INSTITUT FOR FYSIK OG ASTRONOMI
DET NATURVIDENSKABELIGE FAKULTET
AARHUS UNIVERSITET

IFA – NYT UGE: 23

Information fra administrationen

Lukning af et herre- og et damebaderum i ugerne 31 og 32.
I ugerne 31 og 32 samt i begge weekends før og efter vil vi lukke et herre- og et dame baderum, der skal udlånes til henholdsvis Matematik Camp samt Astronomi Camp.
Der vil blive opsat meddelelse udenfor de 2 baderum i god tid i forvejen.

FYSISK kantine
Den **8. – 9. og 10. juni** er fysikkantinen lukket i frokosttiden fra kl. 11.00 – 14.00 på grund af konference.
Ruth Laursen

Fotografering af nye medarbejdere
Foretages nu af **Jens Jacob Iversen**.
Foto-lab vil være åbent tirsdag: 10-11. Telefon: 30 76 07 97.

Ruth Laursen

INSTITUT FOR FYSIK OG ASTRONOMI
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Informationsmøde

Fredag den 19. juni 2009 kl. 8.45

Der er kaffe og brød kl. 8.30

Institut for Fysik og Astronomi

Ruth Laursen

Administrationsleder

Dato: 04. juni 2009

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Afs. CVR-nr.: 31119103

DAGSORDEN

1. Meddelelser
2. Psykisk APV
3. Økonomi
4. ASTRID2:
   - Lokalerokeringer
   - ASTRID2 projektet
5. Eventuelt

Med venlig hilsen

Ivan Stensgaard

CTN LINDHARD LECTURE

Stuart Kauffman, University of Calgary

Stuart Kauffman (born 1939) is an American theoretical biologist and complex systems researcher working on the origin of life on Earth. He has written numerous articles and books on complexity, self-organization and non-equilibrium dynamics in nature, and is particularly well-known for his controversial book "Origins of Order" written while at the Santa Fe Institute for complexity research. Today, Kauffman is Professor of Biological Sciences and of Physics and Astronomy, and the Director of the Institute for Biocomplexity and Informatics at University of Calgary.

The Open Universe and the Sacred

Tuesday 9 June 2009 at 15.15, building1232-115. Coffee from 15.00.

Darwinian "preadaptations" are features of an organism of no selective use in its current environment that might come to be of selective use in some different environment. In that case, due to natural selection, a new functionality can arise. An example is a swim bladder that adjusts buoyancy in some fish; paleontologists believe swim bladders arose from the lungs of lung fish. Such phenomena challenge the view, common in Western science since Descartes, Galileo, Newton, and Einstein, that all that unfolds in the evolution of the universe is describable by natural law.

The essential issue is the determination of possible preadaptations. How would we list all possible selective conditions and specify the feature(s) that might become preadaptations? Indeed, the universe is "open" in complexity but its partially lawless becoming is also not random. We have no model of this in standard science. And yet, if we do not know what CAN happen then reason is an insufficient guide to living our lives.

I believe we need a new Enlightenment and a new symbol to denote the natural creativity of the universe.

BIOINFORMATICS RESEARCH CENTRE (BIRC)
FACULTY OF SCIENCE
AARHUS UNIVERSITY

Professor Klaus Mølmer, Department of Physics and Astronomy, AU
Professor Carsten Wiuf, Bioinformatics Research Centre, AU
http://www.ctn.au.dk

Quantum Optics and Atomic Physics Seminar

Title: Deterministic ultracold ion source targeting the Heisenberg limit

Speaker: Robert Fickler
Ulm University, Germany

Time: Tuesday, June 9 at 10:15

Place: 1520-216

Abstract:

We have realized a universal deterministic single ion source on the basis of a linear segmented ion trap applicable to a wide range of elements and molecules [1,2]. Initially, cold $^{40}Ca^{+}$ ion crystals are trapped within a segmented linear trap. Those ions are then deterministically extracted and detected with an efficiency of 90% at a distance of 29cm. For single ion extraction we measured a mean velocity of 19.47km/s with a 1σ-spread of only 6.3m/s and a beam divergence of 600μrad. We have also demonstrated the extraction of mixed ion crystals containing other dopant ions. Ion ray-tracing simulations predict that it is possible to focus down the ion beam to nm resolution with a custom built Einzel-lens [3]. This technique can e.g. be applied to generate color centers in diamond or to implant P into Si. Both systems provide a possible way for the realization of a solid state quantum computer [4,5]. In addition, the electrical properties of semiconductor devices can be greatly enhanced by the deterministic implantation of single ions [6].

