Marseille 2003
Science with an Extremely Large Telescope

- Introduction
- Existing science case work
- Goals of this Meeting

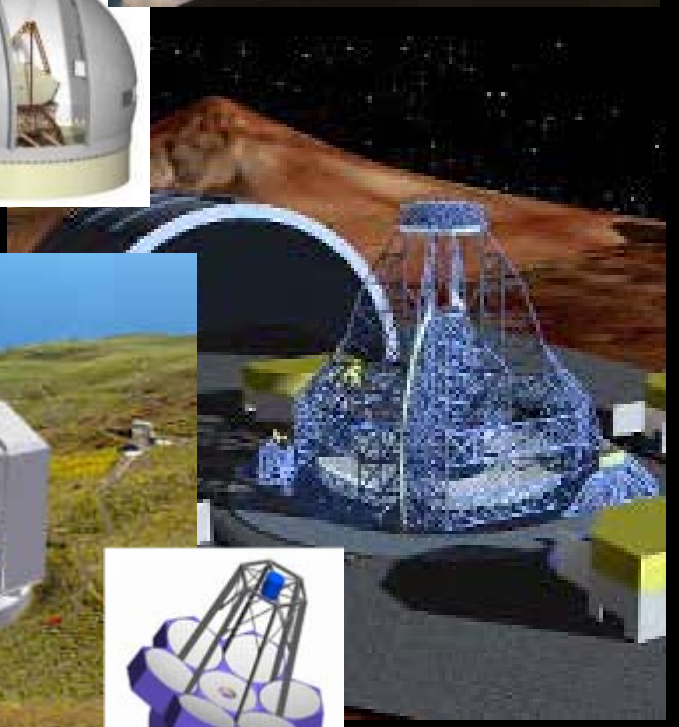
Introduction

- 8-10m class telescopes in operation >10 yrs
- 2nd generation instrumentation being planned/built
- For many scientific drivers current telescopes not big enough!

ELT projects

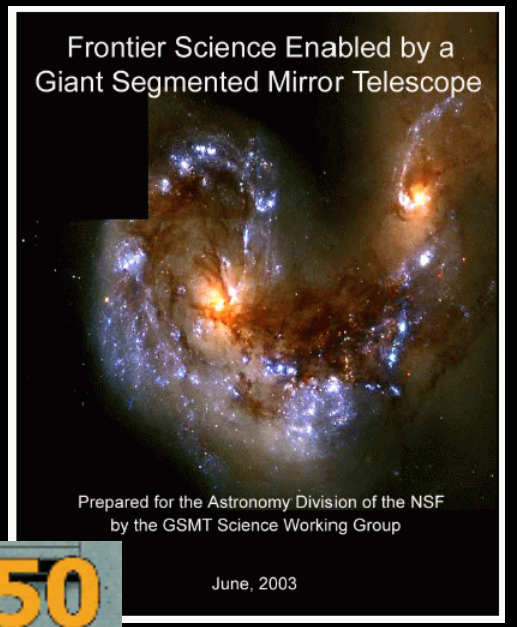
- Activity on ELTs is increasing worldwide
  - OWL 100m
  - Euro50
  - GSMT
  - CELT
  - VLOT

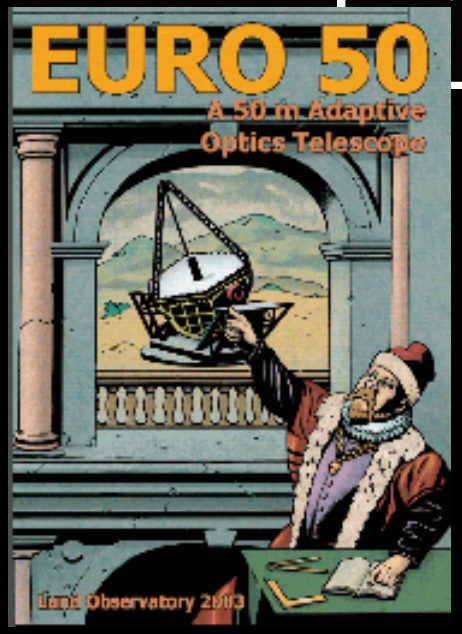
  } TMT 30m
  - Magellan 20 (GMT)
  - LAMA



Existing Science cases

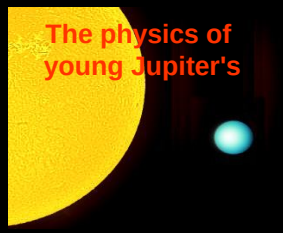
- Leiden documents (for ~100m) from 2001 workshop
  - 65 pages
  - Also converted to requirements
- Euro50 book
  - 80 pages science case
- GSMT book
  - 60 pages + glossy summary
- CELT science report
- Magellan 20 (GMT) case on web
  - 25 pages on web
- VLOT case (presentations)
- .. Others + papers + conf proceedings



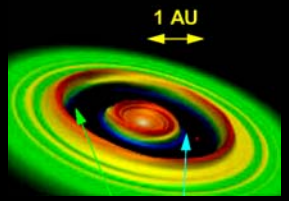


Science Themes Drive Requirements (from GSMT)

