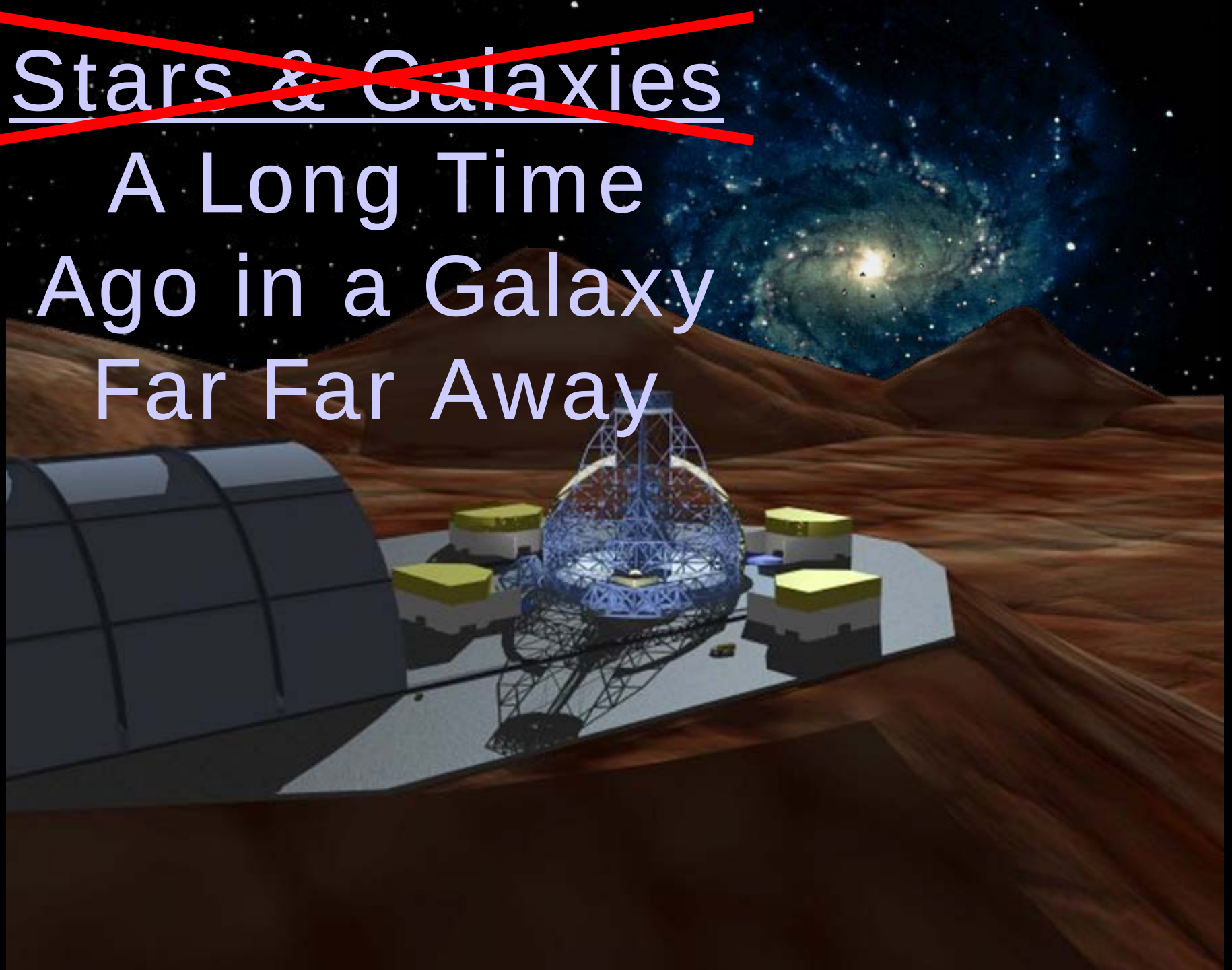

Stars & Galaxies
A Long Time
Ago in a Galaxy
Far Far Away

Where We Started

- No point in duplicating 30-metre science cases
- No point in doing incrementally better than a 30-metre telescope
- So where does a bigger telescope win?
  - For surveys, efficiency $\propto D^0$
  - For resolved sources, efficiency $\propto D$
  - For unresolved sources, efficiency $\propto D^2$

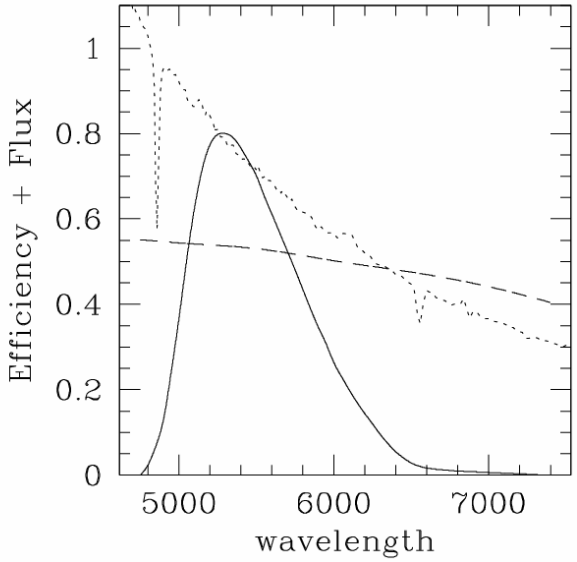
Stellar Populations Across the Universe

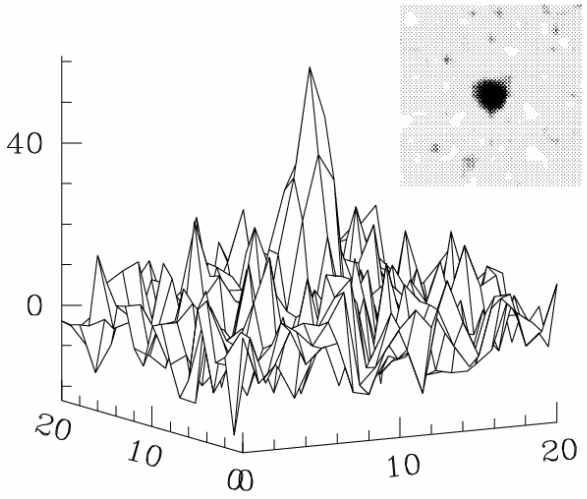
- When were stars formed?
  - — supernovae as a measure from $z=0$ to $z=10$
- Where are they now?
  - — resolved stellar populations of a representative sample of galaxies
  - — and in the other places that stars might be found

