

Symposium

# Broken Mirrors & Drifting Constants

on the physics of fundamental symmetries and fundamental constants of nature,  
and ultra-precise measurements in atomic and molecular clocks

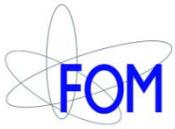


Monday June 6 2011

13:00 – 17:30

Auditorium VU University (Main Building)

De Boelelaan 1105, Amsterdam



## Program: Broken Mirrors & Drifting Constants

In this FOM program we will use the most precise tools of physics available today to test our current physical understanding of the universe as laid out in General Relativity (GR) and the Standard Model (SM). The principal idea behind this program is that effects of new physics either related to hitherto unknown particles or to symmetry-breaking phenomena manifest themselves as minute shifts in the quantum level structures of atoms and molecules. This opens up the possibility to probe physics that is normally associated with TeV-physics in measurements at the feV-level. To detect such phenomena, experiments must be performed at extreme precision, where key ingredients are ultra-stable lasers and cold and controlled samples of atoms and molecules. Recent advances in these key techniques are now providing us a window of opportunity. By joining the scientific and technical knowledge at KVI and VU, we create a unique environment for these challenging precision experiments and their interpretation. We have selected a number of target species which, because of a fortuitous level structure, have an enhanced sensitivity to new physics. These target species range from the He atom, to He<sup>+</sup>, Ra<sup>+</sup> and H<sub>2</sub><sup>+</sup> ions, and H<sub>2</sub>, NH<sub>3</sub> and SrF molecules; all systems at the atomic scale. We will bring these target species under full control and conduct measurements at extreme precision. Our measurements at the atomic scale will provide essential input for long sought after grand-unification theories, complementary to currently ongoing approaches at high energies with accelerators and cosmic particles.

### Scientists involved in the program



Wim Ubachs



Kjeld Eikema



Wim Vassen



Rick Bethlem



Jeroen Koelemeij



vrije Universiteit amsterdam



Klaus Jungmann



Lorenz Willmann



Ronnie Hoekstra



Steven Hoekstra



Rob Timmermans



rijksuniversiteit  
 groningen



Kickoff meeting of the FOM research program

## Broken Mirrors & Drifting Constants

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*Monday June 6<sup>th</sup> 2011*

*Auditorium, Main Building VU University, De Boelelaan 1105, Amsterdam*

- 13:00      **Wim Ubachs** (VU)  
Introduction on the FOM-Program
- 13:20      **Gerard 't Hooft** (Utrecht University)  
Fundamental constants, the hierarchy of large numbers,  
and what do Black Holes have to do with this ?
- 14:00      **Till Rosenband** (NIST Boulder)  
Aluminum ion clocks for fundamental physics and geodesy
- 14:35      **Lorenz Willman** (KVI Groningen)  
Precision measurements on radioactive isotopes
- 15:00      Coffee break
- 15:30      **Mikhail Kozlov** (St. Petersburg)  
Sensitive atoms and molecules for probing variation of constants
- 16:05      **Krzysztof Pachucki** (Warsaw University)  
Precision calculations on two-electron systems: He and H<sub>2</sub>
- 16:40      **Ed Hinds** (Imperial College London)  
Improved measurement of the electron Electric Dipole Moment
- 17:15      Lab visit and Drinks

Information and registration: Marja Herronen ([m.e.herronen@vu.nl](mailto:m.e.herronen@vu.nl))

## You can join us !

We have a total of 8 open PhD positions to join us in this exciting research. We are looking for motivated students, who are willing to take on the challenge of these cutting-edge projects. Projects will be carried out at LaserLaB Amsterdam and at KVI Groningen.

You can contact the local coordinators Wim Ubachs ([w.m.g.ubachs@vu.nl](mailto:w.m.g.ubachs@vu.nl)) and Klaus Jungmann ([k.h.k.j.jungmann@rug.nl](mailto:k.h.k.j.jungmann@rug.nl)) or one of the scientists involved in the program to talk about the possibilities.

