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Proceedings to the 15th International Workshop "What Comes Beyond the Standard Models", July 9--19, 2012, Bled, Slovenia

Scientific Committee:

- *John Ellis* (CERN)
- *David Gross* (KITP)
- *Roman Jackiw* (MIT)

Editors: N.S. MankoÄ BorÅ¡tnik, H.B. Nielsen and D. Lukman
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The Members of the Organizing Committee of the International Workshop "What Comes Beyond the Standard Models", Bled, Slovenia, state that the articles published in the Proceedings to the 15th International Workshop "What Comes Beyond the Standard Models", Bled, Slovenia are refereed at the Workshop in intense in-depth discussions.

Contents:

- Preface in English Language
- Predgovor (Preface in Slovenian Language)
- Talks
- Discussions
- VIA

Preface in English Language

The series of workshops on "What Comes Beyond the Standard Models?" started in 1998 with the idea of Norma and Holger for organizing a real workshop, in which participants would spend most of the time in discussions, confronting different approaches and ideas. It is the fifteenth workshop which took place this year in the picturesque town of Bled by the lake of the same name, surrounded by beautiful mountains and offering pleasant walks and mountaineering. It is therefore the celebration time this year, the time to evaluate the achievements of our workshops.

Let us try to assess what has come out of our very open minded, friendly, cooperative, long, tough and demanding discussions. What topics have our discussions stimulated at least to some extent so that they develop in these years considerably faster than they would without our workshops?

In this proceedings the list of talks in all Bled workshops is added. The topics obviously cover the most open questions of the elementary particle physics and cosmology. Although most of participants were theoretical physicists, many of them with their own suggestions how to make the next step beyond the accepted models and theories, experts from experimental laboratories were very appreciated, helping a lot to understand what do measurements really tell and which kinds of predictions can best be tested.

The organizers must admit that we have learned in the Bled workshops a lot, possibly more than other participants. Presenting our own ideas with proposals how to understand the so far observed phenomena and how to answer open questions of both standard models, the participants were posing us very detailed and demanding questions, wishing to understand the ideas, statements, proofs about the consistency of the proposals and the predictions. Many a time talks turned into very pedagogical presentations in order to clarify the assumptions and the detailed steps, confronting these proposals with the proposals in the literature or of the other participants, so that all possible weak points of the proposals showed up very clearly. And particular these kind of discussions were helpful for authors to find the right next step in building on our proposals.

Organizers hope, however, that all the participants have profited at least a little bit of what we did and that young participants have profited even more than we have.

In these fifteen years experiments made a large step. Among the most important ones is that the LHC (almost) confirmed that the scalar field, named after P. Higgs, is like other fermionic and bosonic fields -- just a field. We all "knew" that LHC must sooner or later measure something which has the scalar Higgs like degrees of freedom. The *standard model*, namely, although built on several non understood assumptions, agrees so far with experimental data surprisingly well. Experiences on other fields of physics teach us that whenever some degrees of freedom show up so strongly indirectly, they must represent at least some collective degrees of freedom. The success of measurements on the LHC leaves, however, unanswered the question about the origin of Higgs. Is this just a new particle, the first boson with the charge, the weak one, in the fundamental representation, the representation which has been so far reserved for fermions? Holger has long time ago predicted its mass as reported in this proceedings. Or it is a superposition of several scalar fields, which take care of new interactions, manifesting so far effectively as the Higgs and the Yukawa couplings, as the Norma's *spin-charge-family* theory explains and predicts, which is also reported in this and previous proceedings of Bled workshops?

The *spin-charge-family* theory predicts no supersymmetric partners to the so far observed particles, but it predicts new families, the fourth coupled to the so far observed three. It also predicts a stable fifth family the members of which might form the dark matter. Holger and Maxim have another explanation for the dark matter. Holger predicts the existence of a cluster of twelve top quarks and anti-quarks (or may be members of the fourth family) forming a bound state due to the Yukawa couplings. Maxim is predicting dark atoms composed of -2 charged clusters of the fifth family quarks bound by Coulomb force with the +2 charged primordial helium nuclei in nuclear-interacting OHe atoms. Direct measurements of the dark matter in Gran Sasso made by DAMA/LIBRA, presented and discussed at Bled workshops, and of other direct measurements, among them CDMS and XENON experiments presented and discussed at Bled, although not yet in agreement with each others, but to the organizers understanding also not in disagreement, are promising to explain which proposals in the literature, with the "Bled" ones included, are offering the right prediction.

