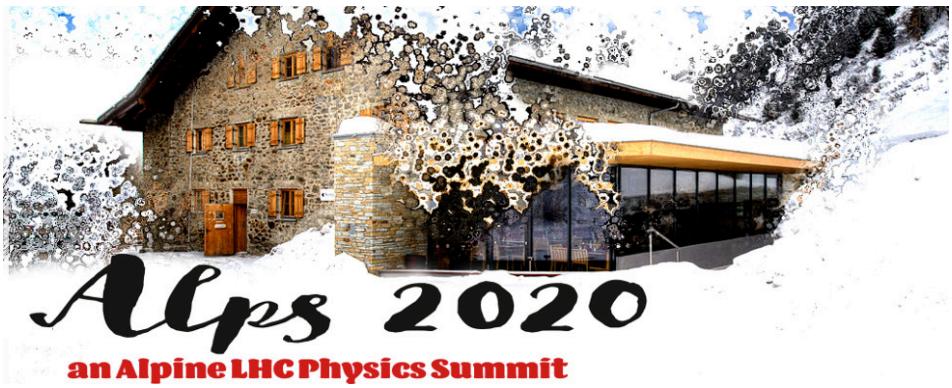
ALPS2020 – Fifth Alpine LHC Physics Summit



Report of Contributions

https://indico.cern.ch/e/820752

Contribution ID: **1** Type: **not specified**

Recent results of light hadron spectroscopy from BESIII

With the world's largest sample of J/psi 1.3 billion events accumulated at the BESIII detector offers a unique opportunity to study light hadron spectroscopy and decays. In this presentation, recent results of the light hadron physics at BESIII will be highlighted. The BESIII experiment has made significant progresses on the light hadron spectroscopy in the J/psi decays, including the amplitude analyses of J/psi radiative and hadronic decays.

Primary authors: JINGZHI, Zhang; LIU, Zhiqing

Presenter: JINGZHI, Zhang

Session Classification: Contributed Talks

Contribution ID: **3** Type: **not specified**

Search for BNV and LNV processes at BESIII

The observed matter-antimatter asymmetry in the universe composes a serious challenge to our understanding of nature. BNV decay has been searched in many experiments to understand this large-scale observed fact. In the case of e+e- collision, few experiments are performed. Here we proposed to search BNV and LNV with currently the world largest J/psi data sets in e+e- collision experiment. The BNV and LNV channel J/psi -> Lambda_c+ e- +c.c. is studied, and no signal event is observed. The upper limit branching fraction is set to be 6.9*10E-8 at 90% C.L., which is still much higher than the estimation based on SM. The Majorana neutrino is searched in LNV decays D-> (K-pi-/Kspi-/K-pi0) e+e+ and no significant signal is observed, the upper limits on the branching fractions are set to be 2.7*10E-6, 3.3*10E-6 and 8.5*10E-6 at 90% C.L., respectively. The Majorana neutrino is also investigated with different mass assumption, ranging from 0.25 to 1.0 GeV/c^2 in the decays D0 -> K-e+nu_N(pi-e+) and D+->Kse+nu_N(pi-e+), and the upper limits on the branching fractions are extracted to be at the level of 10E-7 to 10^-6 at 90% C.L..

Primary author: DAYONG, Wang (University of Beijing)

Presenter: DAYONG, Wang (University of Beijing)

Session Classification: Contributed Talks

Contribution ID: **6** Type: **not specified**

The LHCb upgrades

The LHCb detector is currently being upgraded to be able to take data at higher luminosities and with greater efficiency in Run3. This involves replacement of many subdetector systems, including the vertex detector, upstream tracker, the photodetectors of the ring-imaging Cherenkov detectors, and the downstream tracker. Equally important will be a complete redesign of the data-acquisition system, eliminating the hardware trigger. The status of the upgrade and performance of the software trigger are presented. In addition, LHCb is planning an Upgrade II, a flavour physics experiment for the high-luminosity era. This would be installed in Long Shutdown 4 (2030) and targets an instantaneous luminosity of 1.5 x10^34 cm-2 s-1 and an integrated luminosity of at least 300fb-1. Physics goals include probing new physics scenarios in lepton flavour universality, obtaining unprecedented precision on CKM tests, and expanding the LHCb programme into new measurement areas such as Higgs decays to charm.

