Term Paper Suggestions - Phys 7280-001

Paper due 05/04/21

The references are to arXiv numbers i.e https://arxiv.org. Another source for HEP papers is http://inspirehep.ne where you can search by author, topic word etc.

1 Dark Matter

a) Wimp Dark Matter - Supersymmetry/Supergravity LSP - gravitino b) Composite Dark Matter c) Primordial Black Holes d) Light Dark Matter e) Axionic Dark Matter.

Reviews 1. Gelmini Tasi Lectures 1502.01320 2. Plehn 1705.01987 3.Hooper Tasi Lectures 1812.02029 4 Lisanti Tasi lectures1603.03797 5. Profumo Tasi Lectures 1301.0952

Review of current status of Wimp dark matter 1703.07364. Wino DM under Siege1307.4082v2 Detecting SUSY dark matter 0903.0555

Primorial Black Holes/Non thermal DM 1710.11196, 1603.00023, 1507.08660, 2006.02838

Axionic Dark Matter 1409.5123v2

2 Effective Field theory/Higgs and Standard Model

Pochinski Tasi lectures hep-th/9210046 - A classic introduction to EFT

Neubert 1901.06573

Burgess Introduction to Effective Field Theory (Cambridge 2021).

Effective Field Theory and Gravity:

Burgess gr-qc/0311082 Burgess1711.10592, 1601.04914

Goldberger hep-ph/0701129 Donoghue 1209.3511

Higgs/SM Reviews Falkowski1505.00046 Trott 1706.08945, Chiral Dynamics Leutwyler1510.07511, Leutwyler and Gasser Perturbation Theory to One Loop

J. Gasser (Bern U.), H. Leutwyler (CERN). Aug 1983. 92 pp. Published in Annals Phys. 158 (1984) 142 CERN-TH-3689 DOI: 10.1016/0003-4916(84)90242-2. This is the classic paper on chiral perturbation theory -i.e the low energy EFT of QCD.

3 Grand Unified Theories

Reviews: Wikipedia article and the Scholarpedia article Paul Langacker (2012), Scholarpedia, 7(10):11419 give a good summary. So does the Particle data book article pdg.lbl.gov/2017/reviews/rpp2017-rev-guts.pdf You should pick some aspect or class of models and explore further.

"Supersymmetric Grand Unified Theories From Quarks to Strings via SUSY GUTs" by Stuart Raby Springer, 2017 QC794.6.G7 is available in the Library.

4 Anomalies

You can start with the relevant chapter in Schwartz and then pick some aspect/application. Here are a couple of relatively recent books

"Anomalies in quantum field theory" / Reinhold A. Bertlmann Publisher Info Oxford ; New York : Clarendon Press, 1996 QC174.45 .B397 1996

For the mathematically minded: Topology and geometry in physics / E. Bick, F.D. Steffen (eds.) Publisher Info Berlin ; New York : Springer, ©2005 Subject Topology Geometry QC20.7.T65 T67 2005 and Jean Zinn-Justin hep-th/0201220 |

An older book containing reprints of the original articles is "Current Algebra And Anomalies" S.B. Treiman, Edward Witten (Princeton U.), R. Jackiw (MIT, LNS), B. Zumino (LBL, Berkeley & UC, Berkeley). 1986. Published in Singapore, Singapore: World Scientific (1985) 537p QC793.3.A4 C87 1985 There is a nice discussion on anomalies in Weinberg "Quantum Theory of Fields" Vol 2 chapter 22.

For condensed matter and other applications see for example Frolich arXiv:1802.01 Fujikawa arXiv:1709.08181 who also discusses the relation to Berry's phase.

A closely related subject is Baryo/Lepto genesis for reviews see

Buchmuller et al hep-ph/0502169, Glioti et al 1811.11740, Buchmuller 2009.07294.

4 CP violation

See for example https://pdg.lbl.gov/2017/reviews/rpp2017-rev-cp-violation.pdf
for quark sector and https://journals.aps.org/rmp/abstract/10.1103/RevModPhys.8
for leptonic sector.

5 Neutrino oscillations

See wikipedia article and references therein.