Vienna Central European Seminar 2018

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on Particle Physics and Quantum Field Theory

Global and Local Symmetries

Book of Abstracts

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Corresponding Author: nf252@cam.ac.uk

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Corresponding Author: dschwarz@physik.uni-bielefeld.de

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Corresponding Author: a.eichhorn@thphys.uni-heidelberg.de

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Corresponding Author: alfredo.leonardo.urbano@cern.ch

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Corresponding Author: ennio.salvioni@cern.ch

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Corresponding Author: francesco.sannino@cern.ch

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Corresponding Author: axel.maas@uni-graz.at

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Corresponding Author: grumil@hep.itp.tuwien.ac.at

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Corresponding Author: karl.landsteiner@uam.es

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Corresponding Author: andreas.schaefer@physik.uni-r.de

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An Inert Scalar In The S3 Symmetric Model

Corresponding Author: m.catalina@fisica.unam.mx

We consider the S3 symmetric extension of the Standard Model in which all the irreducible representations of the permutation group are occupied by SU(2) scalar doublets,
one of which is taken as inert. We study the parameter space of the model probing points against physical constraints ranging from unitarity tests to experimental Higgs searches limits. We find that the latter constraints severely restrict the parameter space of the model, and that the relic density of the dark matter candidates lies below the Planck bound for
a large portion of the probed regions.

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Fifth forces and discrete symmetry breaking

Corresponding Author: peter.millington@nottingham.ac.uk

Modifications of general relativity often involve coupling additional scalar fields to the Ricci curvature, leading to scalar-tensor theories of Brans-Dicke type. If the additional scalar fields are light, they can give rise to long-range fifth forces, which are subject to stringent constraints from local tests of gravity. In this talk, we show that fifth forces only arise for the Standard Model (SM) due to mass mixing with the Higgs field, and we emphasise the pivotal role played by discrete and continuous symmetry breaking. Quite remarkably, if one assumes that such light, non-minimally coupled scalar fields exist in nature, the non-observation of fifth forces has the potential to tell us about the structure of the SM Higgs sector and the origin of its symmetry breaking. Moreover, with these observations, we argue that certain classes of scalar-tensor theories (as studied in cos- mology and astro-particle physics) are entirely equivalent to Higgs-portal theories (as studied in high-energy physics) at the level of their dimension-four operators.

Contributed Talks / 20

Gravitational waves from cosmic domain walls

Corresponding Author: saikawa@mpp.mpg.de

Domain walls are sheet-like topological defects produced when a discrete symmetry is spontaneously broken in the early universe. Although the existence of stable domain walls is disfavored by cosmological considerations, it is possible to consider unstable domain walls which disappear early enough not to lead cosmological disasters. In this talk, we discuss the possibility that a significant amount of gravitational waves is produced by annihilation of such unstable domain walls in the early universe. After reviewing cosmological evolution of domain walls, we give an estimate of the expected gravitational wave signal based on the results of numerical simulations. In addition, we briefly review a number of well-motivated particle physics models that predict the formation of unstable domain walls. The detectability of predicted signals is also discussed in prospect of planned gravitational wave observatories.