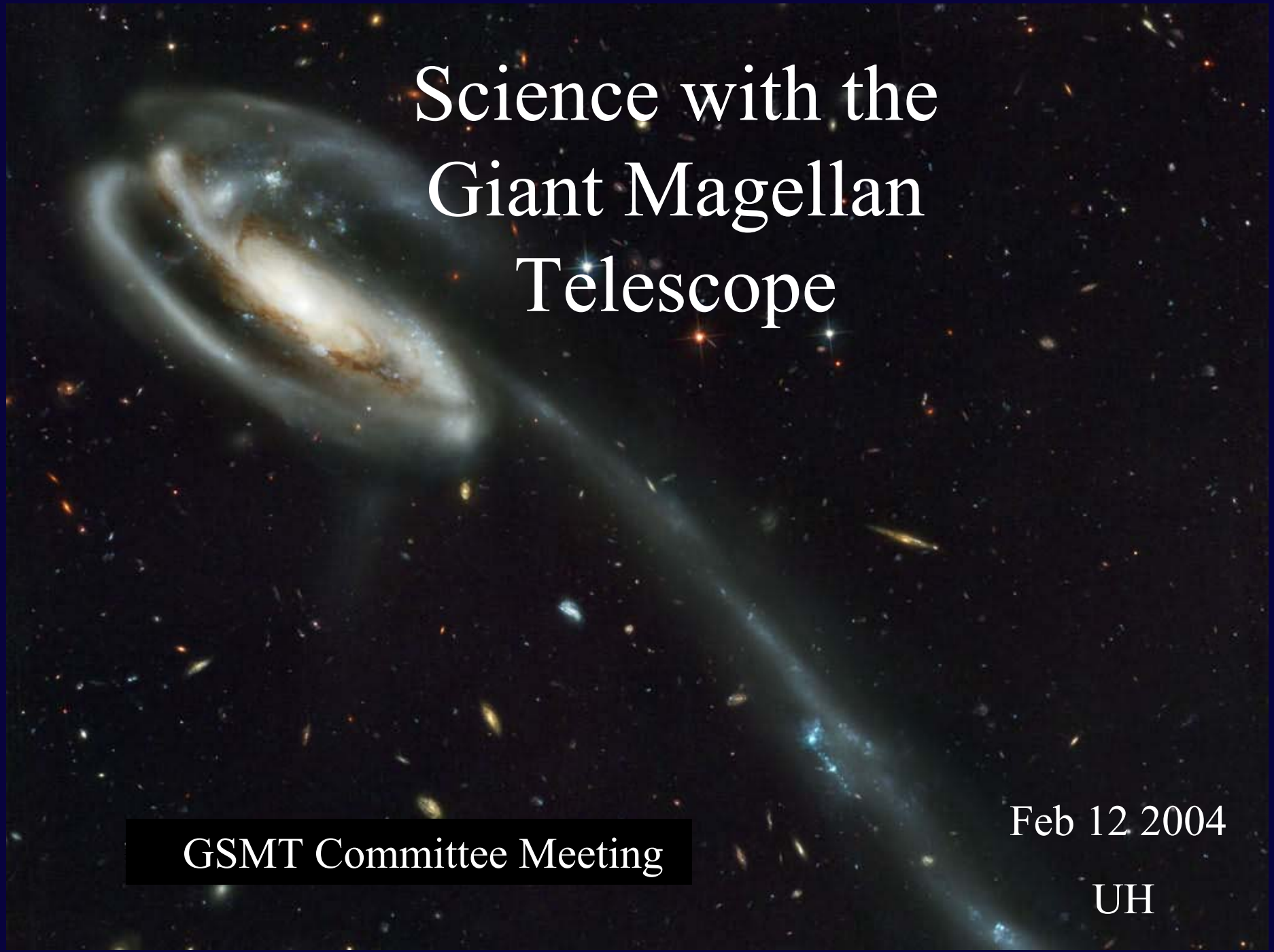


Science with the Giant Magellan Telescope

GSMT Committee Meeting

Feb 12 2004

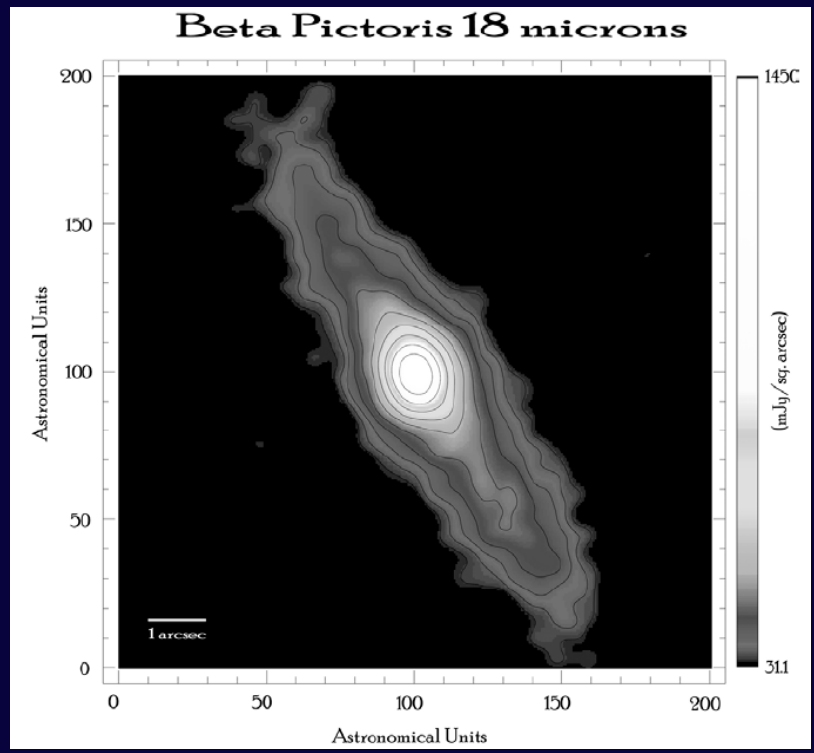
UH

Science Topics

- Formation of Planets & Habitable Worlds
- Uniqueness of our Solar System
- Origin of Stellar Masses
- Stellar Pops and Chemical Evolution
