UKHEP forum
Anomalies and deviations: Introduction

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Science & Technology
Facilities Council

The standard model and naturalness

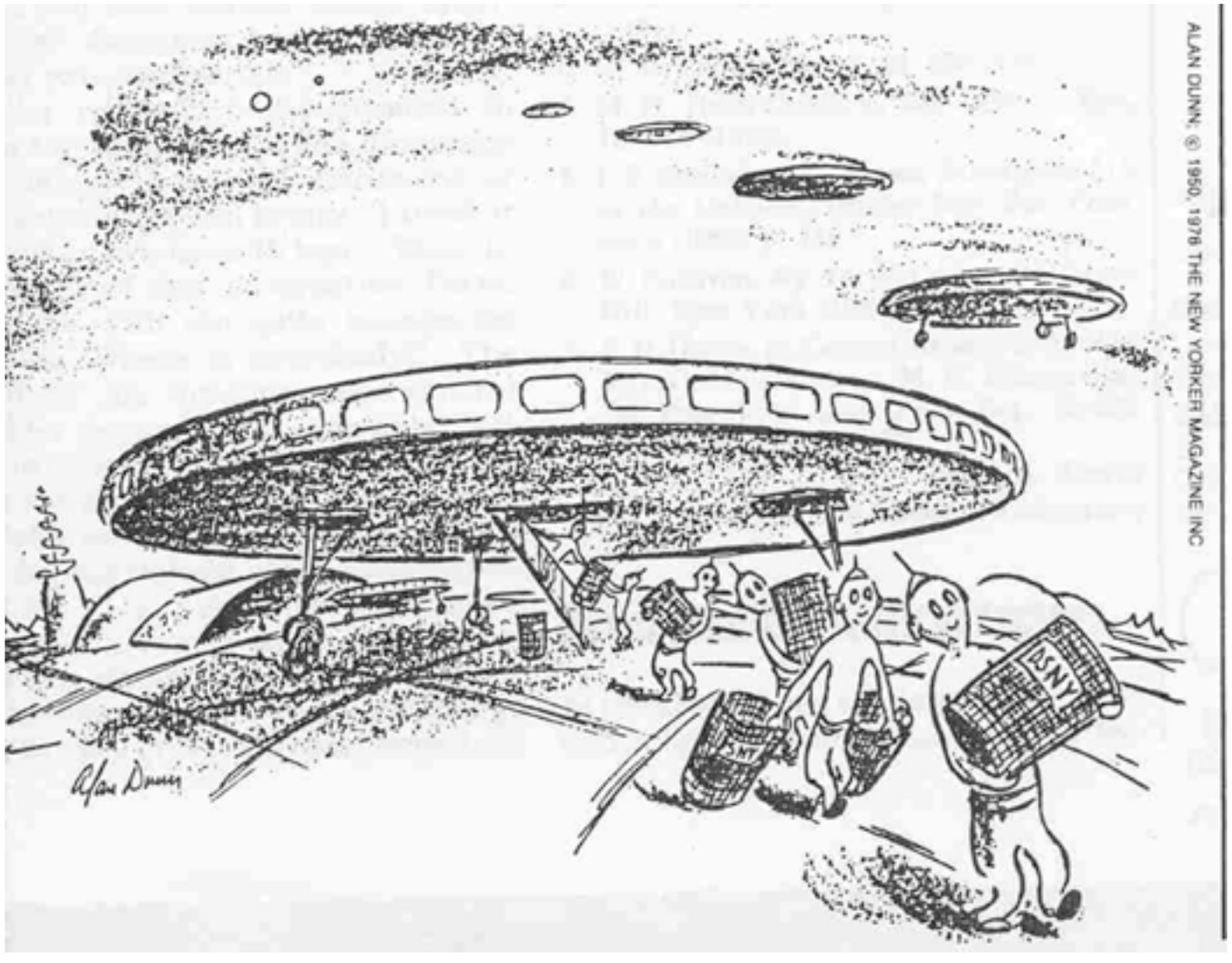
* After discovery of the Higgs boson, it is possible that the standard model is valid until Λ ~ Planck scale.
* But the mass of the Higgs boson is unprotected by any symmetry and hence is of order Λ.
* The observed Higgs boson mass can be achieved by fine tuning
* M_H^2=123456789012345678901234567890123456 78. ← Bare mass^2
  -123456789012345678901234567890123300 53. GeV^2
* By lowering the scale of new physics the amount of fine tuning is reduced. If we insist that the correction to the bare mass does not exceed the observed mass, $\delta M_H^2 = -(0.2\ \Lambda)^2$
* In this case the scale of new physics is ~ 1 TeV.
* Naturalness argument is the main argument for nearby new physics

Standard model and dark matter

- The standard model (without axions) has no natural candidate for dark matter.
- The correct abundance of dark matter is obtained for a self annihilation cross section, consistent with a ~100 GeV particle interacting weakly.
- This again suggests that new physics should be nearby.