Primary authors: RICCIARDI, Stefania; LHCB COLLABORATION

Presenter: LHCB COLLABORATION

Session Classification: Contributed Talks

Contribution ID: **7** Type: **not specified**

News on the CLIC physics potential

The Compact Linear Collider (CLIC) is a TeV-scale high-luminosity linear electron-positron collider under study at CERN. For an optimal exploitation of its physics potential, CLIC is foreseen to be built and operated in three stages, at centre-of-mass energies of 380 GeV, 1.5 TeV and 3 TeV, respectively, for a site length ranging from 11 km to 50 km. Each of the three energy stages adds cornerstones of the full CLIC physics programme, such as Higgs width and couplings, top-quark properties, Higgs self-coupling, and searches for new phenomena through direct and indirect measurements. The construction of the first CLIC energy stage could start by 2026 and first beams would be available by 2035, marking the beginning of a broad CLIC physics programme spanning 25–30 years. An overview of the CLIC project and its physics potential will be presented. CLIC has excellent sensitivity to many BSM physics scenarios, both through direct observation and precision measurements of SM processes. New particles can be discovered in a model-independent way almost up to the kinematic limit. Compared with hadron colliders, the low background conditions at CLIC provide extended discovery potential. In addition to studying new particles directly, BSM models can be probed up to scales of tens of TeV through precision measurements. Beam polarisation allows further constraints on the underlying theory in many cases. CLIC offers the ideal environment for precision measurements of top-quark production and properties; including a top-quark mass measurement with a precision of around 50 MeV, top-quark couplings to the electroweak gauge bosons, forward-backward and polarisation asymmetries, the top Yukawa coupling and CP properties in the ttH coupling, and top-quark pair production through vector-boson fusion.
At the high-energy stages new studies have been undertaken using jet-substructure techniques originally developed for the LHC, and the BSM sensitivity provided by the top physics program at CLIC is illustrated using Effective Field Theory (EFT) approaches.

Primary author: CLICDP COLLABORATION

Presenter: CLICDP COLLABORATION

Session Classification: Contributed Talks

Contribution ID: **9** Type: **not specified**

Predictions in baryon and Higgs sectors from intrinsic quantum mechanics - on neutral pentaquarks and gauge boson couplings

I introduce an idea of intrinsic quantum mechanics where the gauge groups SU(3), SU(2) and U(1) share a common origin in an intrinsic U(3) configuration space for baryons. I present neutral pentaquark predictions in the baryon spectrum and I present Higgs to gauge boson couplings deviating by three percent in signal strengths from standard model predictions. The deviation originates in the appearance of the up-down quark mixing matrix element in the value for the electroweak energy scale determined from neutron decay. As the most recent result, I derive exemplar distributions for proton energy-momentum components showing a hollowness in the proton interior. The idea of intrinsic quantum mechanics is supported by derivations of u and d parton distribution functions for the proton; by a rather accurate value for the electron to neutron mass ratio 1/1839(1); by a theoretical suggestion for the value of the Cabibbo angle and by an equation for the Higgs mass in closed form yielding 125.095(14) GeV. The latter is an order of magnitude more accurate than the present average from combined ATLAS and CMS measurements. Higher statistics should settle the subtle differences between the standard model and intrinsic quantum mechanics predictions here put forward. A change in our conception of mass may ensue.
Main references:
EPL 102 (2013) 42002, EPL 124 (2018) 31001, EPL 125 (2019) 41001, EPL 128 (2019) 11004.
See also arXiv 1710.09271 and book on ResearchGate (2018).

Primary author: TRINHAMMER, Ole Lynnerup (Technical University of Denmark)

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Session Classification: Contributed Talks

Contribution ID: **11** Type: **not specified**

Semileptonic and missing energy decays at Belle II

The Belle II experiment, located at the SuperKEKB accelerator complex near Tokyo in Japan, has started
its 2019 run to collect collision events at large instantaneous luminosities. In this presentation we show results from studying missing energy signatures, such as leptonic and semileptonic B meson decays:
We report studies on re-measuring important standard candle processes, such as abundant inclusive
$B \to X\ell\bar{\nu}_\ell$ and $B \to D^{(*)}\ell\bar{\nu}_\ell$ decays using tagged and untagged
approaches. In addition we establish the presence of charmless semileptonic decays at the endpoint of
the lepton momentum spectrum. We further discuss the potential of Belle II to study the present day
anomaly in ratios of charm semileptonic decays with tau-leptons to light leptons, known as $R(D)$ and
$R(D^*)$ in the literature, and other missing energy modes with future Belle II data.

