

Third IAGA Summer School  
20 – 26 August 2017  
SANSA Space Science, Hermanus



# 1 Lectures

Time / Date	20 Aug Sunday	21 Aug Monday	22 Aug Tuesday	23 Aug Wednesday	24 Aug Thursday	25 Aug Friday	26 Aug Saturday
08:00		Breakfast	Breakfast	Breakfast	Breakfast	Breakfast	Breakfast
09:00		Welcome	Ionosphere I (Katamzi-Joseph)	Electromag- netism I (Thiel)	Geomagnetic field and core dynamics I (Gillet)	Geomagnetic field and core dynamics III (Gillet)	Travel to Cape Town
09:30	Arrival Cape Town / Travel to Hermanus	Online quiz					
10:30		Tea					
11:00		Space physics I (Bering)	Ionosphere II (Cilliers)	Electromag- netism II (Thiel)	Geomagnetic field and core dynamics II (Gillet)	Paleomagnetism I (Turner)	
12:30		Lunch	Lunch	Lunch	Lunch	Lunch	
14:00		Tour of SANSA	Practicals I	Afternoon outing	Practicals II	Paleomagnetism II (Turner)	
15:30		Tea	Tea		Tea	Tea	
15:45		Space physics II (Bering)	Practicals I		Practicals II	Student presentations	
17:15		Space Weather (Kosch)					
18:00		Dinner	Dinner	Dinner	Dinner in town	Public Lecture	
19:00					Dinner		

## Space and magnetospheric physics (Monday)

### Overview of Space Physics Theory

- Particle Orbit Theory
- Kinetic Theory
- Basic Plasma Phenomena
- Fluid and MHD Theory

### The Terrestrial Magnetosphere

- Solar wind Interaction With Magnetized Planets
- Magnetopause and Magnetic Reconnection
- Magnetospheric Configuration
- Magnetospheric Dynamics
- Aurora
- Substorms



*Edgar Bering, University of Houston, USA*

## Space Weather (Monday)

- Magnetic reconnection
- Auroras (structures, electrodynamics, photon emissions)
- Space weather impacts



*Michael Kosch, SANSA Space Science,  
Hermanus, South Africa*

## Ionosphere Part I (Tuesday)

- The Ionosphere: definition and formation
- Structure of the ionosphere
- Radio propagation and measuring techniques
- F2 morphology



*Zama Katamzi-Joseph, SANSA Space Science,  
Hermanus, South Africa*

## Ionosphere Part II (Tuesday)

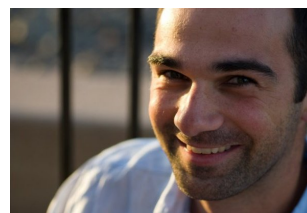
- Ionospheric fluctuations: Causes and consequences
- Measurement of ionospheric scintillation (HF, VHF, L-band, in-situ)
- Impacts of ionospheric scintillation on radio communication and GNSS navigation
- Modelling and mitigation of ionospheric scintillation



*Pierre Cilliers, SANSA Space Science, Hermanus,  
South Africa*

## Electromagnetic induction methods and applications (Wednesday)

- Electrical conductivity of Earth materials
- Source fields for electromagnetic induction
- Theoretical background of electromagnetic methods with focus on magnetotellurics
- Analysing MT data: dimensionality, strike, anisotropy
- Modelling of MT data: from 1D to 4D
- Case study: Tectonics and mineral exploration
- Case study: Geothermal exploration and hydraulic fracture monitoring



*Stephan Thiel, Geological Survey of South  
Australia*

## Geomagnetic main field and core dynamics (Thursday, Friday)

### Part 1: Observations and inverse modelling

- Some insights from the length of day
- About historical records , archeo- and paleo-magnetism
- Modern observations: observatory and satellite data
- Inverse problem and magnetic modeling

### Part 2: Magneto-hydro-dynamics (MHD)

- The induction equation
- A bit of dynamo theory
- Geodynamo simulations: perspectives and limitations

### Part 3: Dynamics within the Earth's core

- Quasi-geostrophy and magnetostrophy
- Kinematic core flows modeling
- MHD waves and Taylor's state
- Towards geomagnetic data assimilation



*Nicolas Gillet, Institut des Sciences de la Terre,  
Université Grenoble Alpes, France*

## Palaeomagnetism: deciphering records of the prehistoric field (Friday)

- **First Principles:** Rocks, sediments and archaeological materials as magnetic recorders
- **Practical Details:** Sampling, measuring, checking for reliability
- **Palaeomagic:** Data interpretation and statistics
- **The Prehistoric field:** The evidence for field variability, excursions, polarity reversals,
- **The Time Averaged Field:** The geocentric axial dipole hypothesis, palaeomagnetic poles, continental reconstruction



*Gillian Turner, Victoria University of  
Wellington, New Zealand*