

I. WW ELASTIC SCATTERING, THE EQUIVALENCE THEOREM, THE ROLE OF THE HIGGS IN UNITARITY AND THE UNITARITY CONSTRAINTS ON THE HIGGS SECTOR

Write a $\gtrsim 10$ pages paper on this subject and prepare a 35 minutes blackboard presentation for this. No transparencies, no laptops. The calculations required for the scattering amplitudes must be explicitly presented in the paper.

Date of the presentation: May 1st

Possible References: The original papers on the subject is from Lee, Quigg and Thacker, Phys Rev Lett **38** (1977) 883 and Phys Rev D**16** (1977) 1519.

Fore more pedagogical presentation you can follow, for example, the Higgs Hunter's Guide book by Gunnion, Haber, Kane and Dawson

II. CP VIOLATION IN $B \rightarrow J/\psi K_s$

Write a $\gtrsim 10$ pages paper on this subject and prepare a 35 minutes blackboard presentation for this. No transparencies, no laptops. The final answer should be derived but also explanation for contributions which are neglected. Also a brief discussion for how this was measured (what was the signal how it was reconstructed), in the asymmetric B-factories, should be included (why asymmetric ?). <http://www.hip.fi/btau/talks/talkRA.ppt>

Date of the presentation: May 1st

Possible References: Y. Nir, arXiv:hep-ph/0510413; The course lecture notes; A talk by, Roy Aleksan, <http://www.hip.fi/btau/talks/talkRA.ppt>; The Babar book, <http://www.slac.stanford.edu/cgi-wrap/getdoc/babar504-005.pdf> .

III. W POLARIZATION IN $t \rightarrow Wb$

Write a $\gtrsim 10$ pages paper on this subject and prepare a 35 minutes blackboard presentation for this. No transparencies, no laptops. Explain via explicit calculation why in the SM we expect roughly 70%-30% longitudinal-transversial W polarization in top decay. Explain also how can this be tested at the Tevatron/LHC.

Date of the presentation: May 6th

Possible References: Michael E. Peskin and Daniel V. Schroeder, An Introduction to Quantum Field Theory (the book, the subsection on top decay within the SM); F. Hubaut, E. Monnier, P. Pralavorio, K. Smolek and V. Simak, “ATLAS sensitivity to top quark and W boson polarization in t anti- t ” Eur. Phys. J. C **44S2**, 13 (2005) [arXiv:hep-ex/0508061].

IV. SUSY VS. UNIVERSAL EXTRA DIMENSIONS SIGNALS AT THE LHC

Write a $\gtrsim 10$ pages paper on this subject and prepare a 35 minutes blackboard presentation for this. No transparencies, no laptops. Explain how a minimal model of universal extra dimension can mimic the LHC signatures of the MSSM. Emphasized should be made on the connection with an unbroken Z_2 symmetry, the missing energy signal at the LHC and the possibility to have dark matter candidate in both frameworks.

Date of the presentation: May 6th

Possible References: H. C. Cheng, K. T. Matchev and M. Schmaltz, “Bosonic supersymmetry? Getting fooled at the LHC,” Phys. Rev. D **66**, 056006 (2002) [arXiv:hep-ph/0205314]; T. Appelquist, H. C. Cheng and B. A. Dobrescu, “Bounds on universal extra dimensions,” Phys. Rev. D **64**, 035002 (2001) [arXiv:hep-ph/0012100]; SUSY course lecture notes.

V. RANDALL-SUNDRUM AND THE HIERARCHY PROBLEM

Write a $\gtrsim 10$ pages paper on this subject and prepare a 35 minutes blackboard presentation for this. No transparencies, no laptops. Explain how the Randall-Sundrum idea solves the hierarchy problem and maintain the weakness of gravity as required by observations.

Date of the presentation: May 8th

Possible References: L. Randall and R. Sundrum, “A large mass hierarchy from a small extra dimension,” Phys. Rev. Lett. **83**, 3370 (1999) [arXiv:hep-ph/9905221]; R. Sundrum, “To the fifth dimension and back. (TASI 2004),” arXiv:hep-th/0508134.