- Dark Matter and Dark Energy
- Galaxy Assembly
- Growth of Black Holes
- First Light and Reionization

Origin of Planets and Habitable Worlds

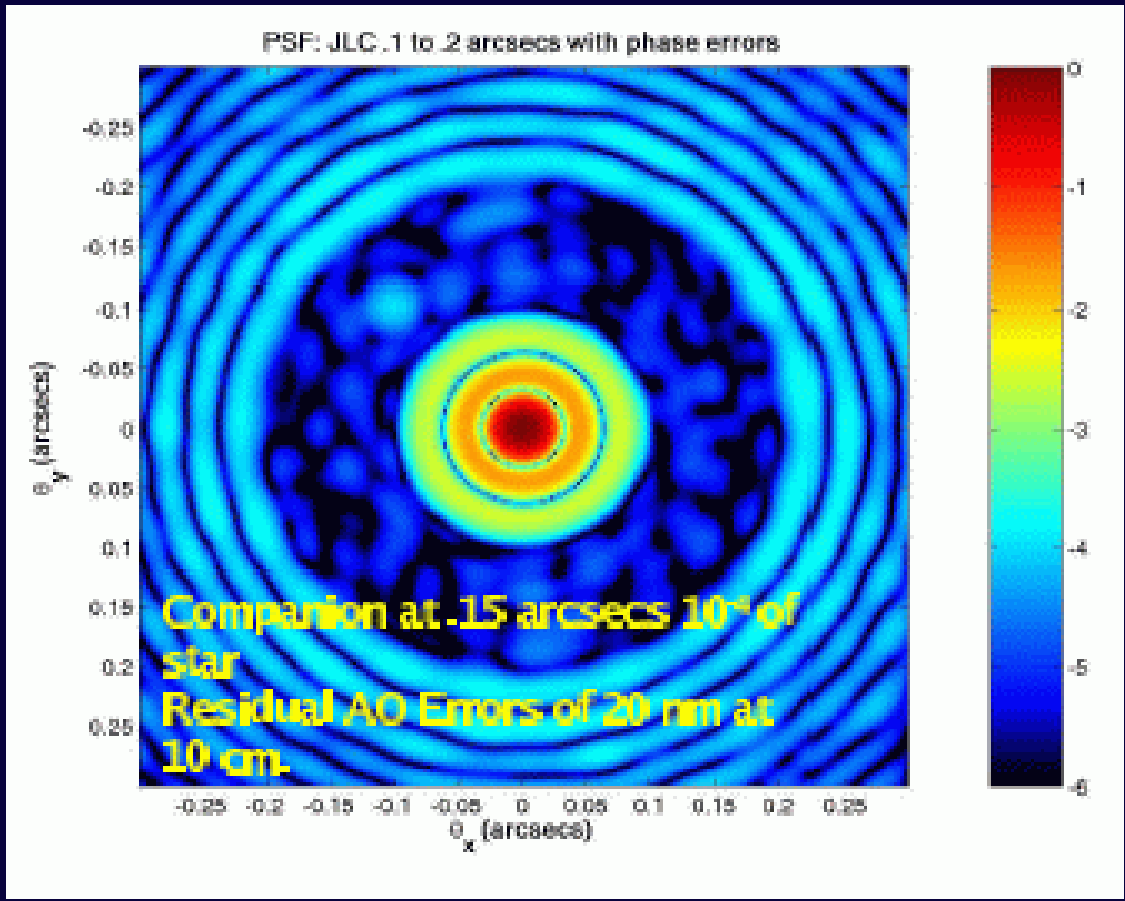
- The planetary mass function
- From disks to planets
- Composition of exoplanets (*transits*)
- Direct imaging of exoplanets