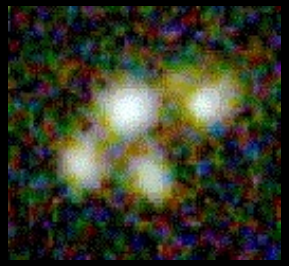
The Birth of Galaxies: Archaeological Record → Near-diffraction limited performance over ~ 2 arc-minute fields (MCAO)



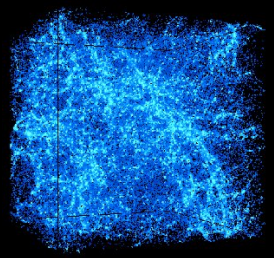
Characterize Exo-Planets → High dynamic range imaging (ExAO)



The Birth of Planetary Systems → High sensitivity Mid-IR spectroscopy



The Birth of Galaxies: Witnessing the Process Directly → Enhanced-seeing over ~ 5 arc-minute field (GLAO)



The Birth of Large Scale Structure → Wide-field, seeing-limited multi-object spectroscopy

Netscape: ELT

File Edit View Go Communicator Help

Back Forward Reload Home Search Netscape Print Security Shop Stop

Bookmarks Location: http://www-astro.physics.ox.ac.uk/~imh/ELT/ What's Related

Internet Lookup New&Cool

ELT SCIENCE CASE

Main page
Marseille meeting
Oxford meeting
Previous work
Tools
People

[No frames]

3. Galaxies and Cosmology

- **Formation of galaxies**
  - Tomography of Gas as a function of Redshift
  - Detecting the first objects (see note a)
  - The structure and evolution of high-redshift galaxies
    - Chemical Abundances
    - Kinematics
    - Star clusters
  - QSO host galaxies
- **Emergence of Large-Scale Structure**
  - Identifications and characterisation of the Sunyaev-Zeldovich detections
  - Proto-Clusters
- **Evolution of the cosmological parameters**
  - Determining the change in the equation of state parameter

Table 3 ELT performance requirements - Galaxies and Cosmology

	FOV [arcmin]	Spatial Resolution [arcsec]	Spectral Resolution	Lambda [microns]	Observational measurement	Target density	Special Requirements
Galaxy Formation							
Tomography of Gas as a function of Redshift	>10	0.05	5000-10000	optical	absorption lines	4.5 / sq arcmin (note b)	Wide field,multi-object
Detecting the first objects	>10	high-strehl AO (note c)	1000-5000 ?	1-2.5	emission lines	?	Wide field, multi-object
The structure and evolution of high-redshift galaxies: Chemical	?	0.1	>1000	1-2.5	line ratios	?	

100%

European ELT science case

- Building on previous work for OWL & Euro-50
- 3 working groups have been formed
  - Stars & Planets - *Hans Zinnecker & Rafael Rebolo*
  - Stars & Galaxies - *Mike Merrifield & Sergio Ortolani*
  - Galaxies and Cosmology - *Jacqueline Bergeron & Bruno Leibundgut*
- At least 50 volunteers

Meeting goals
1) Identify exciting science highlights

- Plan/start short document to accompany FP6 design study bid
- Scientific justification for design study
  - Executive summary, highlighting ~3 exciting goals
  - Detailed science case for the highlighted cases
  - Pretty pictures!
- Select highlights and plan this work!

20 pages

Due Mid January

Meeting Goals
2) Development of full science case

- Engage wider community
- Consider tradeoffs (see template form on web)
  - Telescope size
  - wavelength range of operation
  - FOV
  - IQ
  - Dynamic range
  - Timescale
  - Synergy with JWST, ALMA + other ELTs?
- Fill in gaps in requirements table
- Plan future work – identify areas that need simulations
- Ongoing : will continue in parallel with design study

This meeting - outline

- Introduction
  - Context : OPTICON, FP6 design study proposal
  - Predicted telescope performance, instrumentation
- Science case overview
  - Stars & Planets
  - Stars & Galaxies
  - Galaxies and Cosmology
- Breakout sessions – 3 groups as above
- Review & selection of highlights
- Planning
- Writing!

END OF INTRODUCTION

START OF SUMMARY

Programme for this morning

- Overview of next steps
- Final selection of science themes for FP6 proposal
- PHOTO
- Plan the ~20 page document
  - Suggest short session in working groups
- 11:00-11:30 COFFEE
- 11:30 reconvene
- 12:30 FINISH

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2) Development of full science case

