POSTER PRESENTATIONS BY YOUNG SCIENTISTS IN THE FIELD OF PARTICLE PHYSICS RESEARCH

1. Evidence for the $H \to b\bar{b}$ decay with the ATLAS detector

Authors: F. Ahmadov

Abstract:

The data of the ATLAS experiment collected in 2015-2016, corresponding to an integrated luminosity of 36.1 фб$^{-1}$, are analyzed in order to search for the decay of the Higgs boson into a $b\bar{b}$ quarks pair when produced in association with a vector boson. Two methods were used for data analysis, BDT multivariate techniques for obtaining the main results and «cut-flow» method for the validation of the results. For the Higgs boson with a mass of 125 GeV, an excess of events over the expected background from other Standard Model processes is found with an observed significance of 3.5 standard deviations, compared to an expectation of 3.0 standard deviations. The result of the search for the SM Higgs boson based on Run 2 data is combined with previous results based on the full Run 1 dataset. An excess over the expected SM background is observed, with a significance of 3.6 standard deviations compared to an expectation of 4.0. The measured signal strength with respect to the SM expectation is found to be $\mu = 0.90 \pm 0.18(stat.)^{+0.21}_{-0.19}(syst.)$. This excess indicates the existence of the decay of the Higgs boson into $b\bar{b}$ quarks and for its production in association with a vector boson.

2. How robust is a third family of compact stars against pasta phase effects?

Authors: A. Ayriyan[1], N.-U. Bastian[2], D. Blaschke[2,3,4], H. Grigorian[1], K. Maslov[3,4] and D. N. Voskresensky[3,4]

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Abstract:

We investigate the robustness of third family solutions for hybrid compact stars with a quark matter core that correspond to the occurrence of high-mass twin stars against a softening of the phase transition by means of a construction that mimics the effects of pasta structures in the mixed phase. We consider a class of hybrid equations of state allows quark-hadron phase transition. We present parametrizations that correspond to branches of high-mass twin star pairs with maximum masses between 2.05 $M_\odot$ and 1.48 $M_\odot$ having radius differences between 3.2 and 1.5 km, respectively. When compared to a Maxwell construction with a fixed value of critical pressure Pc, the effect of the mixed phase construction consists in the occurrence of a region of pressures around Pc belonging to the coexistence of hadronic and quark matter phases. Comparing results with constraints given by the binary neutron star merger GW170817 show that at least the heavier of the neutron stars could be a member of the third family of hybrid stars.

3. Online monitoring system for the BM@N experiment

Authors: I. Gabdrakhmanov

Abstract:

In order to effectively maintain experiment it is extremely important to have a flexible and uniform for all detectors, fast and convenient tool to monitor experimental facility.

The BM@N online monitoring system implements decoding of the incoming raw data during the run, preprocessing and visualization on the web-page.

Users can monitor any detector subsystem, select specific detector plane/station, time or strip profile histograms in 1/2/3D view.

The system is developed as a part of the BmnRoot package using the CERN jsROOT library. The lighttpd web server is used.

4. Effects of composite pions on the chiral condensate

Authors: D. Blaschke, A. Dubinin, D. Ebert, A.V. Friesen

Abstract:

We investigate the effect of composite pions on the behaviour of the chiral condensate at finite temperature within the Polyakov-loop improved NJL model. To this end we treat quark-antiquark correlations in the pion channel (bound states and scattering continuum) within a Beth-Uhlenbeck approach that uses medium-dependent phase shifts. A striking medium effect is the Mott transition which occurs when the binding energy vanishes and the discrete pion bound state merges the continuum. This transition is triggered by the lowering of the continuum edge due to the chiral restoration transition. This in turn also entails a modification of the Polyakov-loop so that the SU(3) center symmetry gets broken at finite temperature and dynamical quarks (and gluons) appear in the system, taking over the role of the dominant degrees of freedom from the pions. At low temperatures our model reproduces the chiral perturbation theory result for the chiral condensate while at high temperatures the PNJL model result is recovered. The new aspect of the current work is a consistent treatment of the chiral restoration transition region within the Beth-Uhlenbeck approach on the basis of mesonic phase shifts for the treatment of the correlations.

5. Event Reconstruction in GEM Detector of the BM@N Experiment

Authors: S. Merts

Abstract:

Results of processing experimental data collected during technical run of BM@N experiment in March of 2017 are shown. Methodical results have good agreement with Monte Carlo simulation. It includes set of realistic effects. Description of developed experimental data decoder are presented. Some results of primary vertex and lambda decay reconstruction are shown.

6. Five-Particle Phase-Space Integrals in Massless QCD

Authors: A.F. Pikelner

Abstract:

We present results for the calculation of the fully-inclusive five-particle phase-space integrals in the massless QCD. The evaluation method is based on a numerical solution of the difference recurrence relations in space-time dimensionallity variable with high precision and reconstruction of the analytical results using PSLQ algorithm. We discuss asymptotics of the phase-space integrals in the limit of infinite space-time dimension and various numerical cross-checks of obtained result.

7. Light collection module for "ArgonCube" Liquid Argon TPC

Authors: A. Selyunin

Abstract:

Noble elements in the liquid state at cryogenic temperatures are widely used in particle physics experiments as a medium of the time projection chamber (TPC). One of such experiments is a neutrino DUNE near detector, planned in the United States (Fermilab), which consists of liquid-argon TPC modules. When the charged particle passes through the medium of such TPC, part of its energy is converted into ultraviolet scintillation light. An important task is to register such a light. The scintillation wavelength in liquid argon is 128 nm, which imposes special requirements on the light-readout detector. On the other hand, such a device must be compact and operate at cryogenic temperatures. This work presents a light collection module (LCM) prototype based on the WLS-fibers, covered by tetraphenyl butadiene (TPB), and silicon photomultipliers as photodetectors. The LCM has been fully developed, manufactured and pre-tested at JINR. The results of the LCM tests in liquid argon at the University of Bern (Switzerland) are presented as well.

8. Serial magnetic measurements for the NICA quadrupole magnets

Authors: A.V. Shemchuk

Abstract:

NICA is a new accelerator collider complex under con-struction at JINR, Dubna. More than 250 superconducting magnets are needed for the NICA booster and collider. The NICA Booster magnetic system includes 48 quadrupole superconducting magnets. The rotating coils probe developed for series magnetic measurements of booster quadrupoles doublets, as well as measuring methods are described. Results of magnetic measurements in cryogenic conditions for 12 doublets are presented and discussed.

9. Detection of Galactic Supernova Neutrinos at the NOvA Experiment

Authors: A. Habig, A. Sheshukov, J. Vasel

Abstract:

Core-collapse supernovae emit about 99% of their gravitational energy in a burst of neutrinos. Detecting such a neutrino signal would provide a valuable information both on the neutrino properties and on the stellar collapse physics. The large liquid scintillator detectors used in the NOvA experiment provide a possibility to detect such a signal. A dedicated trigger system was developed for NOvA to perform the search of inverse beta decay neutrino interaction candidates in real time and is able to detect the supernova burst within ~seconds latency and save the data from detectors for further study. This system has been running in stable mode since November 2017. A parallel effort is on-going to develop background rejection and event selection techniques for an offline analysis of these neutrinos.