Beta Pic at 18 microns

High performance AO and near-to-mid-IR are key for this science

Simulated AO+Coronograph



J. Codona et al. U. Arizona

Unlocking the Origin of Stellar Masses

Disentangling brown dwarfs and planets

Star Formation in Extreme Environments

Trapezium with HST

Near & mid-IR spectroscopy with AO

Stellar Populations & Chemical Evolution

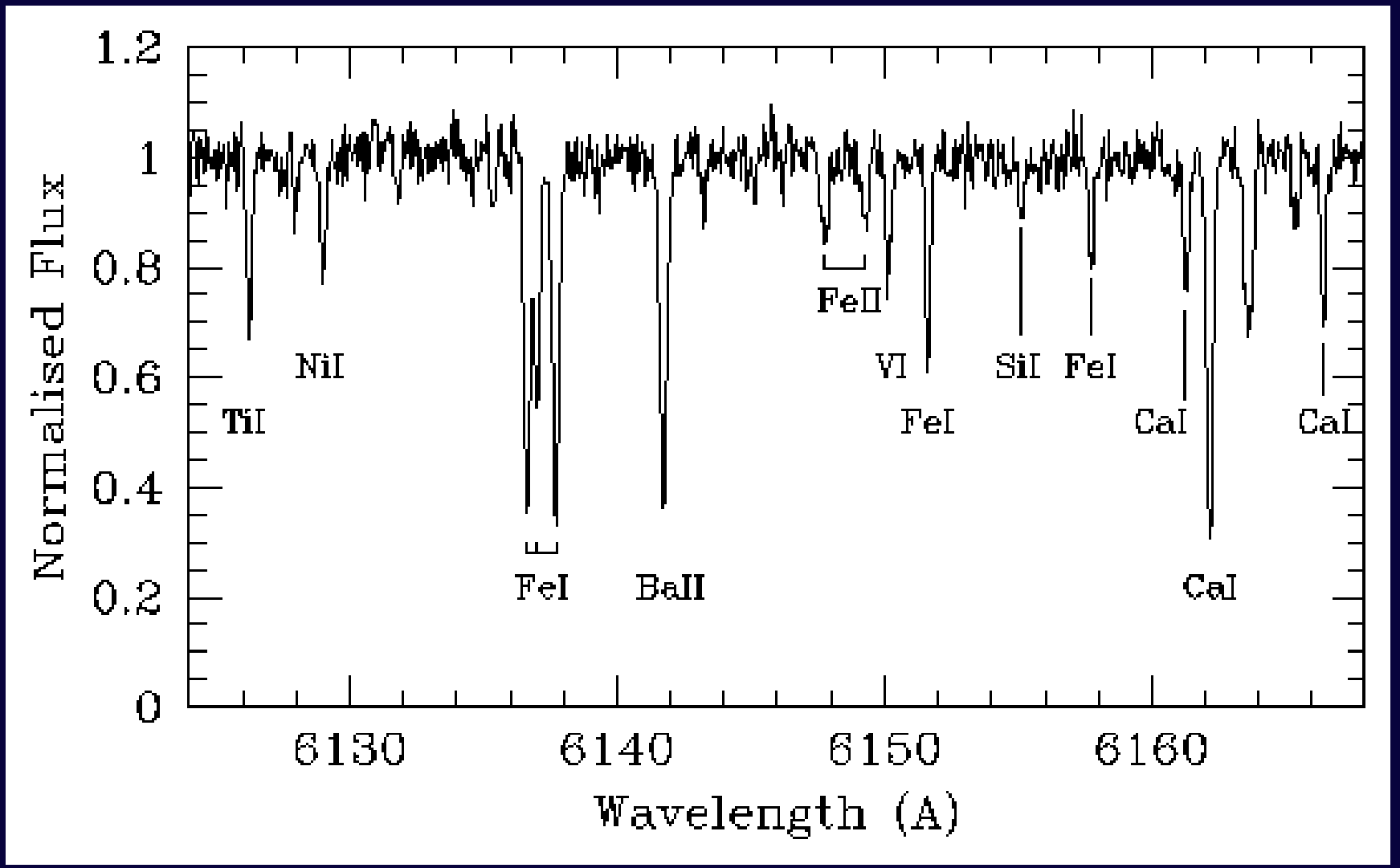
Local Group RGB abundances

Chemical Compositions beyond the Local Group

High SNR spectra of extreme metal poor stars

Stellar populations in crowded regions

High Resolution *visible and near-IR spectroscopy & MCAO*



Simulated 33 hour GMT Spectrum of a Red Giant at the distance of M33

A. McWilliam

Dark Matter and Dark Energy

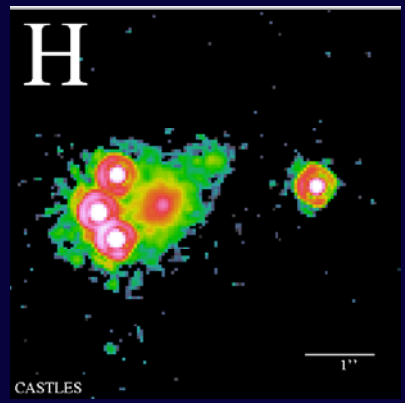
Dark Matter on small and intermediate scales