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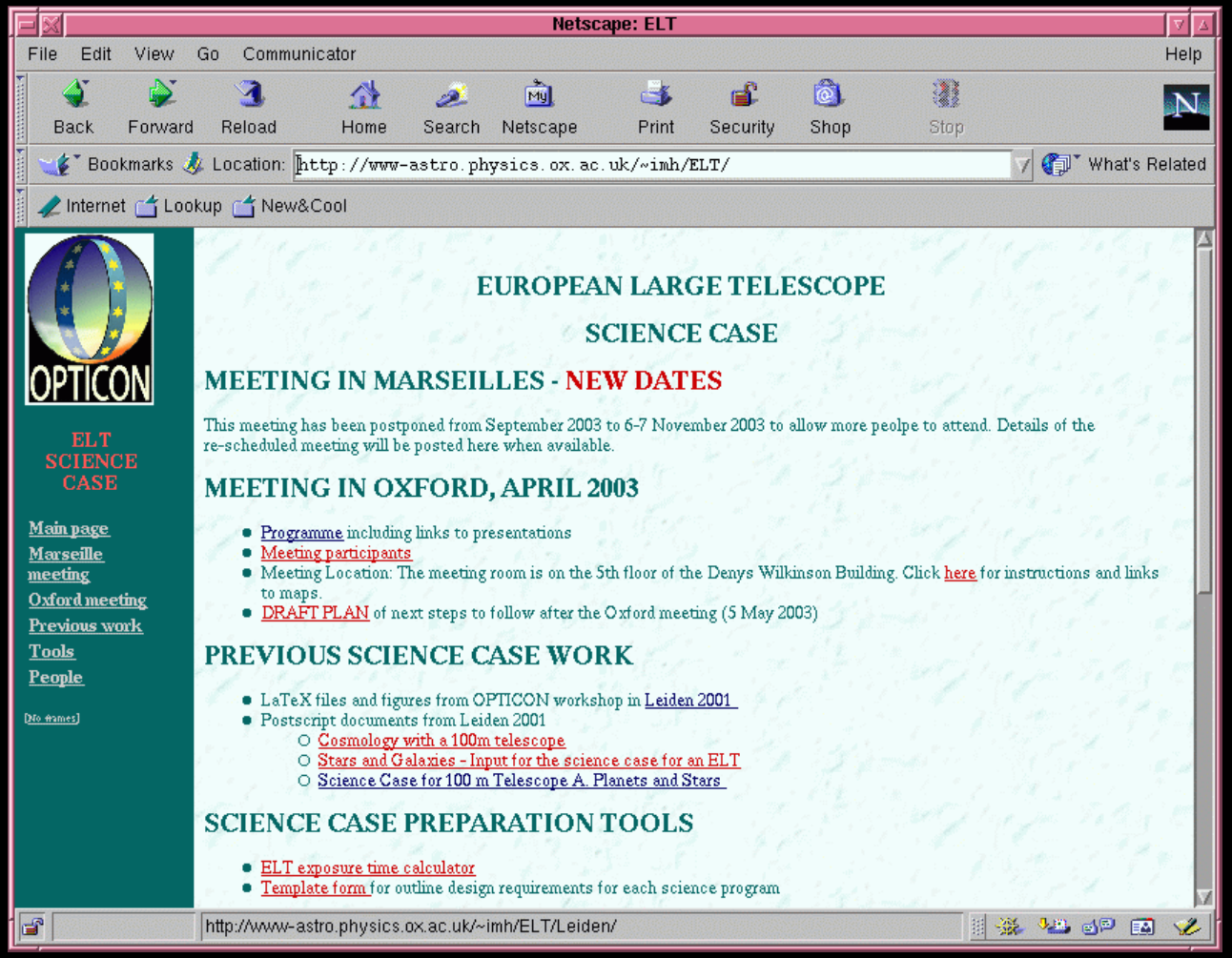
- Presentations please!
  - on web for this group?
- One-page summaries (for use in big book)



http://www-astro.physics.ox.ac.uk/~imh/ELT/

- E-mail addresses
- presentations

Meeting goals
1) Identify exciting science highlights

- Plan/start short document to accompany FP6 design study bid
- Scientific justification for design study
  - Executive summary, highlighting ~3 exciting goals. For non-experts
  - Detailed science case for the highlighted cases. To be refereed
  - Pretty pictures!
- Select highlights and plan this work!

Exact format not yet known

20 pages

Due Mid January

Plan for FP6 proposal + Deadlines

- Exec summary (~2/3 page each) 1st draft in 1 month
- Science case (~6 page each) 1st draft in 1 month
  - Abstract 1st draft NOW
  - Scientific rationale
    - Big question being tackled
    - Keep this FOCUSSED
  - Technical case
    - S/N estimate
    - Why is an ELT needed ?
    - Use form on web: FOV, wavelength range, IQ
    - It's OK to have some unanswered questions – we are proposing a design study!
  - Figures ASAP (for public web pages)

Outline NOW

Science Highlights

- **Terrestrial Planets or "Extra-Solar Systems"**
  - Statistics (~1000)
  - Properties (+Spectroscopy)
  - Orbits
  - Details of planetary systems
  - Formation
- **Stellar populations across the Universe**
  - SFR from SNe up to z=10
  - Resolved stellar populations in representative sample of the Universe (Virgo/Fornax)
- **The Physics of Galaxies from z=2 to z=5**
  - Physics of baryons
  - Kinematics of sub-units in haloes
- **The First Objects and Re-ionisation structure of the Universe**
  - High-z galaxies from z=10 to 15 (in emission)
    - Clustering, Ly-alpha emission/quenching
  - Interplay with IGM (in absorption)
    - Use very bright GRB / QSO / SNe as background object (rare)