ULTRACOLD DIPOLAR GASES (SYDG)

Tilman Pfau
5. Physikalisches Institut
Universität Stuttgart
Pfaffenwaldring 57
70569 Stuttgart
E-Mail: t.pfau@physik.uni-stuttgart.de

Maciej Lewenstein
ICFO The Institute of Photonic Sciences
Av. del Canal Olympic s/n
08860 Castelldefels (Barcelona), Spain
E-Mail: maciej.lewenstein@icfo.es

ÜBERSICHT DER HAUPTVORTRÄGE UND FACHSITZUNGEN

(Hörsaal HV)

Hauptvorträge

SYDG 1.1	Do	10:40	(HV)	**Theoretical challenges of ultracold dipolar gases**, Mikhail Baranov
SYDG 1.2	Do	11:25	(HV)	**Optical production of ultracold polar molecules**, Dave de Mille
SYDG 1.3	Do	12:10	(HV)	**Dipolar effects on spin-mixing inside a spin-1 condensate**, Li You
SYDG 2.1	Do	14:00	(HV)	**Investigation of dipole-dipole interaction in a chromium Bose-Einstein condensate**, Jürgen Stuhler
SYDG 2.2	Do	14:45	(HV)	**Spin-3 Chromium Bose-Einstein Condensates**, Luis Santos
SYDG 2.3	Do	15:30	(HV)	**Thomas-Fermi solution for trapped dipolar Bose-Einstein condensate**, Claudia Eberlein
SYDG 2.4	Do	16:00	(HV)	**Rotating ultracold dipolar gases**, Klaus Osterloh

Fachsitzungen

SYDG 1	**Ultracold dipolar gases I**	Do 10:40–12:55	HV	SYDG 1.1–1.3
SYDG 2	**Ultracold dipolar gases II**	Do 14:00–16:30	HV	SYDG 2.1–2.4

Fachsitzungen

– Hauptvorträge –

SYDG 1 Ultracold dipolar gases I

Zeit: Donnerstag 10:40–12:55 Raum: HV

Hauptvortrag SYDG 1.1 Do 10:40 HV

Theoretical challenges of ultracold dipolar gases — •Mikhail Baranov — Van der Waals-Zeeman Institute, University of Amsterdam, the Netherlands

Recent achievements in theoretical studies of ultracold dipolar gases are discussed, with the main focus on the properties of rapidly rotating dipolar gases, both fermionic and bosonic. As demonstrated, these gaseous systems exhibit a large number of strongly correlated states, which are similar to the fractional quantum Hall states, as well as to the Wigner crystal and Abrikosov lattice states, with the allowance of a thorough control of quantum phase transitions between various ground states.

Hauptvortrag SYDG 1.2 Do 11:25 HV

Optical production of ultracold polar molecules — •Dave de Mille — Dept of Physics, Yale University, Sloane Physics Lab, New Haven, Connecticut 06520, USA

We have recently demonstrated the production of ultracold, polar RbCs molecules in their vibronic ground state, via a multi-step optical "assembly" process beginning from laser-cooled atoms. The resulting sample has translational temperature T 100 uK and a narrow distribution of rotational states. An extension of our techniques, now underway, should allow study of a trapped sample of absolute ground-state RbCs molecules, opening the possibility to study an ultracold gas in the regime of strong dipolar interactions.

Hauptvortrag SYDG 1.3 Do 12:10 HV

Dipolar effects on spin-mixing inside a spin-1 condensate — •Li You — School of Physics, Georgia Institute of Technology, Atlanta, Georgia 30332, USA

Recent observations of coherent spin-mixing dynamics inside spinor condensates have provided spectacular examples of collective quantum coherence. In this talk, we discuss our theoretical studies of dipolar effects on the spin-mixing dynamics.

SYDG 2 Ultracold dipolar gases II

Zeit: Donnerstag 14:00–16:30 Raum: HV

Hauptvortrag SYDG 2.1 Do 14:00 HV

Investigation of dipole-dipole interaction in a chromium Bose-Einstein condensate — •Jürgen Stuhler — 5. Physikalisches Institut, UniversitätStuttgart, Pfaffenwaldring 57, D-70550 Stuttgart

Based on the long-range and anisotropic character of dipole-dipole interactions, many exciting phenomena have been predicted to occur in dipolar quantum gases. To investigate them, we have realized a chromium Bose-Einstein condensate (BEC) of up to 100,000 condensed atoms within a crossed optical dipole trap. The large magnetic moment of chromium gives rise to strong magnetic dipole-dipole interaction (MDDI) that becomes comparable to the isotropic and short-range contact interaction. In agreement with theory of dipolar quantum gases, the MDDI manifests itself in an anisotropic deformation of the expanding Cr-BEC that depends on the orientation of the atomic dipole moments. Using Feshbach resonances to tailor the contact interaction or spinning magnetic fields to tune the MDDI, it is expected that interaction regimes from mainly contact to mainly dipolar can be adjusted.

Hauptvortrag SYDG 2.2 Do 14:45 HV

Spin-3 Chromium Bose-Einstein Condensates — •Luis Santos — Institut für theoretische Physik III, Universität Stuttgart, Pfaffenwaldring 57, D-70550 Stuttgart

We will discuss the physics of spin-3 Chromium Bose-Einstein condensates. We shall first discuss the ground-state properties, and the possible spin phases at low magnetic fields. Later, we shall discuss the dynamics of the spinor condensate, and in particular the possibility of observing the equivalent of the Einstein-de Haas effect due to spin relaxation induced by the dipole-dipole interaction.

Hauptvortrag SYDG 2.3 Do 15:30 HV

Thomas-Fermi solution for trapped dipolar Bose-Einstein condensate — •Claudia Eberlein — University of Sussex, Dept of Physics & Astronomy, Falmer, Brighton BN1 9QH,

The Thomas-Fermi equation for a trapped condensed gas with dipole-dipole interactions in addition to s-wave interaction can be solved exactly. The methods of solution are discussed, and several examples of applications are given.

Hauptvortrag SYDG 2.4 Do 16:00 HV

Rotating ultracold dipolar gases — •Klaus Osterloh — Institut für theoretische Physik, Universität Hannover

Ultracold gases subject to artificial magnetic fields constitute an exciting field of modern theoretical physics, even more exciting, when dipolar interparticle interactions are considered. Their long range character intrinsically allows for strongly pronounced non-local correlations opening up a rich set of competing quantum regimes. On the basis of correlation function analysis and exact diagonalization data, a selection of these regimes is theoretically discussed and explored, the focus being set on fractional quantum Hall states and the variation of the ground state structure on the way from weak to strong correlations.