

**ISSI/HISPAC Workshop on
 “High Performance Clocks, with Special Emphasis on Geodesy and
 Geophysics and Applications to Other Bodies of the Solar System”
 November 30-December 4, 2015**

PROGRAM

Monday, 30 November 2015

Introduction

08:30-09:00 Registration in ISSI, Hallerstrasse 6, 1st floor
09:00-09:30 Welcome and Introduction: What we hope to accomplish **Rafael Rodrigo
Chris Rapley**
09:30-10:15 General Lecture “Cosmic time and Einstein’s universal
antigravitation” **Arthur Chernin**

***I: Clocks, Time Transfer and Technology
 Convenor: Peter Wolf***

I.1. Clocks technology on the ground

10:15-10:45 Time/frequency technology: present status and outlook **Sébastien Bize**
10:45-11:15 Coffee break
11:15-11:45 Optical clocks **Ross Hutson**

I.2. High precision clocks in space

11:45-12:15 European space clock development projects **Stephan Schiller**

I.3. Time transfer – clock comparison

12:15-12:45 GNSS time/frequency transfer **Pascale Defraigne**
12:45-13:15 Two-Way Time and Frequency Transfer **Dirk Piester**
13:15-14:15 Lunch
14:15-15:15 General Discussion **Peter Wolf**

15:15-15:45 Coffee Break

***II: Applications in Earth Sciences
 Convenors: Véronique Dehant and Peter Wolf***

II.1. Using clocks for gravity field determination

15:45-16:15 The benefit of clock measurements for gravity field applications **Jürgen Müller**
16:15-16:45 Post-Newtonian theory of the level surface and undulation of
the Earth’s geoid **Sergei Kopeikin**
16:45-17:15 Clocks-based geopotential determination: complementarity
with existing gravity data and interest in geoscience **Isabelle Panet**
17:15-17:45 Ultra-precise space-borne clocks for observing Earth’s gravity **Pieter Visser**
17:45 Welcome reception at ISSI

II: Applications in Earth Sciences
Convenors: Véronique Dehant and Peter Wolf

II.2. Using clocks for positioning

- 09:00-09:30** Satellite navigation with better and better clocks **Urs Hugentobler**
- 09:30-10:00** Importance of accurate clocks for determining reference frames using VLBI **Harald Schuh**

II.3. Using clocks for reference frames

- 10:00-10:30** Future interactions between time and frequency metrology and geodesy **G rard Petit**
- 10:30-11:00** Coffee break
- 11:00-11:30** Irregularities of Earth's rotation and their measurement with atomic clocks **Sergei Kopeikin**
- 11:30-12:00** The challenge of observing space probes with geodetic VLBI **Axel Nothnagel**

III: Applications in fundamental physics
Convenor: Peter Wolf

III.1. Radioscience and objectives to be done with high precision clocks

- 12:00-12:30** Solar system tests of gravitation and some of their implications at galactic and cosmological scales **Aur lien Hees**
- 12:30-13:00** GNSS and fundamental physics **Pac me Delva**
- 13:00-14:00** Lunch

III.2. Applications in high precision/accuracy clocks in fundamental physics, and related space projects

- 14:00-14:30** Introduction **Peter Wolf**
- 14:30-15:00** Fundamental Physics Tests with Space clocks **Christophe Salomon**
- 15:00-15:30** Fundamental physics with space clocks in highly elliptic orbits **Steve Lecomte**
- 15:30-16:00** Coffee break
- 16:00-16:30** Future advanced clocks in space **Slava Turyshev**
- 16:30-17:00** Measuring the gravitational time delay with optical clocks in Space **Neil Ashby**
- 17:00-18:00** General Discussion

Wednesday, 2 December 2015

IV: Applications in Solar System science
Convenors: Véronique Dehant and Ryan Park

IV.1. Terrestrial planets and the Moon

09:30-10:00 Introduction

Ryan Park

10:00-10:30 Clock on the Moon and improvements in reference frames

Véronique Dehant

10:30-11:00 Coffee break

11:00-11:30 Coupling between space and time dynamics in planetary mission tracking data analysis

Dominic Dirkx

11:30-12:00 Clock oscillators and time correlation with lasers in space: MOLA, LOLA and MLA

Gregory Neumann

12:00-13:00 *Young scientist' presentations*

13:00-14:00 Lunch

14:30 Free time for networking at ISSI (all ISSI facilities are available for small group discussions)

Also: Time to visit the attractions of Bern

19:00 Workshop dinner: Restaurant Kornhauskeller, Bern

Thursday, 3 December 2015

IV: Applications in Solar System science
Convenors: Veronique Dehant and Ryan Park

IV.2. Giant planets, moons and small bodies

09:00-09:30 Clocks onboard planetary missions: uses and limitations	Luciano Iess
09:30-10:00 Precise timing for rotation and interior of terrestrial planets or moons	Tim van Hoolst
10:00-10:30 Laser Altimetry and Laser Ranging in the Outer Solar System	Hauke Hussmann
10:30-11:00 Coffee break	
11:00-11:30 Solar system ephemerides construction by the evolution method	Enrico Mai
11:30-12:00 Mapping the gravity fields of planets and moons with help from accurate clocks	Gregory Neumann
12:00-13:00 General discussion	Tilman Spohn
13:00-14:00 Lunch	

IV.3. Future technology for Solar System

14:00-14:30 Stable oscillators and precision clocks for planetary gravitational Field and atmospheric structure radio science experiments	Ryan Park
14:30-15:00 Advanced laser ranging and astrometry for high-precision navigation and science investigations	Slava Turyshev
15:00-15:30 Accurate optical time transfer between ground and space Paper deferred from Session I.3	Ulrich Schreiber
15:30-16:00 Coffee break	

V: Astrophysics and cosmology
Convenors: Leonid Gurvits and Michael Kramer

V.1. Pulsar timing in astrophysics and cosmology

16:00-16:30 Pulsar timing in astrophysics and cosmology	Alberto Sesana
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V.2. Pulsar timing in aerospace navigation

16:30-17:00 Autonomous spacecraft navigation with pulsars	Werner Becker
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V.3. Timing in high precision Astrometry

17:00-17:30 Data timing, time transfer and onboard clock monitoring for the space astrometry	Sergei Klioner
17:30-19:00 General outline of ISSI book, organization, followed by splinter groups for book chapters	John Zarnecki

ISSI facilities, rooms available

Friday, 4 December 2015

V: Astrophysics and cosmology

Convenors: Leonid Gurvits and Michael Kramer

V.4. Clocks and frequency standards in VLBI

09:30-10:00 Timing and precise oscillators in VLBI

Leonid Gurvits

V.5. Spectroscopy and fundamental constants

10:00-10:30 Search for new physics from astronomical observation of molecules

Wim Ubachs

10:30-11:00 Coffee break

11:00-12:00 Reports from splinter groups, authors
Book plans, action, schedule

Led by Convenors

12:00 Close of Workshop