Distant Stellar Populations

- Significant ionizing flux only produced by most massive stars with $M > 40M_a$
  - — UV and Hα fluxes not robust indicators of star formation
- All stars more massive than $8M_a$ contribute to type II supernova rate
  - — SNe good indicators of star formation
  - — visible at all redshifts

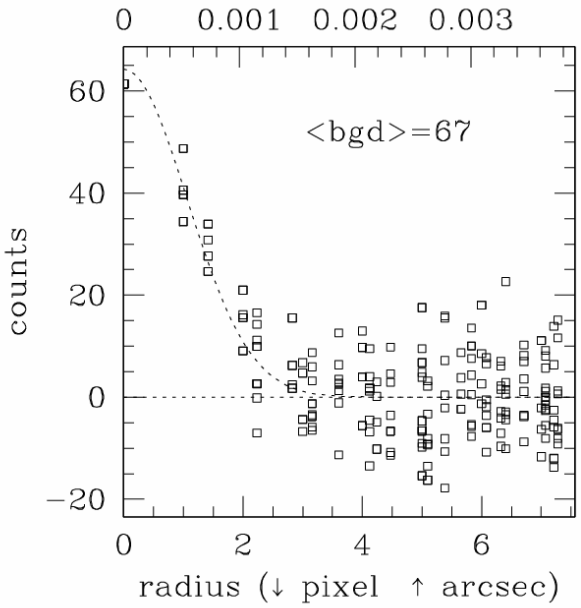
OWL + 0.52 mas pixel (F/60 camera)

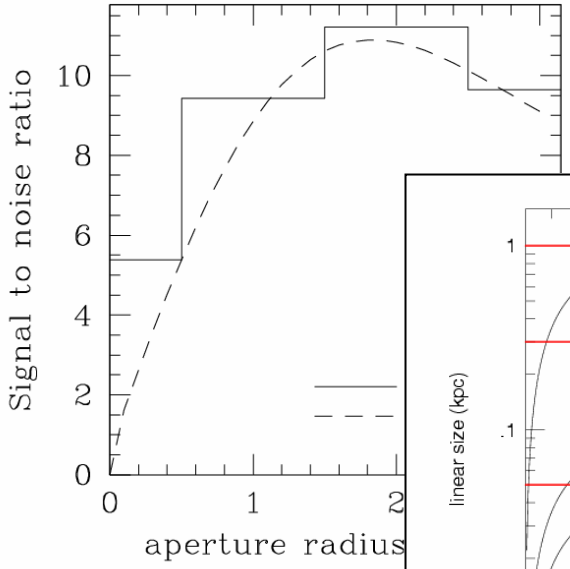


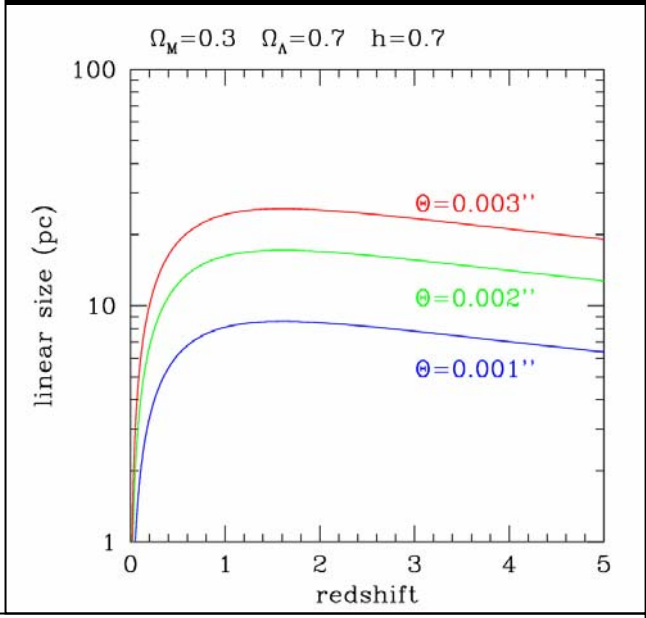


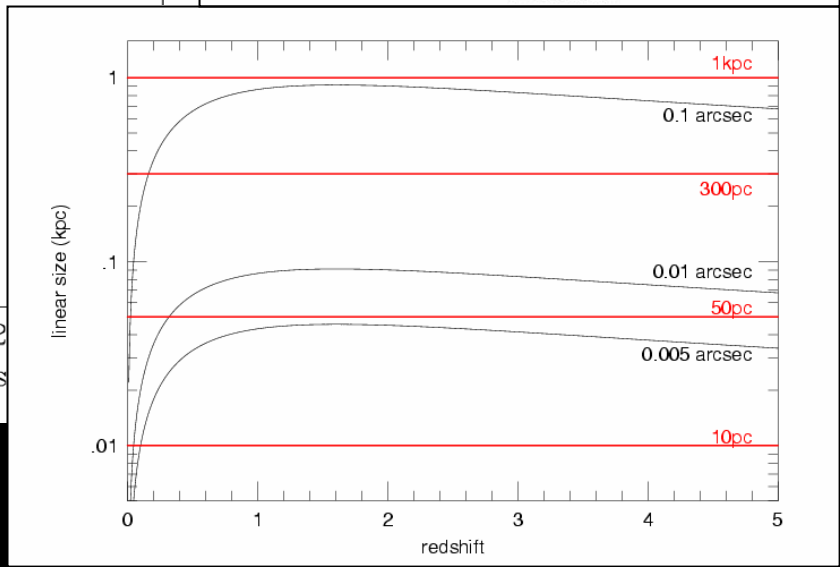
v=35 (A0V) Sky=21.5

PSF=1.3 mas $\Delta t = 1^h$









Results of the Simulations

We plan to image 50 fields in the J, H and K bands (1h each) at 4 different epochs (="SN search")

+ 3 epochs in the K band for the photometric follow-up (i.e. seven K photometric points for each SN)

