



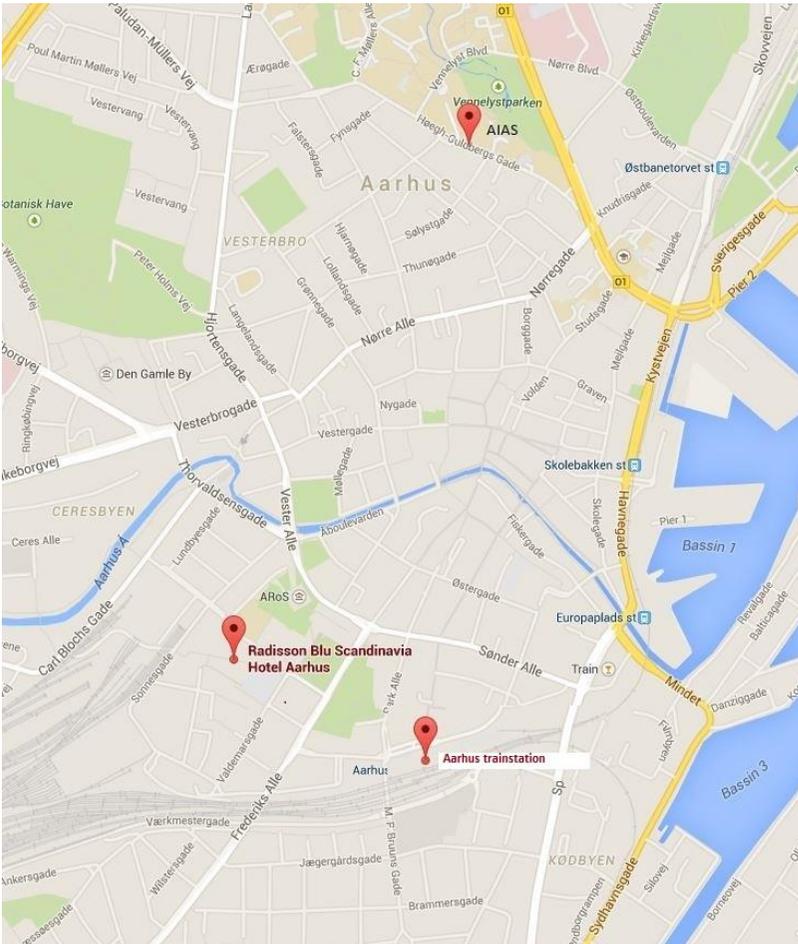
# RYDBERG QUANTUM SIMULATORS

---



AARHUS  
UNIVERSITY

AARHUS INSTITUTE OF ADVANCED STUDIES



## VENUE

Aarhus Institute of Advanced Studies, AIAS

Aarhus University

Høegh-Guldbergs Gade 6B

8000 Aarhus C

Building 1630-1632

[www.aias.au.dk](http://www.aias.au.dk)

## Conference abstract

Quantum Simulators provide new levels of understanding of equilibrium and out-of-equilibrium properties of many-body quantum systems - one of the most challenging problems in physics. Rydberg atoms, due to their outstanding versatility, hold a potential to perform a great variety of useful quantum simulations. Exploiting different aspects of the same experimental and theoretical tools, a whole family of Rydberg Quantum Simulators can address both the coherent and incoherent dissipative dynamics of many-body quantum systems, with potential applications in the understanding and design of artificial light harvesting systems, large quantum systems with controlled decoherence, and novel materials. This workshop will discuss the latest development in the Rydberg atom physics and quantum simulators, focusing on novel generic approaches to quantum simulation, where Rydberg atoms will allow both digital (gate) and analog (interaction) simulations.

## ORGANIZERS

Lena Bering, David Petrosyan, Klaus Mølmer

---

## DAY 1

Wednesday 11 March 2015

- 12.00 – Arrival, registration
- 12.15 – 13.00 Lunch Buffet
- 13.00 – 13.50 Welcome presentation  
**Philippe Grangier** and **Tommaso Calarco**
- SESSION ON INTERACTION CONTROL IN QUANTUM SYSTEMS**  
Chair **Thomas Pohl**
- 13.50 – 14.10 **Johannes Zeiher**  
Many body physics with Rydberg S and P states under the microscope
- 14.10 – 14.30 **Alex Glätzle**  
Designing frustrated quantum magnets with laser-dressed Rydbergs atoms
- 14.30 – 14.50 **Wolfgang Lechner**  
Logarithmic potentials and glassy dynamics in ensembles of Rydberg atoms
- 14.50 – 15.10 **Pierre Pillet**  
Förster resonances in frozen Rydberg gases: two-body and Borromean three-body effects
- 15.10 – 15.30 Coffee and cookies
- 15.30 – 16.15 **INVITED TALK, AIAS SEMINAR**  
DESY: **Karl Jansen** (external speaker)  
Status and open problems of lattice field theories
-

