# GR 3 Supersymmetrie, SYM

Zeit: Freitag 11:45–12:30 Raum: TU BH262

GR 3.1 Fr 11:45 TU BH262

**Plane-wave matrix theory as toy model for N=4 Super-Yang-Mills** — •Thomas Klose — Max-Planck-Institute für Gravitationsphysik, Am Mühlenberg 1, 14476 Potsdam

Plane-wave matrix theory (PWMT) is the conjectured microscopic definition of M-theory on a plane-wave, and an important and interesting theory in its very own right. In this talk, however, we look upon PWMT as toy model for N=4 supersymmetric Yang-Mills theory (SYM) and its role in the AdS/CFT correspondence.

We sketch how the PWMT is obtained as a consistent truncation of SYM on a three-sphere. Within their common domain, PWMT and SYM are classically completely equivalent and quantum mechanically to at least third order of perturbation theory. The recent interest in the spectrum of conformal dimensions and the conjectured integrability of SYM are issues which may now be easily studied within PWMT. The advantage of this approach is the computationally much simpler quantum mechanical nature of the matrix theory. We obtain novel 4-loop results of PWMT and hence are able to make new predictions for SYM.

GR 3.2 Fr 12:00 TU BH262

**Higher-Loop Integrability of Planar $\mathcal{N} = 4$ SYM** — •Virginia Dippel — Max-Planck Institut für Gravitationsphysik, Albert-Einstein-Institut, Am Mühlenberg 1, 14476 Potsdam, Germany

The celebrated AdS/CFT Correspondence conjectures a duality between certain string and gauge theories, e.g. type II B superstring theory on an $AdS_5 \times S^5$ background and 4-dim. $\mathcal{N} = 4$ SYM theory. On a kinematical level the two theories are indeed identical. However, in order to truely test the correspondence, one has to compare the dynamics of gauge and string theory. On the string side the discovery of a $\sigma$-model allowed to use very powerful techniques, that come along with integrable models, in order to calculate the energies of so called semiclassical string states. These semiclassical strings are conjectured to be dual to very long, local, gauge invariant SYM operators. Thus, we expect the gauge theory to be integrable as well. Indeed a description of planar $\mathcal{N} = 4$ SYM in terms of an integrable super spin chain was found at the one-loop level. In this talk we are going to investigate subsectors of this theory in which the integrability extends to higher orders in the coupling constant. We will also comment on the mismatch between the gauge and the string side that was observed at three-loop order in this context.

GR 3.3 Fr 12:15 TU BH262

**Supersymmetry, exact Foldy-Wouthuysen transformation and gravity** — •Sebastian Heidenreich, Thoralf Chrobok, and Horst-Heino v. Borzeszkowski — Institut für Theoretische Physik PN7-1, TU Berlin, Hardenbergstr. 36, 10623 Berlin, Germany

The Dirac particle in general space-time metrics is considered and the Dirac Hamiltonian in Newman-Penrose formalism is constructed. To get the physical meaning of the Dirac Hamiltonian it is necessary to perform the Foldy-Wouthuysen transformation. In most cases this transformation exists only in approximative form. Here we show that for supersymmetric Dirac Hamiltonians depending not explicitly on time the exact Foldy-Wouthuysen transformation can always be constructed.
Further we give some criterions for spin coefficients such that the accompanying Dirac Hamiltonian is supersymmetric. These criterions are fulfilled by the class of static axisymmetric space-time metrics.
Recently Obukhov [1] constructed a different exact Foldy-Wouthuysen transformation for the subclass of conform-stationary space-time metrics and calculated the Dirac-Hamiltonian in Foldy-Wouthuysen representation. We show that the expansion series in orders of $1/mc^2$ of our Dirac Hamiltonian and Obukhov's one coincide.

[1] Y. N. Obukhov, Phys. Rev. Lett. **86**, 2001, 192