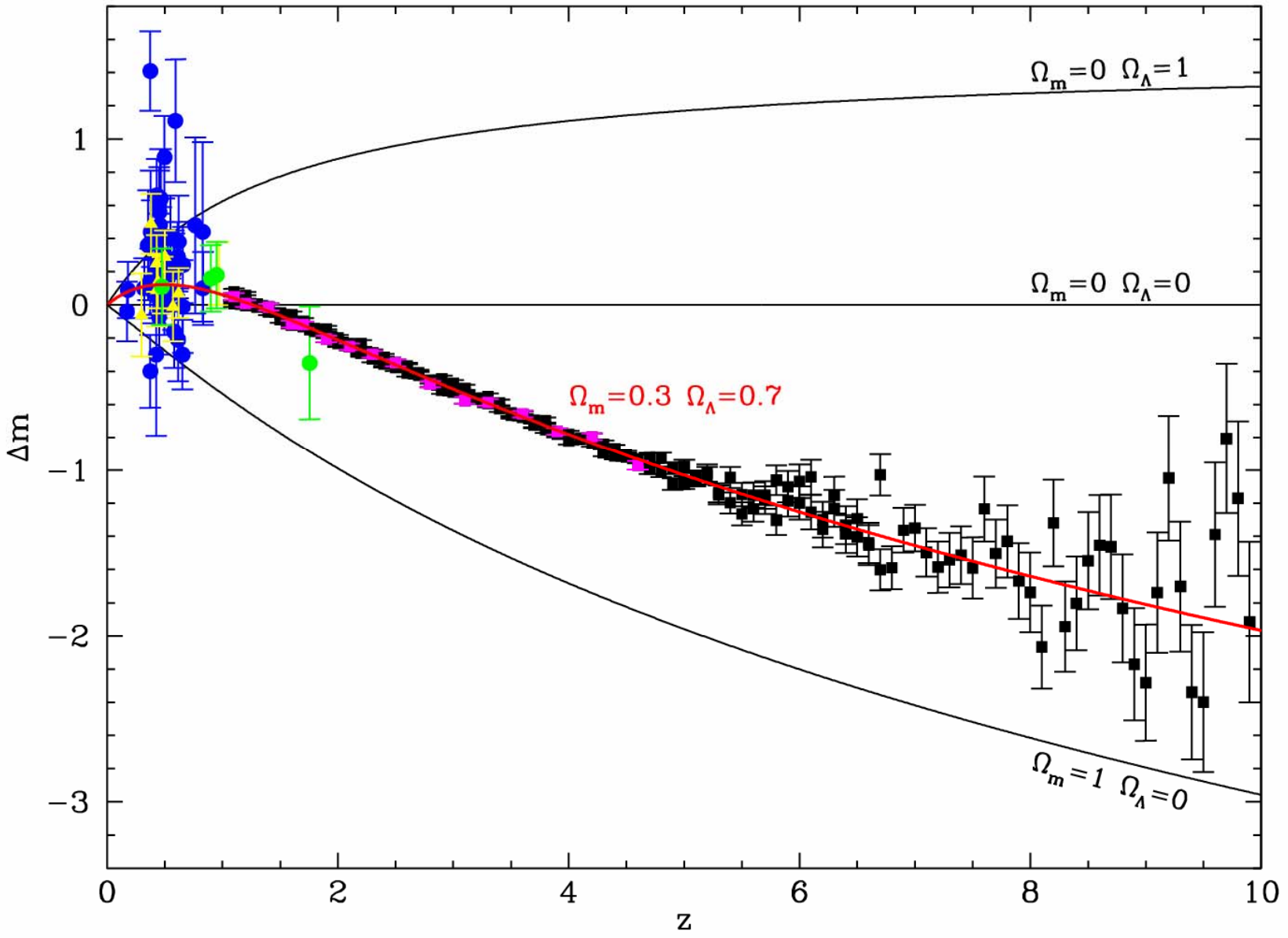
+ 4h for each SN (z< 4.5-5) to get the spectroscopic classification

