

# The Astronomy Undergraduate Programme at the University of Cape Town

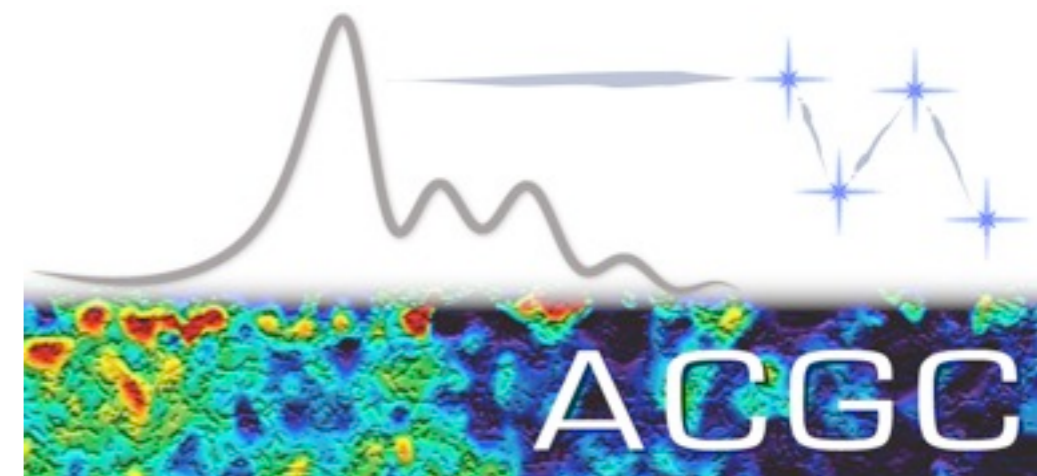
Astronomy at the University of Cape Town (UCT)

The undergraduate astronomy curriculum at UCT

Lessons learnt and future developments

ACGC and the African SKA HCD programme

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**Lecturer, Department of Astronomy**  
SKA HCD workshop, Pinelands, 13 Sep 2012



# **Astronomy at UCT**

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Department of Astronomy (since early 1970s)

Tremendous growth in Astronomy since 2005  
(from 2 to 8 staff members; incl. 2 SARChI professors)

Since 2006, undergraduate major in Astrophysics

Since 2009, UCT-accredited research centre in  
Astrophysics, Cosmology and Gravity

<http://www.acgc.uct.ac.za>

<http://www.ast.uct.ac.za>

# The Astrophysics, Cosmology and Gravity Research Centre

Combined expertise in observational astronomy and theoretical cosmology (Maths and Applied Maths)

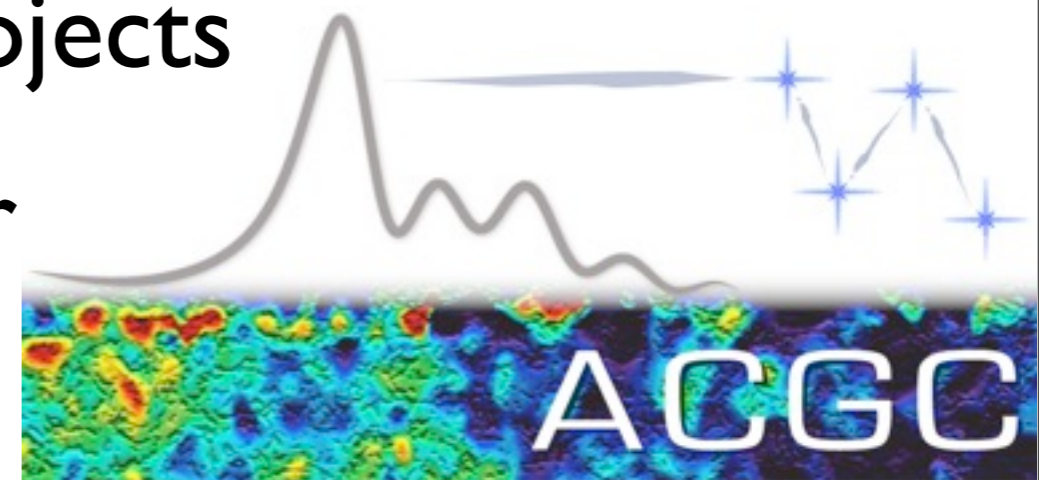
15 Academic Staff, 3 emeritus professors (A-rated)

17 Postdocs (9 in Astronomy)

~40 Postgraduate research students (MSc / PhD)

4 PIs of MeerKAT large survey projects

>2 Astronomy PhD graduates/year



# **The undergraduate astronomy curriculum at UCT**

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Traditionally: BSc in Physics  
specialisation at postgraduate levels

Astrophysics major (1995-2000)  
Failed, too few students

Reinstated the astrophysics major in 2006 in response  
to the changing astronomical landscape (new world-class  
facilities)

# Structure of the Astrophysics Major

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2/4

**AST1000F**

**PHY1004W**

(Co-R: **MAM1000W**)

or

**PHY1023H + PHY1024H**

**MAM1000W**

or

**MAM1005H + MAM1006H**

**MAM1043H**

**MAM1044H**

2.5/3

**AST2002S**

(Pre-R: **PHY1004W**, **MAM1000W**)

**PHY2014F**

(Pre-R: **PHY1004W** (or **PHY2009S** & **MAM1043H**),

**MAM1000W**)

(Co-R: **MAM2000W** (or **MAM2004H** and **MAM2046W**))

**PHY2015S**

(Pre-R: **PHY1004W** (or **PHY2009S** and **MAM1043H**),

**MAM1000W**)

(Co-R: **MAM2000W** (or **MAM2004H** and **MAM2046W**))