**SESSION ON MANY-BODY STRUCTURES AND PHASE TRANSITIONS**

Chair **Immanuel Bloch**

- 16.20 – 16.50    **Thomas Pohl**  
Quantum phases of Rydberg excitations in optically dense gases
- 16.50 – 17.10    **Oliver Morsch**  
Phase transitions and explosions in off-resonantly excited Rydberg gases
- 17.10 – 17.30    **David Petrosyan**  
Spatial correlations of Rydberg excitations in resonantly driven lattice gas
- 17.30 – 17.50    **Jacob Sherson** and **Pinja Haikka**  
Computer games for quantum optimization
- AIAS Lobby
- 18.00 – 21.00    Poster Session with snacks and beer/wine/soft drinks
-

## DAY 2

Thursday 12 March 2015

**SESSION ON NEW CONCEPTS AND NEW PLATFORMS**Chair **Charles Adams**

09.00 – 09.30

**Tommaso Calarco**

Quantum optimal control of Rydberg systems

09.30 – 09.50

**Robert Spreeuw**

Rydberg atoms in lattices on atom chips

09.50 – 10.10

**Christine Koch**

Robust quantum optimal control of Rydberg atoms

10.10 – 10.30

**Servaas Kokkelmans**

Optically imprinted Rydberg lattices

10.30 – 10.50

Coffee and cookies

**SESSION ON BENCHMARKING AND INTERFACES**Chair **Klaus Mølmer**

10.50 – 11.20

**Charles Adams**

Dipolar QED: a new paradigm for quantum simulation

11.20 – 11.40

**Matthias Weidemüller****TBA**

11.40 – 12.00

**Sebastian Gleyzes**

Quantum Zeno Dynamics of a Rydberg atom

12.00 – 12.20

**Johannes Deiglmayr**

Rydberg spectroscopy above surfaces and in an ultracold gas

- 12.20 – 13.00 Lunch: Sandwiches, coffee and cookies  
AIAS Large meeting room (room 204):
- 13.00 – 15.00 **CLOSED SESSION ON PROJECT MANAGEMENT, COMMUNICATION AND DISSEMINATION**  
Chairs **Tommaso Calarco** and **Philippe Grangier**
- 13.00 – 15.00 Free time for the rest (See The Old Town, visit ARoS)
- 15.00 – 15.45 **INVITED TALK, AIAS SEMINAR**  
ETH Zürich: **Matthias Troyer** (external speaker)  
The challenge of achieving quantum supremacy in quantum simulators
- 15.45 – 16.00 Coffee and cookies
- SESSION ON QUANTUM SIMULATION OF OPEN SYSTEMS**  
Chair **Hans-Peter Büchler**
- 16.00 – 16.30 **Sebastian Hofferberth**  
Dephasing with d-state Rydberg atoms
- 16.30 – 17.00 **Juan Garrahan**  
Soft matter analogies in Rydberg systems
- 17.00 – 17.20 **Nicolai Lang**  
Exploring quantum phases by driven dissipation
- 17.20 – 17.40 **Klaus Mølmer**  
Relax and enjoy (Rydberg physics)  
  
Restaurant in Aarhus city
- 18.30 – 21.30 Workshop dinner: Sechzehn restaurant (Europaplads 16, 8000 Aarhus C)
-

# DAY 3

Friday 13 March 2015

- 09.00 – 09.15 A brief introduction of the AIAS  
AIAS Director: **Morten Kyndrup**
- 09.25 – 10.10 **INVITED TALK, AIAS SEMINAR**  
MIT: **Gabriela S. Schlau-Cohen** (external speaker)  
Elucidating the dynamics of single photosynthetic light-harvesting complexes
- 10.10 – 10.30 Coffee and cookies
- SESSION ON QUANTUM SIMULATION OF NON-EQUILIBRIUM SYSTEMS**  
Chair **Matthias Weidemüller**
- 10.30 – 11.00 **Ferdinand Schmidt-Kaler**  
Observation of Rydberg excitations of a single trapped cold ion
- 11.00 – 11.20 **Shannon Whitlock**  
Dipolar spin transport with Rydberg dressed atoms
- 11.20 – 11.40 **Fabio Mezzacapo**  
Classical and quantum glasses with Rydberg-dressed atoms
- 11.40 – 12.15 Summary discussion, future plans and conclusions
-

AIAS Lobby

12.15 – 13.00 Lunch buffet

Department of Physics and Astronomy

13.00 – 15.00 **LAB TOURS**

**Michael Drewsen** (ions)

**Jan Arlt** (BEC)

**Jacob Sherson** (optical lattices)

**Steen Brøndsted** (bio-molecules in storage rings)

15.00 – Departure

---

NOTES:

NOTES:

GETTING TO AARHUS AND AARHUS UNIVERSITY

DIRECTIONS FROM TRAIN STATION TO RADISSON BLU

WALKING DIRECTIONS FROM RADISSON BLU TO AIAS

BUS 1A FROM TRAIN STATION TO AIAS

WALKING DIRECTIONS FROM BUS 1A (NØRREPORT ST.) TO AIAS

## Support

Aarhus Institute of Advanced Studies. AIAS



European Union's Seventh Framework Programme for Research



SIQS