Grand Total=600h (search)+150h(K follow-up)+200h(spectroscopy)=950h+10%

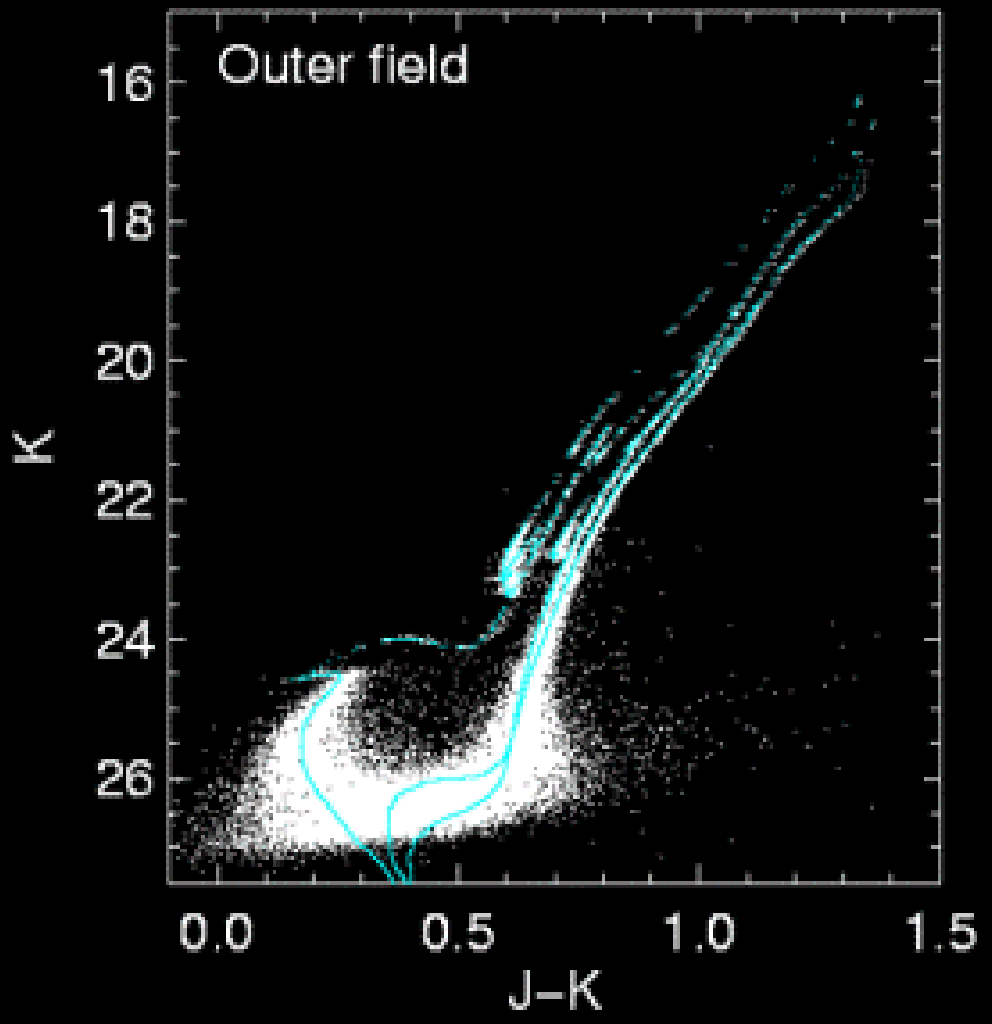
Results of the Simulations

1050h or 130 nights to study 400 SNe up to z=10

This is about twice the size of a current Treasury programme (450 orbits) and it is comparable with the UWFC, which is expected to discover about 500 SNe (at z<1.7) in about 6 months, or SNAP, about 2000 SNe in 2 yr (z<1.7).


Ω_m=0 Ω_Λ=1
Ω_m=0 Ω_Λ=0
Ω_m=0.3 Ω_Λ=0.7
Ω_m=1 Ω_Λ=0
Δm
z
1
0
−1
−2
−3
0
2
4
6
8
10

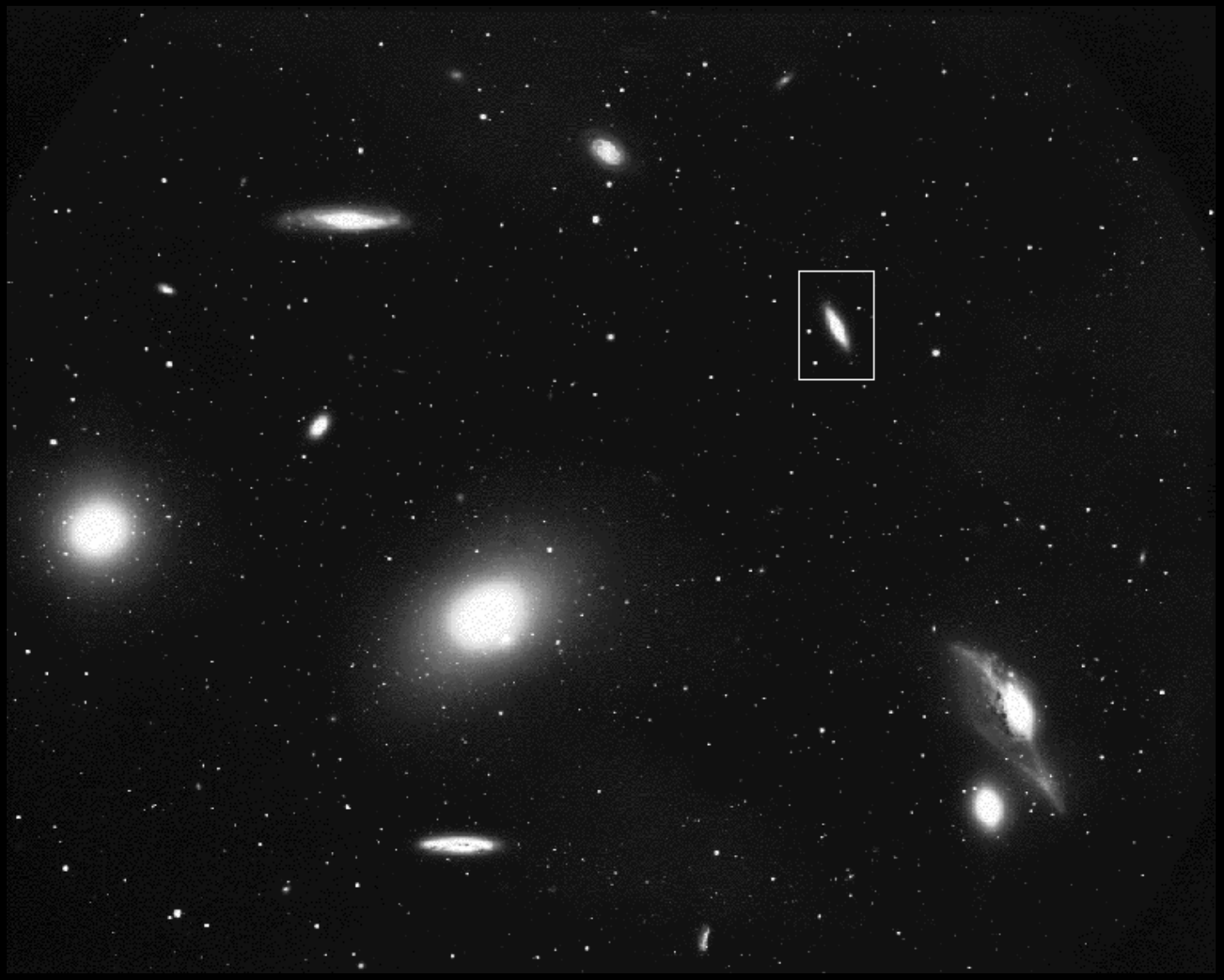
Nearby Stellar Populations



(from GSMT study)

- We can learn a lot about the formation and evolution of our nearby neighbours with a 30-m telescope
- What about a more representative slice of the Universe?
- Need to reach main sequence turn-off.