**MAM2000W**

(Pre-R: **MAM1000W**)

or

**MAM2004H**

(Pre-R: **MAM1000W**)

+

**MAM2046W**

(Pre-R: **MAM1000W**, **MAM1043H**, **MAM1044H**)

1/2

**AST3002F**

(Pre-R: **AST2002S**, **PHY2014F**, **PHY2015S**)

**PHY3021F**

**AST3003S**

(Pre-R: **AST2002S**, **PHY2014F**, **PHY2015S**)

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**Colour-coding: Compulsory, Strongly recommended, equivalent alternative**

**Flexibility in flavours of the Astrophysics BSc:  
Physics, Applied Maths, Astro-technology**

# The undergraduate astronomy curriculum at UCT

AST1000F: Introduction to Astronomy

(open to all on campus)

*Astronomy Today (Chaisson & McMillan)*

AST2002S: Astrophysics

*Astronomy: A Physical Perspective (Kutner)*

*Broad range of topics [incl. extrasolar planets]*

AST3002F: Stellar Astrophysics

*Introduction to Modern Astrophysics (Carroll & Ostlie)*

*Stellar Atmospheres / Stellar Structure and Evolution [observational techniques]*

AST3003S: Galactic and Extragalactic Astrophysics

*Introduction to Modern Astrophysics (Carroll & Ostlie)*

*Interstellar medium / Galaxies [observational techniques]*

# Sutherland Field Trip

## 2nd year students

- overnight trip

## 3rd year students

- 4 nights photometry (1st semester)
- 4 nights spectroscopy (2nd semester)





# The undergraduate astronomy curriculum at UCT

Strong growth in numbers since the reintroduction of the Astrophysics major:

- clear demand for this option
- excellent match with HCD in Astronomy in SA

	2005	2006	2007	2008	2009	2010	2011	2012
AST1000F	60	61	60	125	116	153	129	78
AST2002S	28	16	14	26	30	33	41	38
AST3002F	-	9	4	0	3	11	6	5
AST3003S	-	6	3	0	3	8	5	5



AstroPhys Major		1st year		2nd year		3rd year	
2006 ( <b>13</b> )		<b>4</b>		<b>2</b>		<b>7</b>	
male (62)	female (38)	3	1	-	2	5	2
white (92)	black (8)	3	1	2	-	7	-
2007 ( <b>19</b> )		<b>10</b>		<b>6</b>		<b>3</b>	
male (79)	female (21)	10	-	4	2	1	2
white (68)	black (32)	6	4	4	2	3	-
2008 ( <b>30</b> )		<b>19</b>		<b>11</b>		<b>-</b>	
male (67)	female (33)	10	9	10	1	-	-
white (37)	black (63)	5	14	6	5	-	-
2009 ( <b>42</b> )		<b>24</b>		<b>14</b>		<b>4</b>	
male (64)	female (36)	16	8	8	6	3	1
white (26)	black (74)	5	19	3	11	3	1
2010 ( <b>42</b> )		<b>21</b>		<b>13</b>		<b>8</b>	
male (62)	female (38)	15	6	8	5	3	5
white (33)	black (67)	9	12	2	11	3	5
2011 ( <b>50</b> )		<b>25</b>		<b>20</b>		<b>5</b>	
male (na)	female (na)	n/a	n/a	n/a	n/a	n/a	n/a
white (24)	black (76)	5	20	4	16	3	2

# Lessons learnt and future developments

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## Strengths:

- Growing enrollment in Astrophysics
- Excellent representation of SA demographics
- Input into NASSP (well-prepared students)

## Improvements:

- Throughput at 2nd year (mirrors MAM/PHY)
- astro-technology stream - co-ordination with

Engineering

# The undergraduate astronomy curriculum at UCT

## Changes in 2013

### AST2002S: Astrophysics → AST2002H

- In contact with students over the entire year
- Allows us to use the winter break if needed

### AST2003H: Astronomical Techniques

This course combines a large practical component (radio and optical astronomy practicals) with theoretical background in astronomical techniques, instrumentation and data analysis.

The techniques, instrumentation and data analysis section includes: Positional Astronomy, Detection Systems, Optics and Telescope Design; Multi-wavelength Astronomy  
Observational Techniques: Photometry and Spectroscopy; Orthodox Statistics

# Lessons learnt and future developments

## Ongoing developments:

- assessment of the Astro-technology stream
- potential for introducing radio astronomy at 3rd year
- on-campus practicals
- introduce new media in the curriculum (record lectures and seminars)



## Phased Experimental Demonstrator (PED)

- 4 element interferometer
- Donated by KAT team at the end of 2011
- SAAO agreed to continue hosting it.



## Optical Teaching Observatory

- To be installed by Jan 2013 (roof of the department)
- multi-band imaging & spectroscopy



# ACGC and the African SKA HCD

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Active participant in NASSP (teaching, supervision) and the SKA HCD (supervision, **teaching**)

ACGC academics lead 4/10 MeerKAT Large Survey Projects (student co-supervision, postdocs)

Share experience in undergraduate programme (two way exchange, e.g. practicals)

Mobility (two way, post-PhD)

# ACGC and the African SKA HCD

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- Prof. Claude Carignan : involved in developing astronomy in Burkino Faso . (2 students currently in NASSP)
- Dr Valerio Ribeiro : astronomy development in Mozambique
- Prof. Patrick Woudt : possible student co-supervision on a ThunderKAT project with Prof. Dinesh Somanah (Mauritius)