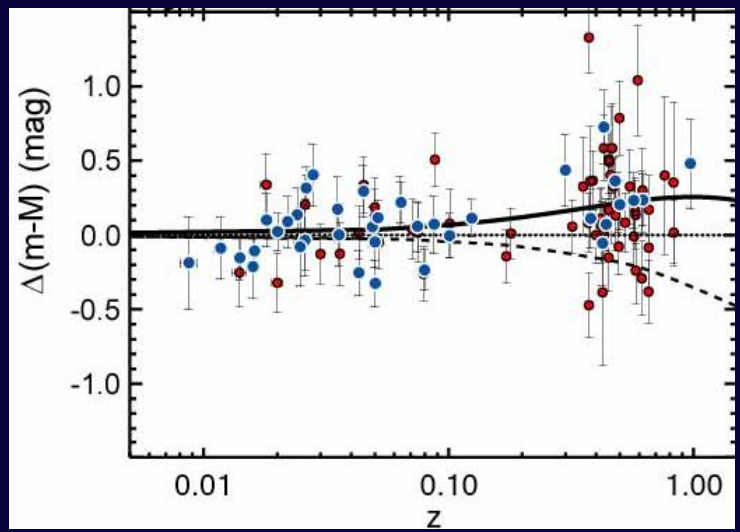
-> galaxy/quasar lensing

-> cluster arcs

-> intercluster stars, Pne dynamical probes

Dark Energy and the expansion history





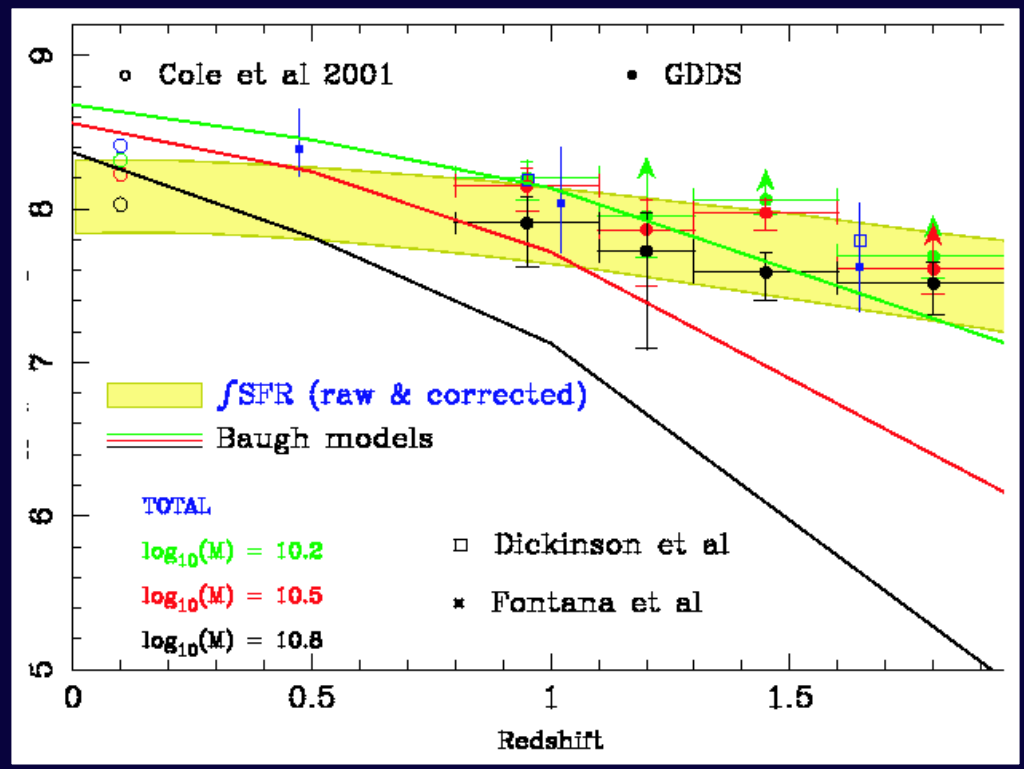
Narrow-field LGS AO, red-optimized spectroscopy, IFUs

