Q 37: Laser applications: Spectroscopy

Time: Wednesday 14:00–15:15 Location: F 142

Q 37.1 Wed 14:00 F 142

Zeeman Effect on Single Silicon-Vacancy Color Centers in Diamond — •Christian Hepp[1], Tina Müller[2], Benjamin Pingault[2], Victor Waselowski[3], Elke Neu[1], Jeronimo Maze[3], Mete Atatüre[2], and Christoph Becher[1] — [1]FR 7.2 - Experimentalphysik, Universität des Saarlandes, 66123 Saarbrücken, Germany — [2]Atomic, Mesoscopic and Optical Physics Group, Cavendish Laboratory, University of Cambridge, JJ Thomson Ave, Cambridge CB3 0HE, United Kingdom — [3]Faculty of Physics, Pontificia Universidad Catolica, Vicuna Mackenna 4860, Santiago 7820436, Chile

We present spectroscopic measurements of the fine structure splitting of single negatively charged silicon-vacancy color centers (SiV^-) in diamond under the influence of high magnetic fields. The single centers have either been created in-situ in isolated CVD nanodiamonds on an iridium surface or, in an advanced approach, have been implanted into a high quality single crystalline diamond with solid immersion lenses fabricated by focused ion beam milling. The SiV^- zero phonon line shows a four line fine structure at liquid helium temperature which is attributed to optical transitions between both split ground and excited states. In the magnetic field, the Zeeman effect splits these states further giving rise to a complex pattern of up to 16 spectral lines with varying splitting strength. We discuss this splitting using a model based on a group theoretical approach for the SiV center in trigonal symmetry, which suggests a spin state $S = 1/2$ and takes into account distortions due to the crystal strain present in the nanodiamonds.

Q 37.2 Wed 14:15 F 142

Interferometric Femtosecond Stimulated Raman Scattering — •Sven Dobner[1], Carsten Cleff[1], Carsten Fallnich[1], and Petra Gross[2] — [1]Institut für Angewandte Physik, Westfälische Wilhelms-Universität, 48149 Münster — [2]Institut für Physik, Carl von Ossietzky Universität, 26129 Oldenburg, Deutschland

We present an optical method for background suppression in femtosecond stimulated Raman spectroscopy (FSRS) based on linear interferometry [1]. An unbalanced Sagnac interferometer reaches an unprecedented background reduction of 17 dB over a broad bandwidth of 60 THz (2000 cm^{-1}) and thereby increases the signal-to-background ratio in the measurement. The interferometric measurement does not reduce the Raman signal to a simple loss signature in the spectrum, but reveals the phase shift, gathered within the nonlinear interaction, as a dispersive lineshape, which is recreated with a simple Lorentzian oscillator model.

[1] Dobner et al., J. Chem. Phys. 137, 174201 (2012)

Q 37.3 Wed 14:30 F 142

Femtosecond characterization of an easily accesible charge transfer system — •Torben Villnow[1], Gerald Ryseck[1], Sarah Bay[2], Vidisha Rai-Constapel[3], Thomas J.J. Müller[2], and Peter Gilch[1] — [1]HHU Düsseldorf, Universitätsstr. 1, 40225 Düsseldorf, AG Femtosekundenspektroskopie — [2]LS Prof. Dr. T.J.J. Müller — [3]LS Prof. Dr. C. Marian

With regard to applications in (organic) photovoltaics numerous intramolecular donor-acceptor systems have been synthesized and characterized. The D-A system (sb078) studied here consists of a phenothiazine donor and anthrachinone acceptor moiety. The moieties are linked by an α-aminoacylamide bridge. Linkage relies on an Ugi-reaction which renders sb078 and related compounds easily synthetically accessible. Electron transfer properties of sb078 have been characterized by means of femtosecond transient absorption spectroscopy. Strong evidence for the very rapid formation of a charge separated state originating from the excited singlet and triplet state of anthrachinone is observed. Even though the singlet dominated charge separated state rapidly decays, the triplet phased state persist for more than 3 ns (range limited by the set-up).

Q 37.4 Wed 14:45 F 142

TDLAS Luftfeuchtemessungen mit extrem kurzer Zelle — •Alexander Hartmann[1], Robert Weigel[1] und Rainer Strzoda[2] — [1]Friedrich-Alexander-Universitaet Erlangen-Nuernberg, Lehrstuhl fuer technische Elektronik, Cauerstrasse 9, 91058 Erlangen — [2]Siemens AG,Corporate Technology, Otto-Hahn-Ring 6, 81739 Muenchen

Diodenlaserspektroskopie für Gaskonzentrationsmessungen ermöglicht Sensoren mit hoher Stabilität, hoher Sensitivität sowie hoher Gasselektivität. Die notwendige Länge der optischen Zelle schränkt jedoch die Anwendung für kompakte Sensoren stark ein. Halbleiterlaser im Wellenlängenbereich um 1.85 μm sowie die dort auftretenden, starken Wasserabsorptionslinien bieten die Möglichkeit, Luftfeuchtesensoren mit optischen Pfaden kleiner 3 cm aufzubauen. Die maximale Auflösung kurzer Zellen ist neben Rauscheffekten auch durch optische Interferenzen, bedingt durch Mehrfachreflexion an gegenüberstehenden Oberflächen, begrenzt. In der vorliegenden Studie hat sich gezeigt, dass sich in diesen Zellen lediglich eine dominante Interferenzschwingung bildet. Basierend auf der Analyse des Fourier-Spektrums, stellen wir eine Methode vor, diese optischen Störungen aus dem Absorptionssignal zu eliminieren. Durch geeignete Wahl des Messfensters, besteht die Möglichkeit die Interferenzschwingung auf eine gewählte Harmonische zu legen, die Abweichung zu korrigieren und die Absorptionslinie ohne Störung zu rekonstruieren. Stabile Absorptionsergebnisse mit Abweichungen kleiner $2 * 10^{-4}$, entspricht ca. 1% relativer Luftfeuchte, gegenüber Phasenänderung der Interferenz und einer Interferenzamplitude von ca. 30% relativ zur Signalstärke wurden damit erzielt.

Q 37.5 Wed 15:00 F 142

Two-photon excited fluorescence utilizing thermal light — •Andreas Jechow[1,2], Henning Kurzke[1], Axel Heuer[1], Michael Seefeldt[1], and Ralf Menzel[1] — [1]Universität Potsdam, Institut für Physik und Astronomie, Photonik, Karl-Liebknecht-Str. 24-25, Haus 28, 14476 Potsdam — [2]Centre for Quantum Dynamics, Griffith University, Brisbane, Australia

Two-photon excited fluorescence (TPEF) is a standard technique in modern microscopy. Due to the low two-photon absorption (TPA) cross section these experiments are typically performed using pulsed laser emission at relatively high intensities, which can lead to photodamage of the probe. Several proposals towards an enhancement of TPA exist including the use of two entangled photons, or biphotons [1].

Here, we utilize thermal light from a fiber-coupled super luminescence diode to demonstrate enhanced TPEF with three common fluorophores that can be used as marker molecules in microscopy. We detected TPEF with powers less than 50 μW and find that the TPA rate for chaotic light is directly proportional to the measured degree of second-order coherence (DSOC), as predicted by theory.

[1] A. Jechow, A. Heuer, and R. Menzel, "High brightness, tunable biphoton source at 976 nm for quantum spectroscopy," Opt. Express 16, 13439-13449 (2008)