[1] J. Meijer et al., Appl. Phys. A 91, 567 (2008)
[2] W. Schnitzler et al., Phys. Rev. Lett. 102, 070501 (2009)
[3] R. Fickler et al., arXiv:0903.3425 (accepted for publication in Journal of Modern Optics)
[4] F. Jelezko et al., Phys. Rev. Lett. 93, 130501 (2004)
[5] B. Kane, Nature 393, 133 (1998)
[6] T. Shinada et al., Nature 437, 1128 (2005)

Michael Drewsen

Coffee, tea and bread rolls will be served at 10.00

Transiting Planets
Proceedings IAU Symposium No. 253, 2008
Frédéric Pont, Dimitar Sasselov & Matthews Holman, eds.

doi:10.1017/S1743921308027063

The impact of stellar jitter on the confirmation of transiting exoplanet candidates around Solar-like stars

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Abstract. The radial velocity technique is commonly used to classify transiting exoplanet candidates. However, stars are intrinsically noisy in radial velocity. No good description of this noise has yet been proffered, although activity in general has been suggested as the source, making it impossible to evaluate its effect on signal detection. In this poster, we propose an activity-based model that incorporates both light and dark stellar spots, capable of producing both photometric and radial velocity time series. We demonstrate its consistency with both SOHO/VIRGO photometry and SOHO/GOLF radial velocities. We then use this model to establish lower and upper limits on the effects of intrinsic stellar noise on the metal lines used to follow up transit candidates, making use of Monte Carlo simulations. Based on these results, we can suggest an optimal observational sampling rate.

Transiting Planets
Proceedings IAU Symposium No. 253, 2008
Frédéric Pont, Dimitar Sasselov & Matthews Holman, eds.

doi:10.1017/S1743921308026537

Measurements of Stellar Properties through Asteroseismology: A Tool for Planet Transit Studies

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[2]Institute of Astronomy, School of Physics A28, University of Sydney, NSW 2006, Australia
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Abstract. Oscillations occur in stars of most masses and essentially all stages of evolution. Asteroseismology is the study of the frequencies and other properties of stellar oscillations, from which we can extract fundamental parameters such as density, mass, radius, age and rotation period. We present an overview of asteroseismic analysis methods, focusing on how this technique may be used as a tool to measure stellar properties relevant to planet transit studies. We also discuss details of the Kepler Asteroseismic Investigation – the use of asteroseismology on the Kepler mission in order to measure basic stellar parameters. We estimate that applying asteroseismology to stars observed by Kepler will allow the determination of stellar mean densities to an accuracy of 1%, radii to 2–3%, masses to 5%, and ages to 5–10% of the main-sequence lifetime. For rotating stars, the angle of inclination can also be determined.

Comm. in Asteroseismology,
Vol. 159, 2009, JENAM 2008 Symposium № 4: Asteroseismology and Stellar Evolution
S. Schuh & G. Handler

Search for sdB/WD pulsators in the Kepler FOV

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[2] Institut für Astronomie, Universität Wien, Türkenschanzstrasse 17, 1180 Vienna, Austria
[3] Institut für Astrophysik, Universität Göttingen, Friedrich-Hund-Platz 1, 37077 Göttingen, Germany
[4] Dept. of Physics and Astronomy, Aarhus University, Ny Munkegade, 8000 Aarhus C, Denmark

Abstract

In this article we present the preliminary results of an observational search for subdwarf B and white dwarf pulsators in the Kepler field of view (FOV), performed using the DOLORES camera attached to the 3.6 m *Telescopio Nazionale Galileo* (TNG).

Individual Objects: KIC10_05807616, KIC10_02020175

QUANTUM OPTICS SEMINAR

Title: Atoms, Molecules, and Microstructured Surfaces: New Methods of Optical Cooling

Speaker: Peter Horak
Optoelectronics Research Centre, University of Southampton, UK

Time: Wednesday, June 10 at 10:15

Place: Phys.Aud.