The Bled workshops proposals are offering several other answers to the open questions in elementary particle physics and cosmology, as can be noticed in the list of titles of all the talks, added to this year proceedings. Future experiments will confirm or disprove their proposals and predictions. But even if not confirmed, new and different ways of looking at the open problems in physics will certainly help to find next better steps beyond the standard models.

Bled Workshops owe their success to participants who have at Bled in the heart of Slovene Julian Alps enabled friendly and active sharing of information, yet their success was boosted by video conferences. Questions and answers as well as lectures enabled by M.Yu. Khlopov via Virtual Institute of Astroparticle physics of APC have in ample discussions helped to resolve many dilemmas.

The reader can find the records of all the talks delivered by cosmovia since Bled 2009 on www.cosmovia.org . The two talks of the fifteenth workshop, presented by Pierluigi Belli and Anatoli Romaniouk, can be accessed directly here .

Let us conclude this preface by thanking cordially and warmly to all the participants, present personally or through the teleconferences at Bled workshops, for their excellent presentations and in particular for really fruitful discussions and the good working atmosphere.

Astri, thank you very much indeed for your present, the poem published in this proceedings!

The workshops take place in the house gifted to the Society of Mathematicians, Physicists and Astronomers of Slovenia by the Slovenian mathematician Josip Plemelj, well known to the participants by his work in complex algebra.

- *Norma MankoÄ BorÅ¡tnik, Holger Bech Nielsen, Maxim Y. Khlopov,* (the Organizing comittee)
- *Norma MankoÄ BorÅ¡tnik, Holger Bech Nielsen, Dragan Lukman,* (the Editors)

Ljubljana, December 2012

Predgovor (Preface in Slovenian Language)

Serija delavnic "Kako preseÄi oba standardna modela, kozmoloÅ¡kega in elektroÅ¡ibkega" ("What Comes Beyond the Standard Models?") se je zaÄela leta 1998 z idejo Norme in Holgerja, da bi organizirali delavnice, v katerih bi udeleÅ¾enci v izÄrpnih diskusijah kritiÄno sooÄili razliÄne ideje in teorije. Letos smo imeli petnajsto delavnico v mestu Bled ob slikovitem jezeru, kjer prijetni sprehodi in pohodi na Äudovite gore, ki kipijo nad mestom, ponujajo priloÅ¾nosti in vzpodbudo za diskusije. Zato je letos Äas za praznovanje in Äas za oceno doseÅ¾kov delavnic.

Poskusimo oceniti, kaj so porodile naÅ¡e zelo odprte, prijateljske, dolge in zahtevne diskusije, polne iskrivega sodelovanja. Poskusimo tedaj oceniti, pri katerih temah so naÅ¡e diskusije vsaj v doloÄeni meri omogoÄile hitrejÅ¡i napredek.

V tem zborniku smo dodali seznam predavanj in diskusij na vseh dosedanjih blejskih delavnicah. Teme oÄitno pokrivajo veÄino odprih vpraÅ¡anj fizike osnovnih delcev in kozmologije. Med udeleÅ¾enci smo bili sicer po veÄini teoretiÄni fiziki, mnogi med nami z lastnimi idejami kako napraviti naslednji korak onkraj sprejetih teorij in modelov. Posebej dobrodoÅ¡li pa so bili tudi predstavniki eksperimentalnih laboratorijev, ki so nam v odprtih diskusijah pomagali razjasniti resniÄno sporoÄilo meritev in katere napovedi lahko poskusi najzanesljiveje preverijo.

Organizatorji moramo priznati, da smo se na blejskih delavnicah nauÄili veliko, morda veÄ kot veÄina udeleÅ¾encev. Ko smo predstavili lastne ideje in predloge, kako razumeti dosedaj opaÅ¾ene pojave in kako odgovoriti na odprta vpraÅ¡anja obeh standardnih modelov ter poroÄali o napredku predlogov, so nam udeleÅ¾enci postavljali zelo podrobna in zahtevna vpraÅ¡anja v Å¾elji razumeti upraviÄenost predpostavk in trditev, zanesljivost in konsistentnost dokazov ter napovedi predlogov. Velikokrat so se predavanja spremenila v zelo pedagoÅ¡ke predstavitve, ki so pojasnile predpostavke in podrobne korake, sooÄile predstavljene predloge s predlogi v literaturi ali s predlogi ostalih udeleÅ¾encev ter jasno pokazale, kje utegnejo tiÄati Å¡ibke toÄke predlogov. Å¡e posebej so te diskusije pomagale avtorjem najti pravilen naslednji korak v razvoju naÅ¡ih predlogov. Vendar organizatorji upamo, da so tudi drugi udeleÅ¾enci odnesli veliko od teh delavnic in da so najveÄ odnesli mladi udeleÅ¾enci.