Visiting the Virgo Cluster

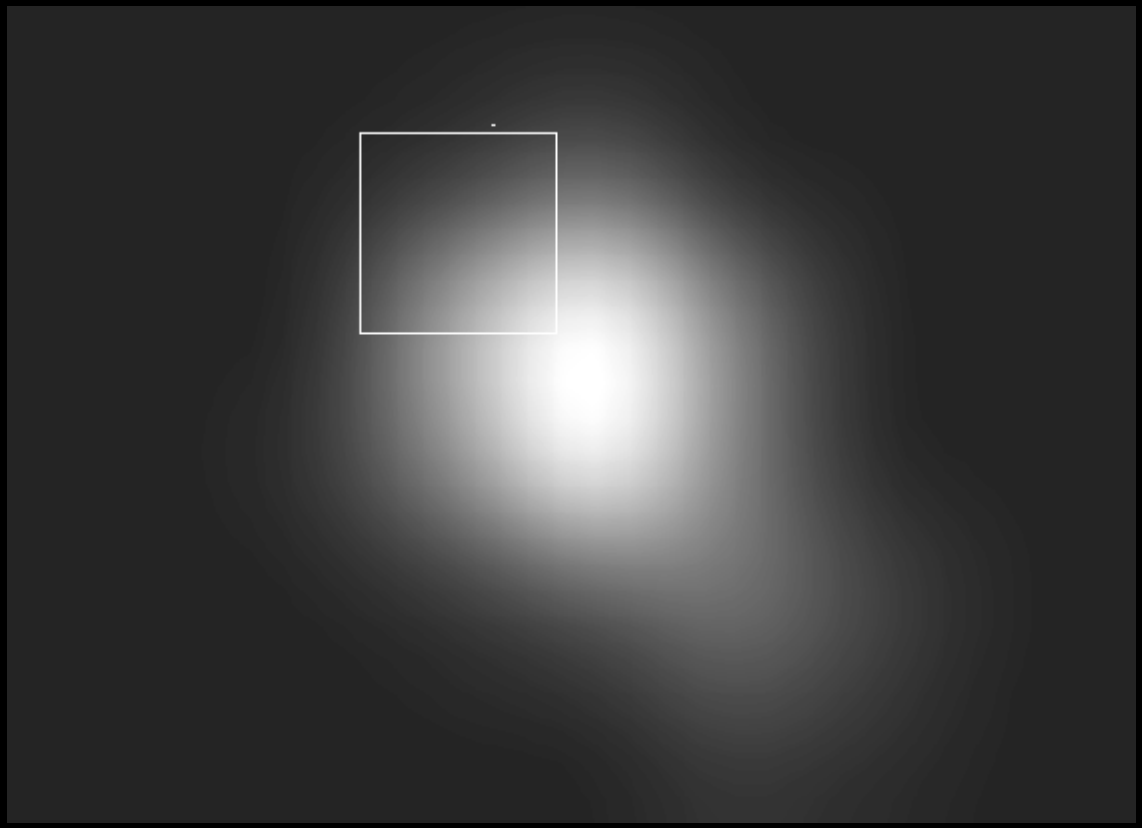


KPNO 4m, field 60’x45´, 20 Mpc

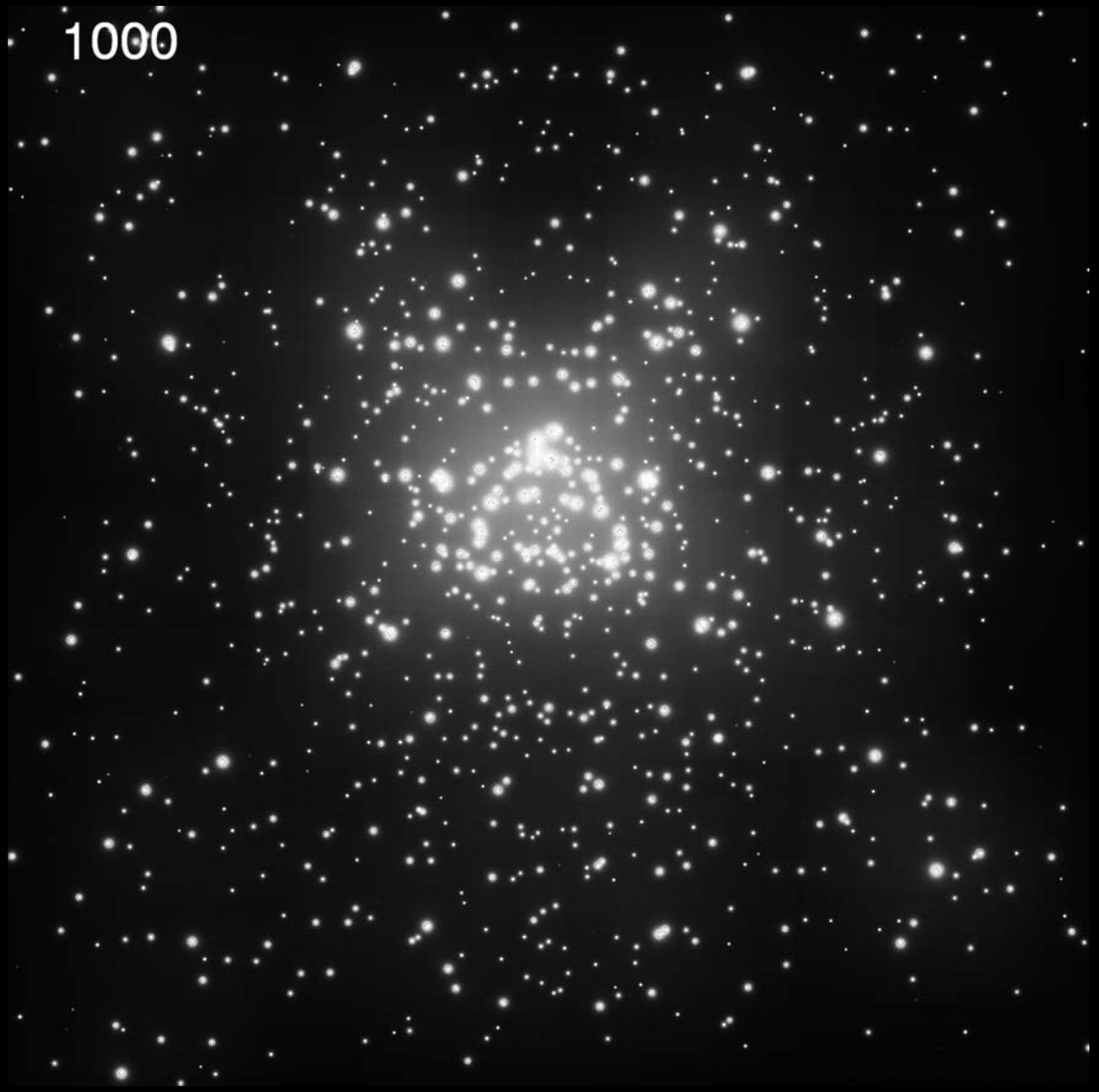
Visiting the Virgo Cluster

NGC 4425, KPNO 4m, field 6’x4´

Visiting the Virgo Cluster

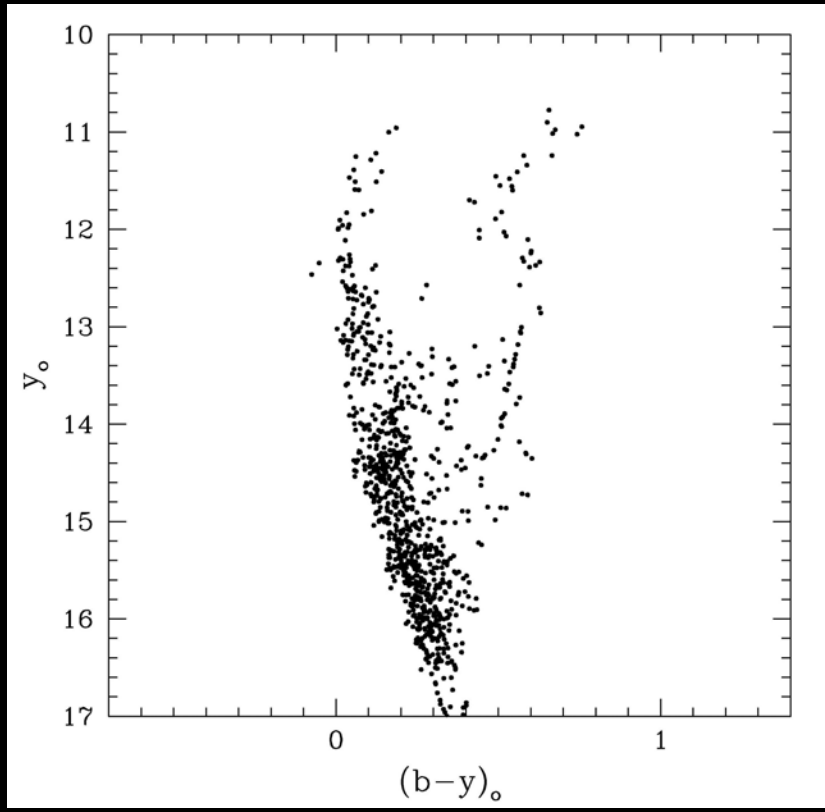


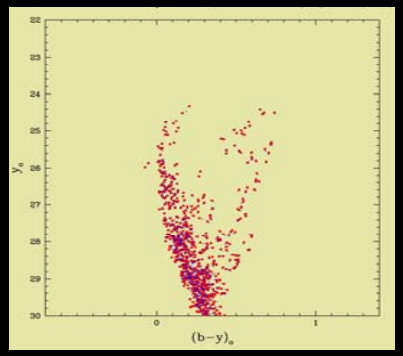
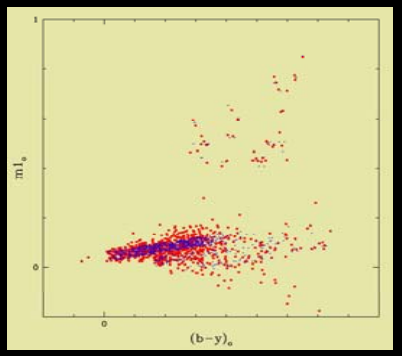