Abstract:

Optical cooling of atoms, ions, and a few molecular species is well established in free space, and has also been demonstrated for particles inside an optical resonator. Alternatively, it can be shown that a single mirror, or a microstructured surface, reflecting a laser beam back onto a scattering particle with some time delay can lead to similar cooling forces. I will discuss the physics behind this novel cooling mechanism and present predictions of friction and steady-state temperature obtained by a perturbative approach. Finally, I will present theoretical and numerical models to investigate optomechanical effects in generalised geometries.

Joan Marler

Coffee, tea and bread rolls will be served at 10.00

IOP PUBLISHING JOURNAL OF PHYSICS: CONDENSED MATTER

J. Phys.: Condens. Matter **21** (2009) 265003 (7pp) doi:10.1088/0953-8984/21/26/265003

Adsorbate reactivity and thermal mobility from simple modeling of high-resolution core-level spectra: application to O/Al(111)

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Received 29 January 2009, in final form 30 April 2009
Published 27 May 2009
Online at stacks.iop.org/JPhysCM/21/265003

Abstract

A high-resolution core-level spectroscopy investigation of the adsorption of oxygen on Al(111) at variable oxygen exposure demonstrates a low surface reactivity for an intensively cleaned surface. The threshold for oxide formation is as high as ∼200 L (langmuirs), at which point the coverage of the chemisorbed oxygen exceeds half a monolayer. A simple model is presented, using which it is possible to deduce the oxygen coverage from the core-level spectra and determine the initial sticking probability. For our data a value of 0.018 ± 0.004 is obtained. The changes in core-level spectra following low-temperature annealing of low-coverage O/Al(111) reflect the formation of gradually larger islands of oxygen atoms (Ostwald ripening). The island formation is consistent with a random-walk model from which the diffusion barrier can be deduced to be in the range of 0.80–0.90 eV.

Transiting Planets
Proceedings IAU Symposium No. IAUS253, 2008
Frédéric Pont, Dimitar Sasselov & Matthews Holman, eds.

doi:10.1017/S1743921308026513

KEPLER: Search for Earth-Size Planets in the Habitable Zone

William Borucki[1], David Koch[1], Natalie Batalha[2], Douglas Caldwell[3], Jorgen Christensen-Dalsgaard[4], William D. Cochran[5], Edward Dunham[6], Thomas N. Gautier[7], John Geary[8], Ronald Gilliland[9], Jon Jenkins[3], Hans Kjeldsen[6], Jack J. Lissauer[1], and Jason Rowe[1]

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[2]San Jose State University, San Jose, CA, 95192, USA
[3]SETI Institute, Mountain View, CA, 94043, USA
[4]University of Aarhus, Denmark
[5]University of Texas at Austin, Austin, TX, 78712, USA
[6]Lowell Observatory, Flagstaff, AZ, 86001, USA
[7]Jet Propulsion Laboratory, Pasadena, CA, 91109, USA
[8]Smithsonian Astrophysical Observatory, Cambridge, MA, 02138, USA
[9]Space Telescope Science Institute, Baltimore, MD, 21218, USA

Abstract. The *Kepler Mission* is a space-based mission whose primary goal is to determine the frequency of Earth-size and larger planets in the habitable zone of solar-like stars. The mission will monitor more than 100,000 stars for patterns of transits with a differential photometric precision of 20 ppm at V = 12 for a 6.5 hour transit. It will also provide asteroseismic results on several thousand dwarf stars. It is specifically designed to continuously observe a single field of view of greater than 100 square degrees for 3.5 or more years.

This paper provides a short overview of the mission, a brief history of the mission development, expected results, new investigations by the recently chosen Participating Scientists, and the plans for the Guest Observer and Astrophysical Data Programs.