The Assembly of Galaxies

The Galaxian Stellar Mass Function (z)

Star Formation and the Origin of the Hubble Sequence

Chemical Evolution at high redshifts



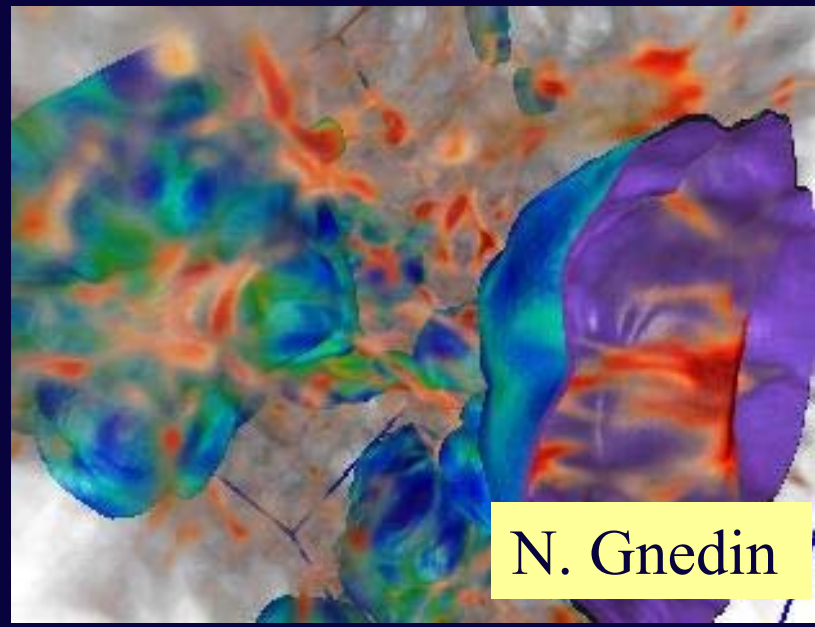
Wide-field MOS, Near-IR spectroscopy, AO imaging/IFU