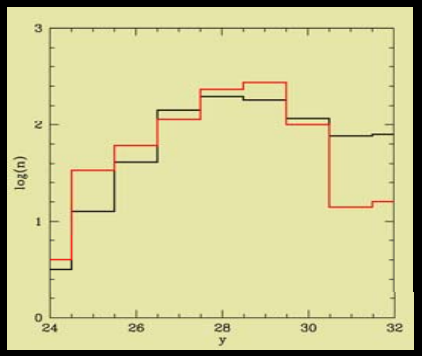
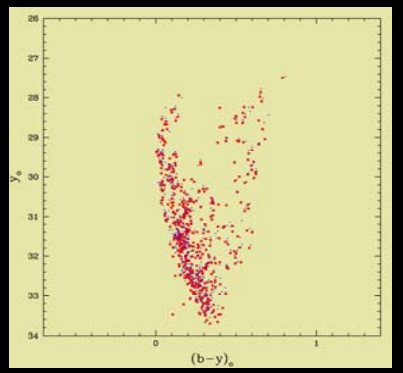
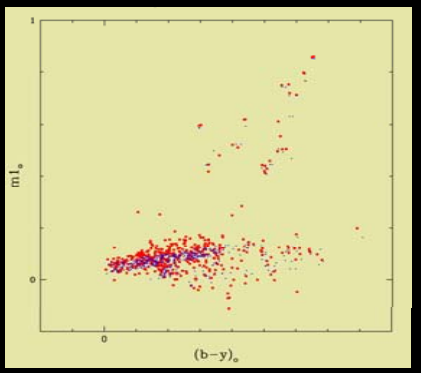
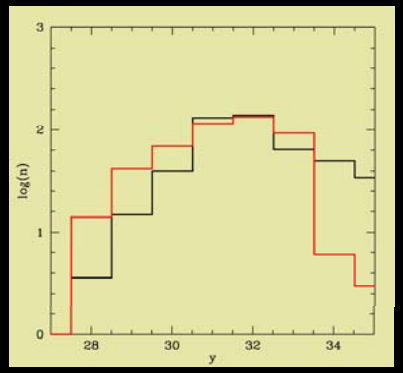
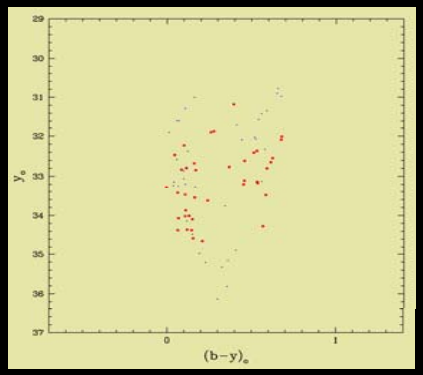
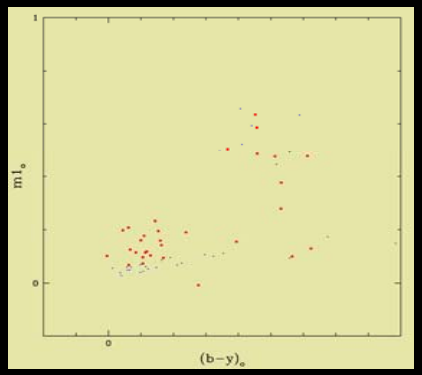
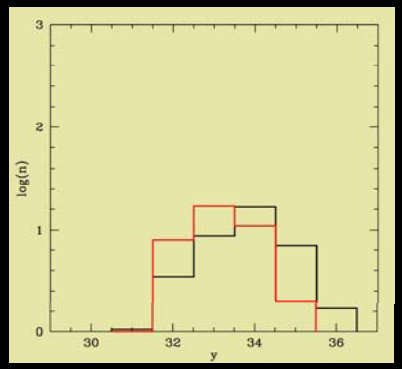
NGC 4425 dwarf, KPNO 4m, field 40”x25”


