Laser spectroscopy of muonic atoms and the proton radius puzzle

Datum: 12.11.18

Uhrzeit: 16:15

Ort: H6

Vortragender: Prof. Dr. Randolf Pohl

Johannes Gutenberg Universität Mainz

The consistency of measurements of fundamental physical quantities is a crucial benchmark for testing both our understanding of the various measurement techniques and our fundamental theoretical framework of physics in general. Recently, laser spectroscopy of muonic hydrogen (µH) revealed a rather significant inconsistency for a very fundamental quantity, i.e., the proton rms charge radius retrieved from these measurements is 4% (or ~6 sigmas) smaller than the CODATA-2014 value [1,2].

Similar to this "proton radius puzzle" also the deuteron charge radius retrieved from muonic deuterium (µD) spectroscopy [3] is 6 sigmas smaller than the CODATA value, but consistent with the smaller proton inside the deuteron. In this talk I will report about a new measurement of the Rydberg constant from the 2S-4P transition in regular hydrogen performed in Garching [4], which supports the smaller, "muonic" value. More recently, however, a new measurement of the 1S-3S transition in Paris confirmed the larger proton radius [5]. Several new measurements, such as hydrogen from Toronto, elastic electron scattering at lower Q2, and new results from electronic and muonic helium will help understand the proton radius puzzle. With most of the new results pointing towards the smaller "muonic" proton radius, also from measurements with electrons, we may have to revise the value of the Rydberg constant. The improved proton radius will then pave the way for tenfold improved tests of QED and the Standard Model.


Ansprechpartner: W. Pfeiffer
Kolloquium Mathematische Physik

Thema:  tba

Datum:  01.02.19

Uhrzeit: 16:15

Ort:  U2-228

Vortragender:  Martin Zirnbauer

University of Cologne

Inhalt:

Ansprechpartner: G. Akemann

Seminar Hochenergiephysik

Measurement of Neutral Hydrogen Bias and Redshift Space Distortions with Cosmological Hydrodynamical Simulations

Thema:

Datum:  15.11.18

Uhrzeit: 14:15

Ort:  D6-135

Vortragender:  Atsushi Nishizawa

Nagoya Univ.

Inhalt:

Ansprechpartner: D. Schwarz
Seminar Kondensierte Materie

**Thema:** Spin-orbit torque in one-dimensional systems

**Datum:** 08.11.18

**Uhrzeit:** 14:15

**Ort:** D5-153

**Vortragender:** Mirko Daumann

**Bielefeld University**

**Inhalt:**

Ansprechpartner: Thomas Dahm

Seminar Mathematische Physik

**Thema:** Symmetry Transition from GUE to chGUE protecting Chirality

**Datum:** 12.07.18

**Uhrzeit:** 14:15

**Ort:** D5-153

**Vortragender:** Mario Kieburg

**Bielefeld University**

Symmetry transitions of systems have been always of particular interest in physics. There are only few real systems, that are pure and ideal yielding the desired results predicted by simplified, analytically feasible models. This is also the case for the spectral statistics of linear operators corresponding to such realistic systems, which are usually described by random matrices. Especially the global symmetries can be
well-captured by random matrices, since the local spectral statistics on the level of the mean level spacing is extremely sensitive to these symmetries. Therefore, the question arises what the statistics would look like when a symmetry transition takes place to compare these results efficiently with physical measurements. Exactly this has been the goal of my joint work with Takuya Kanazawa when we studied an interpolation between the Gaussian unitary ensemble (GUE) and the chiral Gaussian unitary ensemble (chGUE) while protecting the chirality of the matrix. This transition is motivated by several QCD applications. Particularly the protection of the chirality leads to surprising effects. I am going to report on these results which comprise finite matrix size as well as the limit of large matrix dimensions.

Ansprechpartner: Gernot Akemann

Seminar AG Zufallsmatrizen

Thema: Local laws for polynomials of Wigner matrices

Datum: 14.11.18

Uhrzeit: 16:15

Ort: V3-201

Vortragender: Yuriy Nemish

Institute of Science and Technology Austria

We consider general self-adjoint polynomials in several independent random matrices whose entries are centered and have constant variance. Under some numerically checkable conditions, we establish the optimal local law, i.e., we show that the empirical spectral distribution on scales just above the eigenvalue spacing follows the global density of states which is determined by free probability theory. First, we give a brief introduction to the linearization technique that allows to transform the polynomial model into a linear one, which has simpler correlation structure but higher dimension. After that we show that the local law holds up to the optimal scale for the generalized resolvent of the linearized model, which also yields the local law for polynomials. Finally, we show how the above results can be applied to prove the optimal bulk local law for two concrete families of polynomials: general quadratic forms in Wigner matrices and symmetrized products of independent matrices with i.i.d. entries. This is a joint work with Laszlo Erdős and Torben Krüger.

Ansprechpartner: Gernot Akemann