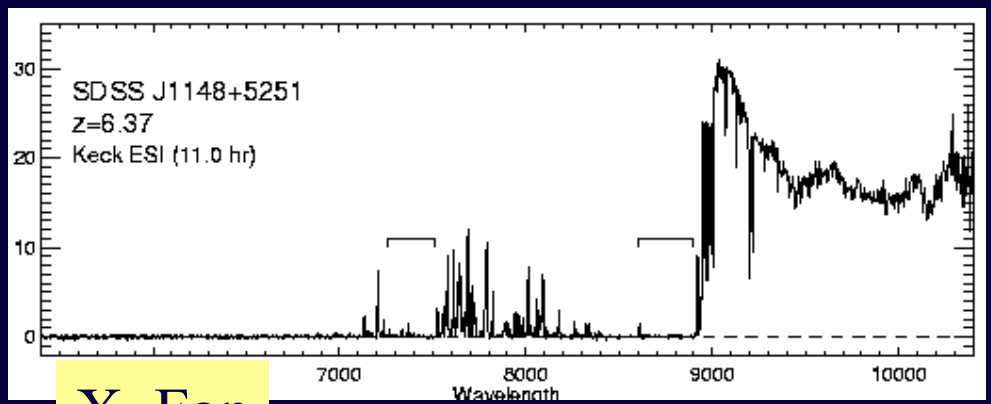
First Light and Reionization of the IGM

Reionization Topology

Global evolution of the IGM

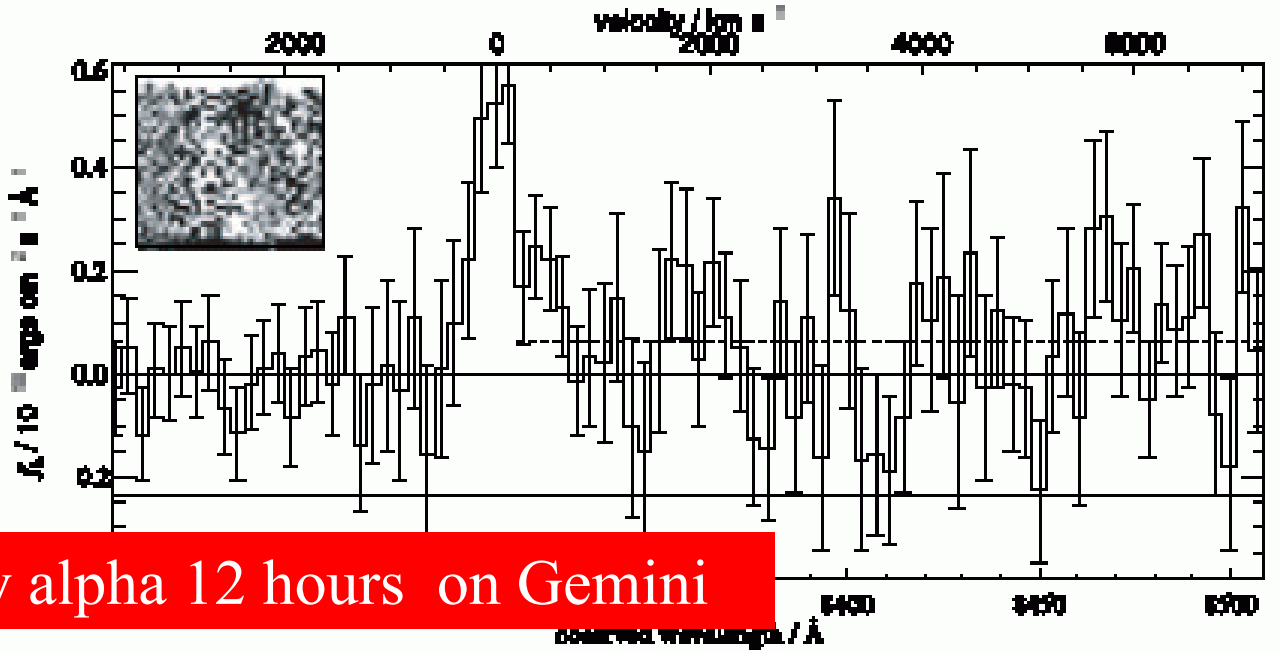
First Light



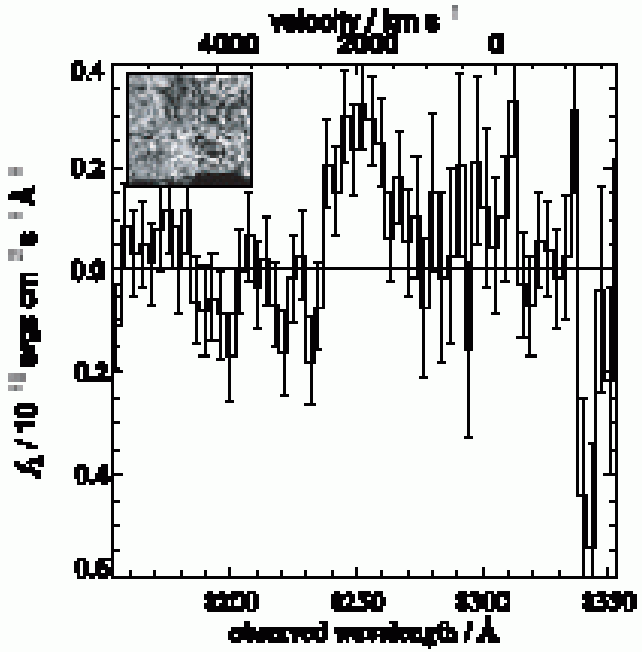


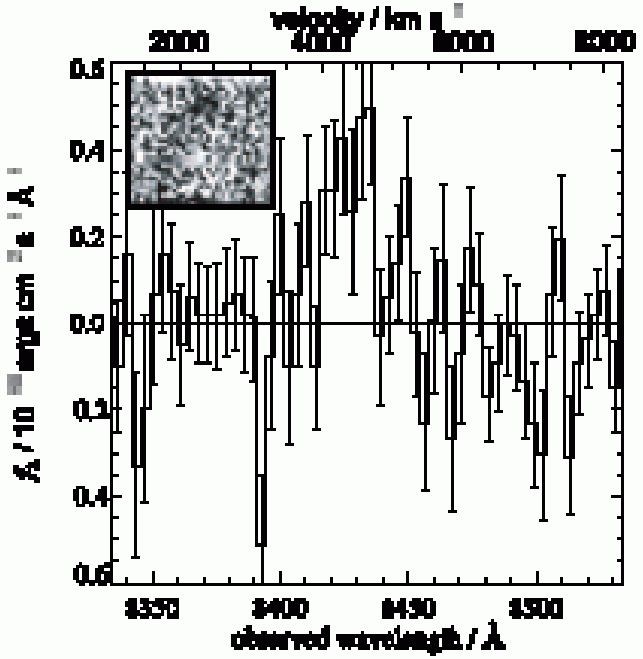
Far Red is Critical

Wide-field MOS, Near-IR spectroscopy, AO imaging/IFU



Z = 6 Ly alpha 12 hours on Gemini





Instrument Suite

Straight Gregorian Instruments:

Intermediate field optical MOS

near-IR Imaging MOS

*mid-IR imager & spectrometer**

Folded Port Instruments:

AO-fed near-IR imager w/IFU

single object/small field Echelle

AO Priorities

High Definition AO & Coronography

Exoplanets are the killer application: a factor of 2-3 in resolution could be all the difference. High dynamic range and tuned PSF suppression are key

Wide-Field Ground-Layer AO

Galaxy assembly & evolution, stellar populations, first light, IGM energetics

MCAO important but lower scientific priority

MOAO lowest AO priority, high technical risk

Operational Model

- Play to strengths of the telescope

  don't try to be all things to all people
  minimize costs - maximize impact

- Emphasis on large consortium-wide programs

- Time critical observations need accomodation: GRBs, transits, occultations, Sne, temporal monitoring

  --> *Impacts telescope architecture*

Heritage

Magellan 6.5m

GMT & Magellan

LBT 8.4m mirror

LBT mount