collaboration) [2900 authors]: Search for supersymmetry in final states with charm jets and missing transverse momentum in 13 TeV *pp* collisions with the ATLAS detector. ***J HIGH ENERGY PHYS*** **2018**:9 050/1-44 (2018)
9. Aaboud M et al. (ATLAS Collaboration) [2913 authors]: Measurements of b-jet tagging efficiency with the ATLAS detector using $t\bar{t}$ events at $\sqrt{s}$ = 13 TeV. ***J HIGH ENERGY PHYS*** **2018**:8 089/1-47 (2018)
10. Aaboud M et al. (ATLAS Collaboration) [2869 authors]: Search for flavour-changing neutral current top-quark decays t → qZ in proton-proton collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector. ***J HIGH ENERGY PHYS*** **2018**:7 176/1-41 (2018)
11. Aaboud M et al. (ATLAS Collaboration) [2870 authors]: Search for pair production of heavy vector-like quarks decaying into high-p_T W bosons and top quarks in the lepton-plus-jets final state in pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector. ***J HIGH ENERGY PHYS*** **2018**:8 048/1-41 (2018)
12. Aaboud M et al. (ATLAS Collaboration) [2903 authors]: Search for exclusive Higgs and Z boson decays to $\phi\gamma$ and $\rho\gamma$ with the ATLAS detector. ***J HIGH ENERGY PHYS*** **2018**:7 127/1-37 (2018)
13. Aaboud M et al. (ATLAS Collaboration) [2902 authors]: Search for pair production of up-type vector-like quarks and for four-top-quark events in final states with multiple *b*-jets with the ATLAS detector. ***J HIGH ENERGY PHYS*** **2018**:7 089/1-68 (2018)

14. Aaboud M et al. (ATLAS Collaboration) [2900 authors]: Search for Higgs boson decays to beyond-the-Standard-Model light bosons in four-lepton events with the ATLAS detector at $\sqrt{s}$ = 13 TeV. ***J HIGH ENERGY PHYS*** **2018**:6 166/1-51 (2018)
15. Aaboud M et al. (ATLAS Collaboration) [2885 authors]: Search for top-squark pair production in final states with one lepton, jets, and missing transverse momentum using 36 fb^{-1} of $\sqrt{s}$ = 13 TeV *pp* collision data with the ATLAS detector. ***J HIGH ENERGY PHYS*** **2018**:6 108/1-96 (2018)
16. Aaboud M et al. (ATLAS Collaboration) [2874 authors]: Search for supersymmetry in final states with missing transverse momentum and multiple b-jets in proton-proton collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector. ***J HIGH ENERGY PHYS*** **2018**:6 107/1-58 (2018)
17. Aaboud M et al. (ATLAS Collaboration) [2874 authors]: Search for long-lived charginos based on a disappearing-track signature in *pp* collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector. ***J HIGH ENERGY PHYS*** **2018**:6 022/1-48 (2018)
18. Aaboud M et al. (ATLAS Collaboration) [2903 authors]: Measurement of inclusive jet and dijet cross-sections in proton-proton collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector. ***J HIGH ENERGY PHYS*** **2018**:5 195/1-47 (2018)
19. Aaboud M et al. (ATLAS Collaboration) [2880 authors]: Measurement of differential cross sections and W^+/W^- cross-section ratios for *W* boson production in association with jets at $\sqrt{s}$ = 8 TeV with the ATLAS detector. ***J HIGH ENERGY PHYS*** **2018**:5 077/1-60 (2018)
20. Aaboud M et al. (ATLAS and CMS Collaborations) [5098authors]: Combination of inclusive and differential $t\bar{t}$ charge asymmetry measurements using ATLAS and CMS data at $\sqrt{s}$ = 7 and 8 TeV. ***J HIGH ENERGY PHYS*** **2018**:4 033/1-68 (2018)
21. Aaboud M et al. (ATLAS Collaboration) [2907 authors]: Search for heavy resonances decaying into a *W* or *Z* boson and a Higgs boson in final states with leptons and *b*-jets in 36 fb^{-1} of $\sqrt{s}$ = 13 TeV pp collisions with the ATLAS detector. ***J HIGH ENERGY PHYS*** **2018**:3 174/1-53 (2018)
22. Aaboud M et al. (ATLAS Collaboration) [2906 authors]: Measurement of the Higgs boson coupling properties in the $H \to ZZ^* \to 4\ell$ decay channel at $\sqrt{s}$ = 13 TeV with the ATLAS detector. ***J HIGH ENERGY PHYS*** **2018**:3 095/1-60 (2018)
23. Aaboud M et al. (ATLAS Collaboration) [2904 authors]: Search for W W/W Z resonance production in $\ell\nu qq$ final states in pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector. ***J HIGH ENERGY PHYS*** **2018**:3 042/1-45 (2018)
24. Aaboud M et al. (ATLAS Collaboration) [2893 authors]: Searches for heavy ZZ and ZW resonances in the $\ell\ell qq$ and $\nu\nu qq$ final states in pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector. ***J HIGH ENERGY PHYS*** **2018**:3 009/1-53 (2018)
25. Aaboud M et al. (ATLAS Collaboration) [2904 authors]: Search for dark matter and other new phenomena in events with an energetic jet and large missing transverse momentum using the ATLAS detector. ***J HIGH ENERGY PHYS*** **2018**:1 126/1-53 (2018)

See also: R-F CMS Collaboration (Hajdú C, Horváth D, Vámi T)