Mini symposium on Dipolar Quantum Gases.
10^{th}-11^{th} of July,
Schrödinger Saal, IQOQI, Innsbruck.

Tuesday 10^{th} of July.

Morning

9:00 - 10:00	Russell Bisset. **Determining the roton frequency using a static optical perturbation.**
10:00 - 10:45	Daniel Petter. **Update on roton measurements.**
10:45-11:15	*Coffee break*
11:15 - 12:15	Danny Baillie. **Recent studies of the properties of dipolar droplets.**
12:15 - 13:00	Arno Trautmann. **Quantum degenerate mixture of different dipolar atomic species.**

13:15 – Lunch

Afternoon – Open discussions

15:00 – Skype with Luis Santos

--- Arrival of external guest: Robert Zillich around 4pm.

Evening – Social Dinner

18:30 leaving all together from University

19:15 reservation at Soul kitchen

Wednesday 11th of July.

Morning – "Public" Symposium: ultracold, theoretical physics invited

9:00 - 10:00 Blair Blakie. (LIVESTREAM on youtube)

Droplet crystal ground states of a dipolar Bose gas

I will outline work in my group on dipolar Bose-Einstein condensates, focusing on our recent work related to the ground states in a cylindrically symmetric harmonic trap. This system has a rich phase diagram, including droplet crystal states in which a set of droplets arrange into a lattice pattern that breaks the rotational symmetry of the trap. We have developed an analytic model that describes small droplet crystals and can be used to qualitatively describe the phase diagram obtained by full numerical calculations. We show that in certain regimes a coherent low-density halo surrounds the droplet crystal giving rise to a novel phase with localized and extended features.

10:00 - 10:30 Daniel Petter.

Rotonisation of the Excitation Spectrum in a dipolar BEC

In 2003 the existence of a roton mode (a minimum in the dispersion relation at a finite momentum) was predicted in the excitation spectrum of a dipolar Bose gas, similar to the celebrated case of superfluid He II. In contrast to He II, the roton mode in a dipolar gas does not require strong interactions, but rather arises from the long-range and anisotropic nature of the dipolar interactions, already at a mean-field level. In my talk, I will briefly review our recent observations of the population of the roton mode in a gas of erbium atoms by quenching the interaction strength to a regime where its energy becomes imaginary. Then I will present our ongoing investigation of the roton mode in the stationary dispersion relation of the gas, that is for real and finite energy of the roton mode. We probe this regime in our experiment thanks to precise Bragg spectroscopy measurements.

10:30-11:00 Coffee break

11:00 - 12:00 Robert Zillich.

Rotons and Correlations

The fine control of atoms in an ultracold quantum gas allows to shape the interaction and drive phase transitions e.g. to a liquid, change the strength of correlations, or create excitations. Dipolar Bose gases and Rydberg gases support roton modes, where the dispersion relation has a local minimum at finite wave number, hence the system becomes "soft" and eventual enters a new phase. In this talk, I will give an overview of our work on dipolar quantum gases for which we use a variational pair density functional theory formulated explicitly in terms of pair correlations. We obtain different regimes of dipolar gases with rotons of different physical meaning, investigate the transition to a stripe phase, and discuss orientational phase transitions. Time-dependent interactions allow to study non-equlibrium dynamics; we discuss the signature of a quench to rotons in the dynamics of pair correlations.

12:00 - 12:30 Vincent Corre.

Doubly degenerate Fermi-Fermi mixture of dysprosium and potassium atoms.

Strongly interacting mass imbalanced Fermi-Fermi mixtures are predicted to exhibit rich phase diagrams, that include in particular exotic superfluid phases. We report on the production of a Fermi-Fermi mixture of ^{40}K and ^{161}Dy where both species are degenerate. We rely on dipolar scattering to evaporative cool the polarized gas of dysprosium, that in turns acts as a coolant to sympathetically cool the gas of potassium, also polarized. In the absence of potassium, the dysprosium gas is cooled down to T/T_F=0.09. When mixed, the two species reach T/T_F=0.3. Analyzing the cross-thermalization of the two species we are able to give an estimate of the inter-species scattering cross section.

12:45 – Lunch

Afternoon – Open discussions

--- 17:00 Departure of external guest (Robert Zillich).