Naturvidenskabelig kvalifikationseksamen
Forskeruddannelsens Del A

FYSIK / ASTRONOMI

Kandidat:	Anna Sejersen Riis
Vejleder:	Steen Hannestad
Ekstern censor:	Steen H. Hansen
Intern censor:	Aksel S. Jensen
Eksaminatorer:	Dmitri Fedorov og Hans Kjeldsen
Tid og sted:	9. juni kl. 13:00 i lokale 1525-323
Emne:	**Measuring Neutrino Properties with Beta Decay**

Naturvidenskabelig kvalifikationseksamen
Forskeruddannelsens Del A

FYSIK

Kandidat:	Henriette Astrup Leth
Vejleder:	Lars Bojer Madsen
Ekstern censor:	Jens Olaf Pepke Pedersen
Intern censor:	Jørgen Christensen-Dalsgaard
Eksaminatorer:	Hans Fynbo og Niels Egede Christensen
Tid og sted:	12. juni kl. 9:30 i lokale 1525-229
Emne:	**Multiple ionization processes in diatomic molecules exposed to short intense laser pulses** The Monte Carlo wave packet approach

Naturvidenskabelig kvalifikationseksamen
Forskeruddannelsens Del A

FYSIK

Kandidat:	Jan Conrad Baggesen
Vejleder:	Lars Bojer Madsen
Ekstern censor:	Jens Olaf Pepke Pedersen
Intern censor:	Jørgen Christensen-Dalsgaard
Eksaminatorer:	Hans Fynbo og Niels Egede Christensen
Tid og sted:	12. juni kl. 12:30 i lokale 1525-229
Emne:	**Laser Assisted Photoelectric Effect from Metal Surfaces**

Naturvidenskabelig kvalifikationseksamen
Forskeruddannelsens Del A

FYSIK

Kandidat:	Jens Hedegaard Nielsen
Vejleder:	Henrik Stapelfeldt
Ekstern censor:	Jens Olaf Pepke Pedersen
Intern censor:	Jens Ulrik Andersen
Eksaminatorer:	Nicolai Nygaard og Alberto Imparato
Tid og sted:	11. juni kl. 14:15 i lokale 1525-323
Emne:	**Alignment and Orientation of Quantum-State-Selected Molecules: Towards Studies in Helium Droplets**

Naturvidenskabelig kvalifikationseksamen
Forskeruddannelsens Del A

FYSIK / ASTRONOMI

Kandidat:	Katrine Skovbo
Vejleder:	Steen Hannestad
Ekstern censor:	Steen H. Hansen
Intern censor:	Aksel S. Jensen
Eksaminatorer:	Dmitri Fedorov og Hans Kjeldsen
Tid og sted:	9. juni kl. 15:30 i lokale 1525-323
Emne:	**Analytical Approaches to Non-linear Structure Formation**

QUANTUM OPTICS SEMINAR

Title: Ion distribution in radiofrequency traps and the effects of the DC-electrodes in the anharmonics terms of the RF field

Speaker: Jofre Pedregosa
Universite de Marseille-Provence, France

Time: Thursday, June 4 at 10:15

Place: Phys.Aud.

Abstract:

Radiofrequency traps are a useful experimental approach to investigate a large spectra of fundamental physics. In particular they allow the study of Coulomb crystals, where an ensemble of trapped ions organize themselves in shell-like structures. Generally, the trap of choice to obtain crystallization is a linear quadrupole trap. However, very little work in this area has been done with higher order traps, such as octopoles, where dynamics are governed by a different potential shape. In order to learn about the ion distribution in multipole traps, I will present a method, originally developed for particles in Penning trap, that model the trapped ion cloud as a cold fluid, which is applicable to any type of linear RF trap, allowing to scale the size of large samples with the trapping parameters and the number of trapped ions, for different linear dimensions of the trap. I will also introduce a detailed study of the anharmonics components in the radiofrequency field as a function of different possible implementations of linear quadrupole traps. Anharmonics terms play an important role in the process known as ?RF-heating?, main responsible of the lost of ions from this type of traps. It will be shown how the geometry of the DC-electrodes drastically affects these terms.