Primary author: PERUZZI, Ida (Laboratori Nazionali di Frascati dell'INFN)

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Session Classification: Contributed Talks

Contribution ID: **13** Type: **not specified**

Dark sector searches at Belle II

The Belle II experiment at the SuperKEKB energy-asymmetric e^+e^- collider is a substantial upgrade of the B factory facility at the Japanese KEK laboratory. The design luminosity of the machine is 8×10^{35} cm^{-2}s^{-1} and the Belle II experiment aims to record 50 ab^{-1} of data, a factor of 50 more than its predecessor. During 2018, the machine has completed a commissioning run, recording a data sample of about 0.5 fb^{-1}. Main operations started in March 2019 with the complete Belle II detector: an integrated luminosity of 6.5 fb^{-1} has been collected so far. These early data sets, with specifically designed low multiplicity triggers, offer already the possibility to search for a large variety of dark sector particles in the GeV mass range, complementary to LHC and to dedicated low energy experiments. The talk will review the status of the dark sector searches at Belle II, with a focus on the discovery potential of the early data, and show the first results.

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Session Classification: Contributed Talks

Contribution ID: **14** Type: **not specified**

Measurement of charm-mixing parameter y_CP in D0 → KSω decays at Belle

Within the Standard Model, CP-violation in the charm system is very small, making it a good probe for new physics. The observable y_{CP} parameterizes charm-mixing in D^0 decays to CP-eigenstates and is sensitive to CP-violation in the charm system. The current world average value of y_{CP} is $(0.715 \pm 0.111)\%$, where the precision mostly comes from CP-even decays of D^0. It includes a measurement from CP-odd final state, $K^0_S\phi$, in an analysis that assumes no CP-violation. I will present the first measurement of y_{CP} in the CP-odd decay $D^0 \to K^0_S\omega$, allowing for CP-violation, using the full Belle dataset. I would also discuss the Belle II prospects of y_{CP} from CP-odd decays.

Primary authors: Dr NAYAK, Minakshi (Tel Aviv University); Prof. CINABRO, David (Wayne State University)

Presenter: Dr NAYAK, Minakshi (Tel Aviv University)

Session Classification: Contributed Talks

Contribution ID: **16** Type: **not specified**

Massless composite vector particles

Brout-Englert-Higgs physics is an integral part of many BSM scenarios,
such as grand-unified theories, partial compositeness models and (broken) supersymmetric theories. Recent analytic results, based on manifest gauge invariance, suggest that in these models one has to reconsider setting the physical spectrum equal to the elementary one.

We illustrate this by considering a toy model for different BSM theories, an SU(2) gauge theory coupled to a single adjoint Higgs. Such a sector plays a role, e.g., in the emergence of QED in GUTs.

It is predicted that, even at weak coupling, such model exhibits a massless composite vector state, as well as massive composite vector states which differ from the elementary ones. We provide support for these predictions using lattice gauge theory.

Primary authors: AFFERRANTE, Vincenzo (University of Graz); MAAS, Axel Torsten (University of Graz); TOEREK, Pascal (University of Graz)

Presenter: AFFERRANTE, Vincenzo (University of Graz)

Session Classification: Young Scientist Forum

Contribution ID: **17** Type: **not specified**

Quark masses and mixings from a minimal parameterisation of new physics

The simplest possible parameterization of new physics that results in an ultraviolet complete gauge-Yukawa sector of the Standard Model is explored. To this end, an antiscreening contribution to the beta function of the Abelian hypercharge gauge coupling, and a flavor-universal, antiscreening contribution to the beta functions of the Yukawa couplings are added. These two free parameters give rise to an intricate web of Renormalization Group fixed points. Their predictive power extends to the quarks' flavor structure and mixing patterns. This results in a fixing of some of the free parameters and on constraints on others due to the properties of Renormalization Group fixed points and flow.

Primary author: Prof. ALKOFER, Reinhard (U. Graz)

Presenter: Prof. ALKOFER, Reinhard (U. Graz)

Session Classification: Contributed Talks

Contribution ID: **18** Type: **not specified**

Latest results from the NA62 experiment at CERN.

The NA62 experiment at the CERN SPS is designed to measure the branching ratio of the $K^+ \to \pi^+ \nu\bar{\nu}$ decay, one of the best candidates to reveal indirect effects of new physics at the highest mass scales with a very precisely predicted branching ratio of less than 10-10.
NA62 took data in 2016-2018.
Data statistics collected in 2016 allowed NA62 to reach the Standard Model sensitivity for $K^+ \to \pi^+ \nu\bar{\nu}$, entering the domain of 10-10 single event sensitivity and showing the proof of principle of the experiment. Thanks to the statistics collected in 2017, NA62 surpasses the present best sensitivity. The analysis strategy is reviewed and the preliminary result from the 2017 data set is presented. The sensitivity to a range of lepton flavour and lepton number violating kaon decays provided by the NA62 data set improves over the previously reported measurements. Results from the searches for these processes with a partial NA62 data sample are presented.