V teh petnajstih letih so eksperimenti napravili velike korake. Med najpomembnejÅ¡imi doseÅ¾ki je potrditev, da je skalarno polje, eden od bistvenih privzetkov *standardnega modela*, imenovano po P. Higgsu, prav tako polje kot ostala fermionska in bozonska polja. Izmerili so ga na LHC. Äeprav smo vsi ‘‘vedeli’’, da mora LHC prej ali slej izmeriti nekaj podobnega tej prostostni stopnji, ker so nas izkuÅ¡nje na ostalih podroÄjih fizike nauÄile, da se vedno, kadar se neka prostostna stopnja posredno kaÅ¾e tako izrazito, kot se je pri osnovnih delcih Higgsov skalar, taka prostostna stopnja potrdi, je doseÅ¾ek LHC izreden in pomemben. VpraÅ¡anje pa ostaja, kaj je Higgsov skalar? Je to novi delec, prvi bozon s Å¡ibkim nabojem v fundamentalni upodobitvi, ki je bila doslej rezervirana samo za fermione? Z maso, ki jo je Å¾e dolgo nazaj napovedal Holger, kar pojasnjuje v tem zborniku? Ali pa je superpozicija veÄ skalarnih polj, ki poskrbijo za doslej nepoznane interakcije med fermionskimi in bozonskimi polji in so opazna kot Higgsov skalar in Yukawine sklopitve, kot to pojasni in napove Normina teorija spinov, nabojev in druÅ¾in, predstavljena v tem in prejÅ¡njih zbornikih?

Teorija spinov, nabojev in druÅ¾in napoveduje, da ni supersimetriÄnih partnerjev dosedaj opaÅ¾enih delcev, to je fermionskih in bozonskih polj. Napove pa nove druÅ¾ine, od katerih je Äetrta sklopljena z dosedaj opaÅ¾enimi tremi. Napove tudi stabilno peto druÅ¾ino, ki pojasni iz Äesa je temna snov. Holger in Maxim imata za temno snov drugaÄni razlagi. Holger napoveduje gruÄe dvanajstih kvarkov in antikvarkov z imenom *t* (ali morda celo Älanov Äetrte druÅ¾ine, ki jo napoveduje Norma), ki jim Yukawine skopitve zagotovijo stabilnost. Maxim napoveduje atome temne snovi, sestavljene iz gruÄ pete druÅ¾ine kvarkov z elektromagnetnim nabojem -2, ki jih jedrska sila poveÅ¾e s helijevim jedrom iz kvarkov prve druÅ¾ine, ta nosi elektromagnetni naboj +2, v atome "OHe". Direktne meritve temne snovi je v Gran Sassu opravil poskus DAMA/LIBRA, ki je bil predstavljen na blejskih delavnicah in smo o njem podrobno diskutirali. Tudi druge direktne meritve smo temeljito prediskutirali, posebej poskusa XENON in CDMS, ki sta tudi bila predstavljena na Bledu. Äetudi se zdi, da so med sabo izkljuÄujejo, organizatorji menimo, da si tudi ne nasprotujejo in da obetajo pojasniti, kateri predlogi v literaturi, vkljuÄno z ,,blejskimi’’, ponujajo prave napovedi.

Predlogi, predstavljeni na blejskih delavnicah, kot lahko razberemo iz naslovov tem, predstavljenih in diskutiranih na vseh dosedanjih Blejskih delavnicah, teme in avtorji so objavljeni v tem zborniku, ponujajo odgovore na marsikatero od ostalih odprtih vpraÅ¡anj fizike osnovnih delcev in kozmologije. BodoÄi eksperimenti bodo te predloge in njihove napovedi potrdili ali ovrgli. Tudi, Äe jih ne potrdijo, bodo ti novi in razliÄni pogledi na odprta vpraÅ¡anja v fiziki gotovo pomagali najti poti, kako preseÄi standardna modela.