Where is everybody?

* The Fermi Paradox(1950)
* Contradiction between theoretical ideas on probability of alien life and the lack of any observation.
* Do we have a “Fermi scale paradox(2015)” as well?



Other issues

* The standard model in its simplest form does not contain masses and mixing for neutrinos
* Since both masses and mixings have been observed, neutrino physics proponents argue the BSM physics has been already discovered in the neutrino sector.
* There could be still more to discover
* And there is the issue of the cosmological constant.

Programme: Thursday

Thursday, 5 November 2015

09:30 - 10:00	Tea/Coffee
10:00 - 10:15	Welcome *15'* Speaker: Keith Ellis
10:15 - 10:50	BSM searches at CMS *35'* Speaker: Henning Flaecher
11:00 - 11:35	BSM searches at ATLAS *35'* Speaker: Alex Martyniuk
11:45 - 12:20	High-pT phenomenology *35'* Speaker: Michael Spannowskj
12:30 - 14:00	Lunch
14:00 - 14:35	Higgs couplings *35'* Speaker: Alexandre Nikitenko Material: Slides
14:45 - 15:20	Dark matter direct searches *35'* Speaker: David Cerdeno
15:30 - 16:05	Dark matter indirect searches *35'* Speaker: Pat Scott
16:15 - 16:45	Tea/Coffee
16:45 - 17:20	Critical Interpretation of Planck results *35'* Speaker: Jo Dunkley
17:30 - 18:05	g-2 *35'* Speaker: Dominik Stockinger
18:15 - 20:00	Poster session and Reception
20:00 - 22:00	Dinner

Programme Friday

Friday, 6 November 2015

09:00 - 09:35	Reactor flux anomaly theory and experiment *35'* Speaker: Daniel Dwyer
09:45 - 10:20	LSND, MiniBoone and future experiments on sterile neutrinos *35'* Speaker: Georgia Karagiorgi
10:30 - 11:00	Tea/Coffee
11:00 - 11:35	Theory of mass and sterile neutrinos *35'* Speaker: Alex Merle
11:45 - 12:20	Low energy extension beyond the Standard Model *35'* Speaker: Maxim Pospelov
12:30 - 14:00	Lunch
14:00 - 14:35	Anomalies in flavour physics *35'* Speaker: Greig Cowan
14:45 - 15:20	Understanding flavour anomalies *35'* Speaker: Sebastian Jaeger
15:30 - 16:00	Adjourn

Thanks to Alex Lenz, Stefania Ricciardi et al.

IPPP involvement in BSM physics

* Associateship program — 2015/2016 awards

Costas Andreopoulos,RAL/Liverpool,*Global Tuning of the GENIE Neutrino Monte Carlo Generator.*
Clare Burrage, Nottingham, *Connecting Cosmology and Phenomenology.*
Malcolm Fairbairn, Kings College London, *Dark Matter*
Claire Gwenlan(Oxford), Mark Sutton(Sussex),*Fast NNLO QCD predictions for LHC Run 2 and beyond*
Chris Hays,Oxford, *Probing new physics with Higgs interactions*
Sebastian Jaeger,Sussex, *Probing the TeV scale with mixing and rare decays*
Georgia Karagiorgi, Manchester, *Searching for New Physics in the Neutrino Sector*
Cristina Lazzeroni, Birmingham, *Search for new physics in Kaon Decays*
Kenneth Long,Imperial, *Neutrino nucleus inclusive and exclusive cross section measurement using muon-derived beams*
Chris Pollard, Andy Buckley Glasgow, *Differential measurements of g->bb kinematics in V+bb events*
Mike Seymour,Manchester, *Massive Initial State Partons in Herwig++*
Matthew Wingate, Cambridge, *B meson mixing and decays using Lattice QCD*
Steven Worm, RAL, *Dark Matter modelling for Direct Detection*

* Enhancement of IPPP staff working in this area — two new lectureships, one targeted towards BSM physics.
* BSM talk at Annual Theory Meeting (20-22 December 2015)