DY 27 Granular Matter and Contact Dynamics II

Time: Tuesday 16:30–18:00 Room: SCH 251

DY 27.1 Tue 16:30 SCH 251

Can one hear the shape of a ball? — •C.A. Krülle — Experimentalphysik V, Universität Bayreuth, D-95440 Bayreuth

The coefficient of restitution for the impact of a ball falling on a smooth horizontal surface can be measured by utilizing a very simple and practical method originally suggested by Alan D. Bernstein (Am. J. Phys. 45, 41 (1977)): The typical ticktack generated by multiple collisions between the bouncing object and the underlying plane is recorded by use of a microphone connected with the sound card of a PC. From this the restitution coefficient can be derived easily as the ratio of successive time intervals between sound signals. If the falling object is not precisely spherical the obtained values for the coefficient of restitution will scatter depending on - among other things - the degree of ellipticity. A careful analysis of this dependence shows that modern audio recording devices have been developed to such a high level that even deviations in the micron range can be detected and thus "heard" by a careful listener.

DY 27.2 Tue 16:45 SCH 251

Gas-grain simulations: the "Quicksand-Effect" — •Dirk Kadau[1], Eirik G. Flekkøy[2], and Dietrich E. Wolf[1] — [1]Department of Physics, Duisburg-Essen University, D-47048 Duisburg, Germany — [2]Department of Physics, University of Oslo, Postbox 1048 Blindern, 0316 Oslo, Norway

When modeling granular matter often the influence of the surrounding gas or fluid is neglected for simplicity. A simple model to couple the discrete grain dynamics to the continuous dynamics of a compressible fluid or gas is presented. As an example we investigate the quicksand phenomenon using a model where the granular system is fluidized by an upward flow. Can one really drown in quicksand or will the buoyancy be even increased by the sand grains?

DY 27.3 Tue 17:00 SCH 251

Ripple generation under shear — •Andreas Wierschem[1], Christof Krülle[2], Ingo Rehberg[2], and Nuri Aksel[1] — [1]Technische Mechanik und Strömungsmechanik, Universität Bayreuth, D-95440 Bayreuth — [2]Experimentalphysik V, Universität Bayreuth, D-95440 Bayreuth

The generation of ripples in desserts or at beaches by wind or tidal currents is a paradigm of instabilities in granular material under shear. Research has been focused mainly on the surface profile of the granular layer, describing the ripples and their instability in terms of global parameters. Here, we present an experimental study of the velocity field in the overlying fluid. We characterize the field at onset of ripple generation and show how the ripples exert a feedback on the fluid flow in an annular-ring geometry with driven upper lid.

DY 27.4 Tue 17:15 SCH 251

Sound propagation in granular matter — •Ioannis Tzavaras and Michael Schulz — Universität Ulm, Abteilung Theoretischer Physik, Albert-Einstein-Allee 11, 89069 Ulm

The aim of this contribution is to find a suitable mathematical description for the propagation of mechanical excitations as for example sound waves in granular matter. We determined numerically the frequency spectrum of a linear chain of particles (up to 5 particles under periodic boundary conditions). The calculations were based on equations of motion, that were derived from a potential that vanishes as long as the particles are not in contact and that is that of a harmonic oscillator, when the particles press on each other, in other words when the distance of next neighbours is smaller than 2R (R: radius of the particles). The shape of the numerical solutions of the equations of motion for a linear chain of N particles suggested that a short time after the excitation solitons occur. We tried to approximate the equations of motion by fitting the parameters to the Toda lattice equation, which shows an exponential interaction between nearest neighbour particles and possesses analytical solutions especially soliton solutions. We could show that the soliton solution of the Toda lattice equations fulfils the equation of motion of granular matter too, if the soliton has a very small velocity, amplitude and a large width. At present time the concern of our work is to transfer the equation of motion of granular matter into the Korteweg de Vries (KdV) equation by performing the continuum limit and some transformations that connect also the Toda equation with the KdV equation.

DY 27.5 Tue 17:30 SCH 251

Velocity distributions of levitated granular gases — •Corinna Maass, Nathan Isert, Christof Aegerter, and Georg Maret — Fachbereich Physik, Universität Konstanz, Universitätstrasse 10; 78457 Konstanz

Granular gases can show counterintuitive behaviour, such as clustering, non-Maxwellian velocity distributions and de-mixing. Theoretical studies have emphasised the role of inhomogeneous heating, collisions with boundaries and gravity on these effects, as well as the possibility of observing Maxwell-Boltzmann distributions also in granular materials. This is mainly due to the inelasticity of the collisions and different restitution coefficients of the bounding walls. In order to study the influence of the above effects, we diamagnetically levitate granular gases of different constituting particles, such as polystyrene and bismuth. A homogeneous heating of the granular gas is achieved by adjusting the magnetic field gradient, such that there is a simultaneous forcing of all of the granular particles. The resulting velocity distributions are recorded using video-microscopy and particle tracking. We also discuss the influence of particle number and restitution coefficient on the dynamics of the granular gas.

DY 27.6 Tue 17:45 SCH 251

Wet granular matter: A two component non-Abelian sandpile model — •Christoph Kohlhammer and Michael Schulz — Universität Ulm, Abteilung Theoretische Physik, Albert Einstein-Allee 11, 89069 Ulm

We consider a two component non-Abelian sandpile model reflecting several important properties of wet granular matter. By introducing appropriate threshold conditions and consitent toppling rules we obtain a model with SOC behaviour. On the basis of fluctuations of the dissipative work we define a temperature of the granular system and show its connection to the avalanche size. In particular, we find that our temperature, defined above, characterizes the tension of the sandpile. These tensions are influenced by resonances leading to very sharp extrema and phase transitions. Computer simulations show a broken renormalisation exponent which can be shown to be equivalent to that of the well known Abelian sandpile models. The particle density as a system size independent variable delivers also indications of a phase transition as a function of the relation between wet and dry particles.