Äetudi so k uspehu "Blejskih delavnic" najveÄ prispevali udeleÅ¾enci, ki so na Bledu omogoÄili prijateljsko in aktivno izmenjavo mnenj v osrÄju slovenskih Julijcev, so k uspehu prispevale tudi videokonference, ki so poveyale delavnice z laboratoriji po svetu. VpraÅ¡anja in odgovori ter tudi predavanja, ki jih je v zadnjih letih omogoÄil M.Yu. Khlopov preko Virtual Institute of Astroparticle physics , APC, Pariz), so v izÄrpnih diskusijah pomagali razÄistiti marsikatero dilemo.

Bralec najde zapise vseh predavanj, objavljenih preko "cosmovia" od leta 2009, na strani www.cosmovia.org. Tam sta tudi letoÅ¡nji predavanji Pierluigija Bellia in Anatolija Romaniouka.

Naj zakljuÄimo ta predgovor s prisrÄno in toplo zahvalo vsem udeleÅ¾encem, prisotnim na Bledu osebno ali preko videokonferenc, za njihova predavanja in Å¡e posebno za zelo plodne diskusije in odli\v cno vzduÅ¡je.

PrisrÄna hvala, Astri, za tvojo pesem, objavljeno v tem zborniku.

Delavnica poteka v hiÅ¡i, ki jo je DruÅ¡tvu matematikov, fizikov in astronomov Slovenije zapustil v last slovenski matematik Josip Plemelj, udeleÅ¾encem delavnic, ki prihajajo iz razliÄnih koncev sveta, dobro poznan po svojem delu v kompleksni algebri.

- *Norma MankoÄ BorÅ¡tnik, Holger Bech Nielsen, Maxim Y. Khlopov,* (Organizacijski odbor)
- *Norma MankoÄ BorÅ¡tnik, Holger Bech Nielsen, Dragan Lukman,* (Uredniki)

Ljubljana, grudna (decembra) 2012

Talks

arXiv:1301.6243 [pdf, ps, other]
Title: DAMA/LIBRA results and perspectives
Authors: R. Bernabei (1), P. Belli (1), A. Di Marco (1), F. Cappella (2), A. d'Angelo (2), A. Incicchitti (2), V. Caracciolo (3), R. Cerulli (3), C. J. Dai (4), H. L. He (4), X. H. Ma (4), X. D. Sheng (4), R. G. Wang (4), F. Montecchia (1,5), Z. P. Ye (4,6) ((1) Univ. and INFN Roma Tor Vergata, (2) Univ. and INFN Roma, (3) INFN LNGS, (4) IHEP Beijing, (5) Univ. Tor Vergata, (6) Univ. Jing Gangshan)
Comments: 12 pages, Proceed. of the 15th Bled Workshop "What Comes Beyond Standard Models" (December 2012), Vol. 13, No. 2
Subjects: Galaxy Astrophysics (astro-ph.GA); High Energy Physics - Phenomenology (hep-ph)

arXiv:1211.5684 [pdf, ps, other]
Title: The nuclear physics of OHe
Authors: J.R. Cudell, M. Khlopov, Q. Wallemacq
Comments: Contribution to the proceedings of the 15th Workshop "What Comes Beyond the Standard Models", Bled, July 9-19, 2012
Subjects: Cosmology and Extragalactic Astrophysics (astro-ph.CO); High Energy Physics - Phenomenology (hep-ph); Nuclear Theory (nucl-th)

arXiv:1212.4571 [pdf, ps, other]
Title: Charged lepton and Neutrino masses from a low energy SU(3) flavour symmetry model
Authors: Albino Hernandez-Galeana
Comments: 16 pages, 4 figures, To appear in the Proceedings to the 15th Bled Workshop "What Comes Beyond the Standard Models", DMFA - ZALOZNISTVO, December 2012, Vol. 13, No. 2. arXiv admin note: substantial text overlap with arXiv:1111.7286
Subjects: High Energy Physics - Phenomenology (hep-ph)

arXiv:1301.3812 [pdf, ps, other]
Title: Flavour Symmetric Mass Matrices
Authors: Astri Kleppe
Comments: 8 pages, To appear in the Proceedings to the 15th Bled Workshop "What Comes Beyond Standard Models", DMFA ZALOZNISTVO, December 2012, Vol. 13, No. 2
Subjects: High Energy Physics - Phenomenology (hep-ph)