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Session Classification: Contributed Talks

Contribution ID: **20** Type: **not specified**

New results from the CUORE experiment

The Cryogenic Underground Observatory for Rare Events (CUORE) is the first bolometric experiment searching for neutrinoless double-beta ($0\nu\beta\beta$) decay that has been able to reach the one-ton scale. The detector, located at the Laboratori Nazionali del Gran Sasso in Italy, consists of an array of 988 TeO_2 crystals arranged in a compact cylindrical structure of 19 towers. Following the completion of the detector construction in August 2016, CUORE began its first physics data run in 2017 at a base temperature of about 10 mK. Following multiple optimization campaigns in 2018, CUORE is currently in stable operating mode. In 2019, CUORE released its 2nd result of the search for $0\nu\beta\beta$ corresponding to a TeO_2 exposure of 372.5 kg·yr and a median exclusion sensitivity to a ^{130}Te $0\nu\beta\beta$ decay half-life of 1.7×10^{25} yr. We find no evidence for $0\nu\beta\beta$ decay and set a 90% C.L. Bayesian lower limit of 3.2×10^{25} yr on the ^{130}Te $0\nu\beta\beta$ decay half-life. In this talk, we present the current status of CUORE's search for $0\nu\beta\beta$, as well as review the detector performance. We finally give an update of the CUORE background model and the measurement of the ^{130}Te two neutrino double-beta ($2\nu\beta\beta$) decay half-life.

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Presenter: VIGNATI, Marco (INFN - National Institute for Nuclear Physics)

Session Classification: Contributed Talks

Contribution ID: **22** Type: **not specified**

Neutrino Non-Standard Interactions: Complementarities Between LHC and Oscillation Experiments

Physics beyond the standard model may induce significant deviations in the couplings involving neutrinos generally referred to as Non-Standard neutrino Interactions (NSI). We present a complementarity study between LHC and oscillation experiments to probe NSIs. We perform the analyses in a simplified model and an illustrative ultraviolet completion. The present and high-luminosity LHC sensitivities to NSIs are derived with jets plus missing energy searches. We show that besides constraining the allowed NSI parameter space, the LHC data can break relevant degeneracies from oscillation experiments. The results will be presented.

Primary authors: Dr JANA, SUDIP (Max-Planck-Institut für Kernphysik); BABU, Kaladi (Oklahoma State University); GONÇALVES, Dorival (University of Pittsburgh); MACHADO, Pedro (Fermilab)

Presenter: Dr JANA, SUDIP (Max-Planck-Institut für Kernphysik)

Session Classification: Contributed Talks

Contribution ID: **23** Type: **not specified**

The CP nature of the Higgs top Yukawa coupling

While the CP nature of the Higgs vector-boson interaction has already been tightly constrained, the CP properties of the Higgs top Yukawa coupling are still comparably unexplored. In this talk, we report on a fit of a general top Yukawa model to all relevant LHC measurements. In addition to modifying the Higgs top-quark interaction, we also allow for new physics contributions to the couplings of the Higgs boson to photons, gluons, and massive vector bosons. We find that the current data still allows a sizeable CP-odd Higgs top Yukawa coupling.

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Session Classification: Contributed Talks

Contribution ID: **24** Type: **not specified**

Recent results on direct dark matter search with the XENON experiment

The recent results on direct dark matter search with the XENON1T detector are discussed: the WIMP scenario as well as other dark matter hypotheses have been constrained with unprecedented sensitivity. XENONnT, the next phase of the XENON project, will probe dark matter with a factor 10 higher sensitivity than XENON1T. The current status of XENONnT assembly and commissioning is presented.

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Presenter: Dr MACOLINO, Carla (IJCLab - Orsay)

Session Classification: Contributed Talks

Contribution ID: **26** Type: **not specified**

NEWS-G: Search for Light Dark Matter with a Spherical Proportional Counter

The NEWS-G collaboration is searching for light dark matter candidates using a spherical proportional counter. Access to the mass range from 0.1 to 10 GeV is enabled by the combination of low energy threshold, light gaseous targets (H, Ne), and highly radio-pure construction. The current status of the experiment will be presented, along with the first NEWS-G results obtained with SEDINE, a 60 cm in diameter spherical proportional counter operating at LSM (France), excluding cross-sections above 4.4x10^{-37} cm^2 for 0.5 GeV WIMP using a neon-based gas mixture. The construction of the next generation, 140 cm in diameter, spherical proportional counter using 4N copper at LSM will be discussed, along with the latest advances in SPC instrumentation. The detector, following initial commissioning at LSM is currently being installed at SNOLAB (Canada), with the first physics run scheduled for later this year. Finally, future prospects and applications of spherical proportional counters will be summarised.

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Session Classification: Contributed Talks