

08.128.624 Supersymmetry

Instructor: Felix Yu (yu001@uni-mainz.de)

- Lectures: Fr 10:00 am-12:00 pm (c.t.) in Minkowski Raum (05-119), Staudinger Weg 7
- Textbook references:
 - Mikhail Shifman, Advanced Topics in Quantum Field Theory (**Main reference**)
 - John Terning, Modern Supersymmetry (**Main reference**)
 - Ian Aitchison Supersymmetry in Particle Physics
 - Howard Baer and Xerxes Tata, Weak Scale Supersymmetry: From Superfields to Scattering Events
 - Michael Dine, Supersymmetry and String Theory: Dynamics and Duality
 - Steven Weinberg, The Quantum Theory of Fields, Volume III
 - Julius Wess and Jonathan Bagger, Supersymmetry and Supergravity
- ArXiv references:
 - Stephen Martin, A Supersymmetry Primer, hep-ph/9709356

Lecture plan

Fri. October 18, Lecture 1 Introduction and motivation; the Coleman-Mandula theorem and its loophole; review of Poincaré algebra and extension to SUSY algebra; superspace;

Fri. October 25, Lecture 2 Immediate consequences of unbroken SUSY; superfields; SUSY transformations of scalars and fermions; Chiral and vector superfields and auxiliary components; superpotential interactions; Kähler potential; the Wess-Zumino SUSY model

Fri. November 1 Holiday

Fri. November 8, Lecture 3 Superpotential and Lagrangian descriptions of interactions; super-QED; Fayet-Iliopoulos D-term; Super-Higgs mechanism

Fri. November 15, Lecture 4 Flat directions and vacuum manifold; R-symmetries; Holomorphy and non-renormalization of the superpotential; Holomorphic gauge coupling

Fri. November 22, Lecture 5 Spontaneous breaking of SUSY; O’Raifeartaigh model/F-term breaking; Fayet-Iliopoulos model/D-term breaking; Goldstinos

Fri. November 29, Lecture 6 The MSSM and soft SUSY breaking via gauge mediation, anomaly mediation, supergravity mediation; MSSM fields and interactions

Fri. December 6, Lecture 7 MSSM phenomenology: Hierarchy problem; Higgs physics; flavor physics; WIMP and super-WIMP dark matter

Fri. December 13, Lecture 8 MSSM phenomenology: LHC searches

Fri. December 20 Vacation

Fri. December 27 Holiday

Fri. January 3 Holiday

Fri. January 10, Lecture 9 Super-Yang-Mills theories; Super-QCD; 't Hooft anomaly matching

Fri. January 17, Lecture 10 Seiberg magnetic and electric duality; ADS superpotential; conformal window

Fri. January 24, Lecture 11 Additional topics of interest

Fri. January 31, Lecture 12 Additional topics of interest

Fri. February 7, Lecture 13 Conformal field theory; a-theorem; c-theorem