Aurelien Dantan

Journal of Cosmology and Astroparticle Physics
An IOP and SISSA journal

Grid based linear neutrino perturbations in cosmological N-body simulations

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Received January 2, 2009
Revised April 16, 2009
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Published May 5, 2009

Abstract. We present a novel, fast and precise method for including the effect of light neutrinos in cosmological N-body simulations. The effect of the neutrino component is included by using the linear theory neutrino perturbations in the calculation of the gravitational potential in the N-body simulation. By comparing this new method with the full non-linear evolution first presented in [1], where the neutrino component was treated as particles, we find that the new method calculates the matter power spectrum with an accuracy better than 1% for $\sum m_\nu \lesssim 0.5\,\mathrm{eV}$ at $z = 0$. This error scales approximately as $(\sum m_\nu)^2$, making the new linear neutrino method extremely accurate for a total neutrino mass in the range $0.05 - 0.3\,\mathrm{eV}$. At $z = 1$ the error is below 0.3% for $\sum m_\nu \lesssim 0.5\,\mathrm{eV}$ and becomes negligible at higher redshifts. This new method is computationally much more efficient than representing the neutrino component by N-body particles.

Keywords: power spectrum, cosmological simulations, cosmological neutrinos

ArXiv ePrint: 0812.3149

doi:10.1088/1475-7516/2009/05/002

JCAP05(2009)002

PHYSICAL REVIEW D **79,** 043512 (2009)

Are cosmological neutrinos free-streaming?

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(Received 23 June 2008; published 12 February 2009)

Precision data from cosmology suggest neutrinos stream freely and hence interact very weakly around the epoch of recombination. We study this issue in a simple framework where neutrinos recouple instantaneously and stop streaming freely at a redshift z_i. The latest cosmological data imply $z_i \lesssim 1500$, the exact constraint depending somewhat on the assumed prior on z_i. This bound can be translated into a bound on the coupling strength between neutrinos and majoronlike particles.

DOI: 10.1103/PhysRevD.79.043512 PACS numbers: 98.80.−k, 14.60.St, 14.80.Mz

Research Article

Journal of MASS SPECTROMETRY

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(www.interscience.com) DOI 10.1002/jms.1546

Transition metals as electron traps. I. Structures, energetics, electron capture, and electron-transfer-induced dissociations of ternary copper–peptide complexes in the gas phase

František Tureček,[a]* Jace W. Jones,[a] Anne I. S. Holm,[b] Subhasis Panja,[b] Steen Brøndsted Nielsen[b] and Preben Hvelplund[b]

Electron-induced dissociations of gas-phase ternary copper-2,2′-bipyridine complexes of Gly-Gly-Gly and Gly-Gly-Leu were studied on a time scale ranging from 130 ns to several milliseconds using a combination of charge-reversal ($^{+}CR^{-}$) and electron-capture-induced dissociation (ECID) measured on a beam instrument and electron capture dissociation (ECD) measured in a Penning trap. Charge-reduced intermediates were observed on the short time scale in the $^{+}CR^{-}$ and ECID experiments but not in ECD. Ion dissociations following electron transfer or capture mostly occurred by competitive bpy or peptide ligand loss, whereas peptide backbone fragmentations were suppressed in the presence of the ligated metal ion. Extensive electron structure theory calculations using density functional theory and large basis sets provided optimized structures and energies for the precursor ions, charge-reduced intermediates, and dissociation products. The Cu complexes underwent substantial structure changes upon electron capture. Cu was calculated to be pentacoordinated in the most stable singly charged complexes of the [Cu(peptide − H)bpy]$^{+\bullet}$ type where it carried a ∼+1 atomic charge. Cu coordination in charge-reduced [Cu(peptide − H)bpy] intermediates depended on the spin state. The themodynamically more stable singlet states had tricoordinated Cu, whereas triplet states had a tetracoordinated Cu. Cu was tricoordinated in stable [Cu(peptide − H)bpy]$^{-\bullet}$ products of electron transfer. [Cu(peptide)bpy]$^{2+\bullet}$ complexes contained the peptide ligand in a zwitterionic form while Cu was tetracoordinated. Upon electron capture, Cu was tri- or tetracoordinated in the [Cu(peptide)bpy]$^{+}$ charge-reduced analogs and the peptide ligands underwent prototropic isomerization to canonical forms. The role of excited singlet and triplet electronic states is assessed.

Keywords: electron transfer; copper-peptide complexes; electronic states; *ab initio* calculations; ion structures