

χ PT and Electroweak Symmetry Breaking

A. Pich

Lecture 1: Spontaneous Symmetry Breaking

- Linear and non-linear sigma models
- Goldstone theorem
- Chiral symmetry
- Effective Goldstone theory

Lecture 2: Chiral Perturbation Theory

- Chiral symmetry breakings & external sources
- Lowest-order χ PT
- Weinberg's power counting
- Loops
- χ PT at $O(p^4)$ and beyond

Lecture 3: Non-leptonic Weak Transitions of Light Quarks

- Effective short-distance Hamiltonian
- χ PT realization
- $K \rightarrow 2\pi$ amplitudes & ϵ'/ϵ
- Rare Kaon decays

Lecture 4: Massive Fields

- CCWZ formalism
- Resonance chiral theory
- Integration of heavy scales: Low-energy constants
- UV behaviour

Lecture 5: Electroweak Effective Theory

- Standard Model Higgs mechanism
- Custodial symmetry
- Equivalence theorem
- Linear and non-linear effective theories

Lecture 6: Fingerprints of Heavy Scales

- Electroweak resonance effective theory
- Integration of heavy scales
- UV conditions

References

- [1] A. Pich, “Effective field theory: Course”, hep-ph/9806303.
- [2] A. Pich, “Chiral perturbation theory”, Rept. Prog. Phys. **58** (1995) 563 [hep-ph/9502366].
- [3] S. Scherer and M. R. Schindler, “A Primer for Chiral Perturbation Theory”, Lect. Notes Phys. **830** (2012) 1.
- [4] S. Scherer and M. R. Schindler, “Chiral perturbation theory for baryons”, Lect. Notes Phys. **830** (2012) 145.
- [5] V. Cirigliano, G. Ecker, H. Neufeld, A. Pich and J. Portoles, “Kaon Decays in the Standard Model”, Rev. Mod. Phys. **84** (2012) 399 [arXiv:1107.6001 [hep-ph]].
- [6] J. Bijnens and G. Ecker, “Mesonic low-energy constants”, Ann. Rev. Nucl. Part. Sci. **64** (2014) 149 [arXiv:1405.6488 [hep-ph]].
- [7] A. Pich, “Electroweak Symmetry Breaking and the Higgs Boson”, Acta Phys. Polon. B **47** (2016) 151 [arXiv:1512.08749 [hep-ph]].
- [8] A. Pich, I. Rosell and J. J. Sanz-Cillero, “Oblique S and T Constraints on Electroweak Strongly-Coupled Models with a Light Higgs”, JHEP **1401** (2014) 157 [arXiv:1310.3121 [hep-ph]].
- [9] A. Pich, I. Rosell, J. Santos and J. J. Sanz-Cillero, “Fingerprints of heavy scales in electroweak effective Lagrangians”, JHEP **1704** (2017) 012 [arXiv:1609.06659 [hep-ph]].
- [10] G. Buchalla, O. Catà and C. Krause, “Complete Electroweak Chiral Lagrangian with a Light Higgs at NLO”, Nucl. Phys. B **880** (2014) 552 [Err: Nucl. Phys. B **913** (2016) 475] [arXiv:1307.5017 [hep-ph]].