arXiv:1212.3184 [pdf, other]
Title: Do we have the explanation for the Higgs and Yukawa couplings of the standard model?
Authors: Norma Susana Mankoc Borstnik
Comments: 22 pages, revised version. arXiv admin note: substantial text overlap with arXiv:1207.6233
Subjects: High Energy Physics - Phenomenology (hep-ph)

arXiv:1212.2362 [pdf, other]
Title: Discrete symmetries in the Kaluza-Klein-like theories
Authors: N.S. Mankoc Borstnik, H.B. Nielsen
Comments: 17 pages, corrected previous version
Subjects: High Energy Physics - Theory (hep-th); High Energy Physics - Phenomenology (hep-ph)

arXiv:1211.7269 [pdf, ps, other]
Title: Correspondence between future-included and future-not-included theories
Authors: Keiichi Nagao, Holger Bech Nielsen
Comments: 10 pages, references added, to appear in the proceedings of the 15th workshop "What Comes Beyond the Standard Models", Bled, Slovenia, Jul.9-19, 2012
Subjects: Quantum Physics (quant-ph); High Energy Physics - Theory (hep-th)

arXiv:1212.5716 [pdf, other]
Title: PREdicted the Higgs Mass
Authors: Holger Bech Nielsen
Comments: 40 pages, To appear in the Proceedings to the 15th Bled Workshop "What Comes Beyond Standard Models", DMFA ZALOZNISTVO, December 2012, Vol. 13, No. 2 This later version has a couple of references more
Journal-ref: In Bled Proceedings of the 15th Workshop "What Comes Beyond the Standard Models'' Bled, July 9-19, 2012; 15th Anniversary Workshop, Ljubljana Decmber 2012, DMFA-zalozhnishtvo. ISSN 1580-4992
Subjects: High Energy Physics - Phenomenology (hep-ph)

arXiv:1212.3044 [pdf, ps, other]
Title: Our String Field Theory Liberating Left and Right Movers as Constituent "Objects"
Authors: Holger B. Nielsen, Masao Ninomiya
Comments: 22 pages, 7 figures, the 15th Workshop "What comes beyond the Standard Models", Bled,Slovenia, July 2012
Subjects: High Energy Physics - Theory (hep-th)

Discussions

arXiv:1212.4055 [pdf, other]
Title: Masses and mixing matrices of quarks within the spin-charge-family theory
Authors: Gregor Bregar, Norma Susana Mankoc Borstnik
Comments: 11 pages, To appear in the Proceedings to the 15th Bled Workshop "What Comes Beyond Standard Models", DMFA ZALOZNISTVO, December 2012, Vol. 13, No. 2
Subjects: High Energy Physics - Phenomenology (hep-ph)

arXiv:1212.2370 [pdf, other]
Title: Families of spinors in $d=(1+5)$ with zweibein and two kinds of spin connection fields on an almost S^2
Authors: D. Lukman, N.S. Mankoc Borstnik
Comments: 10 pages, To appear in the Proceedings to the 15th Bled Workshop "What Comes Beyond Standard Models", DMFA ZALOZNISTVO, December 2012, Vol. 13, No. 2
Subjects: High Energy Physics - Theory (hep-th); Mathematical Physics (math-ph)

arXiv:1112.0889 [pdf, ps, other]
Title: What at all is the Higgs of the Standard model and what is the origin of families?
Authors: Norma Susana Mankoc Borstnik
Comments: 12 pages, no figures
Subjects: High Energy Physics - Phenomenology (hep-ph)

arXiv:1212.2374 [pdf, other]
Title: Massless solutions for families of spinors for the toy model in $d=(1+5)$
Authors: M. Stimulak, A. Zaloznik, N.S. Mankoc Borstnik
Comments: 3 pages, To appear in the Proceedings to the 15th Bled Workshop "What Comes Beyond Standard Models", DMFA ZALOZNISTVO, December 2012, Vol. 13, No. 2. Name spelling corrected
Subjects: Mathematical Physics (math-ph)

VIA

arXiv:1211.5306 [pdf, ps, other]
Title: Virtual Institute of Astroparticle physics - science and education online
Authors: Maxim Yu. Khlopov
Comments: 9 pages, 3 figures, Invited contribution to Proceedings of XV Bled Workshop "What comes Beyond the Standard Model?"
Subjects: General Physics (physics.gen-ph)