1000

Nearby Stellar Populations

- 50 Metre Telescope
- Strömgren vby images simulated
- Exposure: 200 000 sec / passband
- Strehl ratio: 0.7
- Circular aperture PSF
- 0”.003 arcsec resolution
- 0”.3 arcsec seeing limited PSF
- Image size: 2048x2048 pixels
- Image scale: 0."001 / pixel
- FOV: 2"x2"



	NGC6192	CMD	m_1	Luminosity function
	Image size: 2048X2048 pixels pixel size: 1 milliarcsec	Blue dots original data, red dots measured data	Blue dots original data, red dots measured data	Black curve background population, red curve cluster population
1 Mpc	 Exposure in y: 3 hours			
5 Mpc	 Exposure in y: 55 hours			
20 Mpc	 Exposure in y: 55 hours			

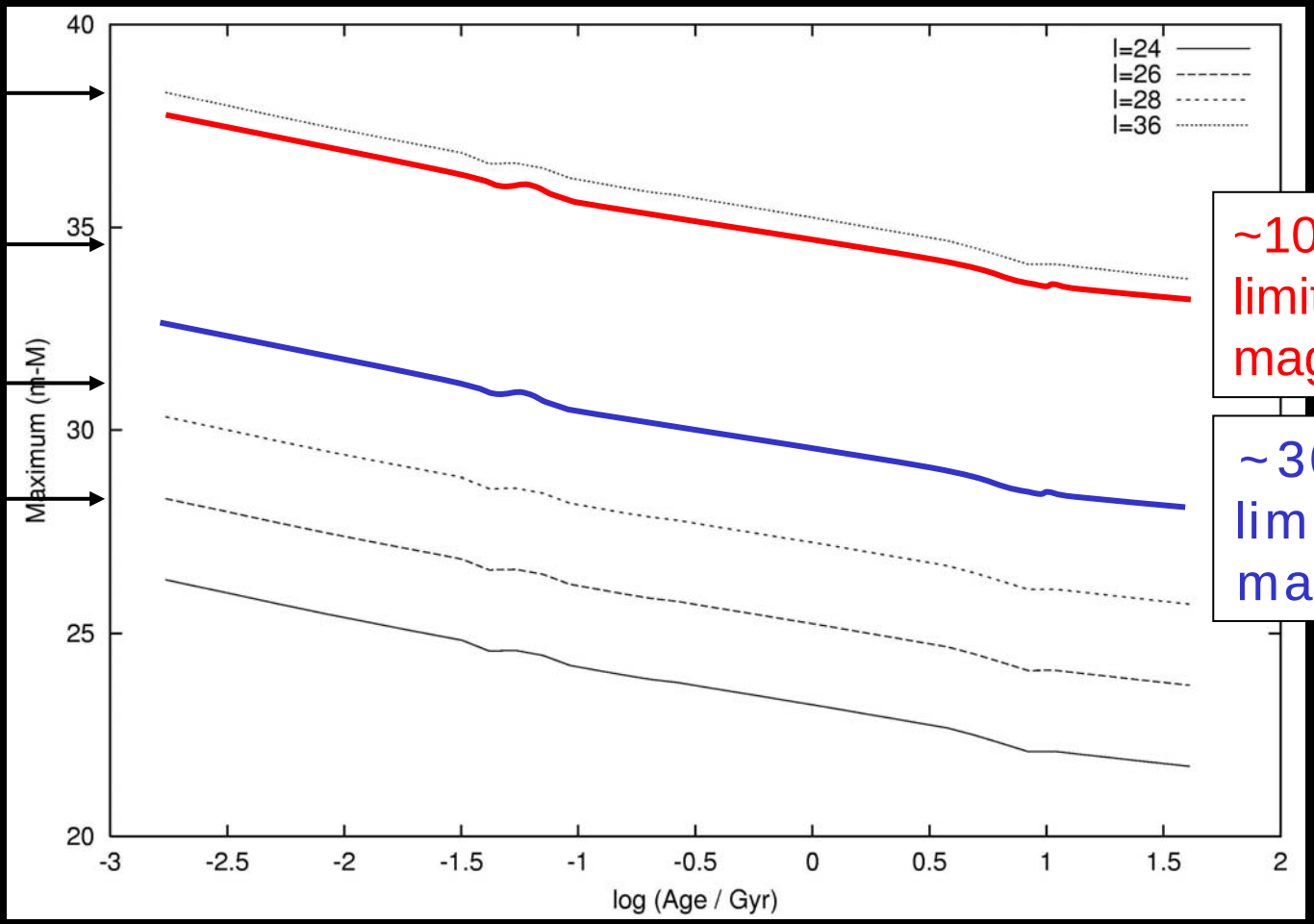
Nearby Stellar Populations

z ~ 0.1

Coma

Virgo

M82

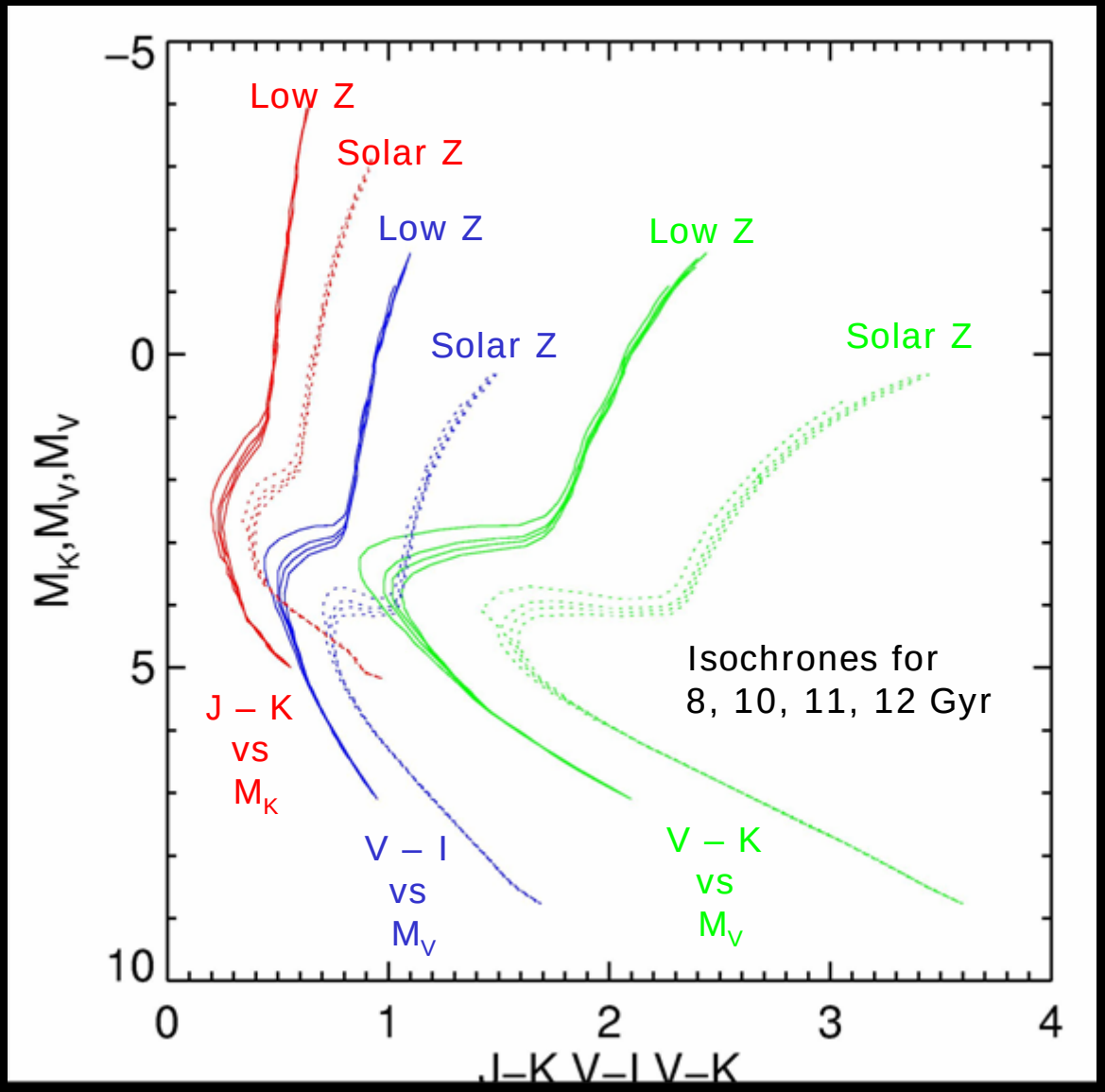


~100-metre limiting magnitude

~30-metre limiting magnitude

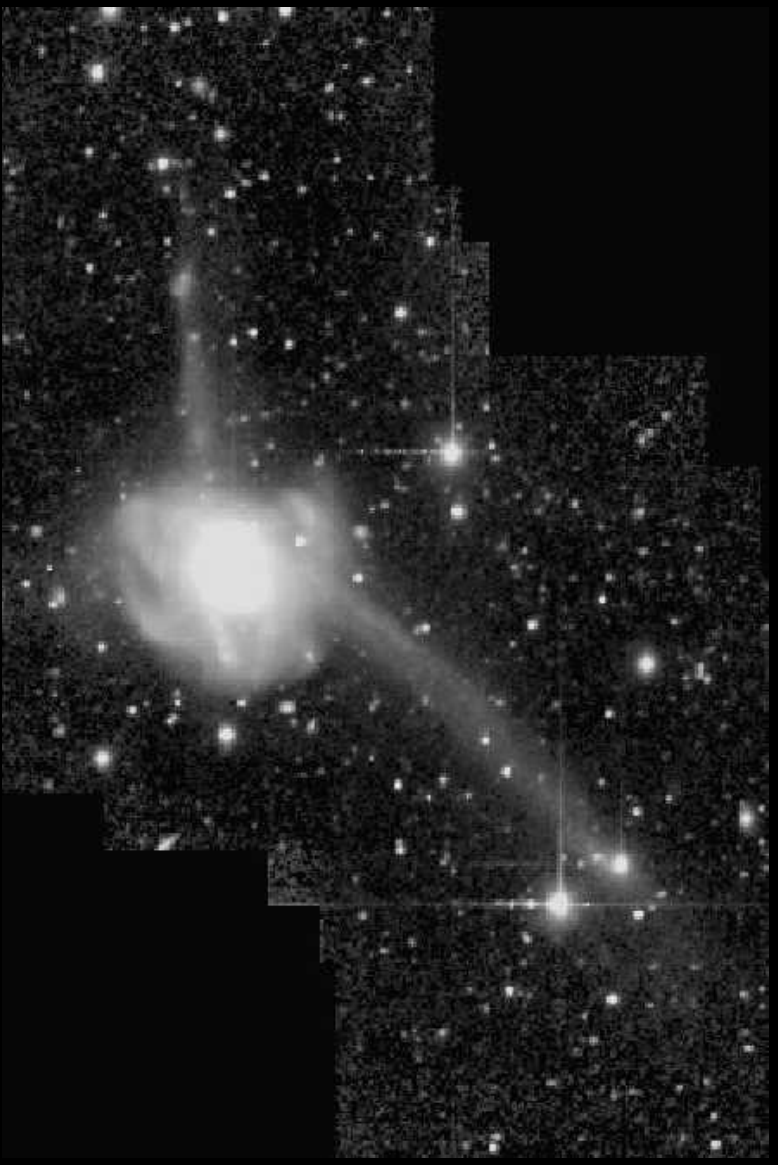
(from Frayn 2003)

Nearby Stellar Populations

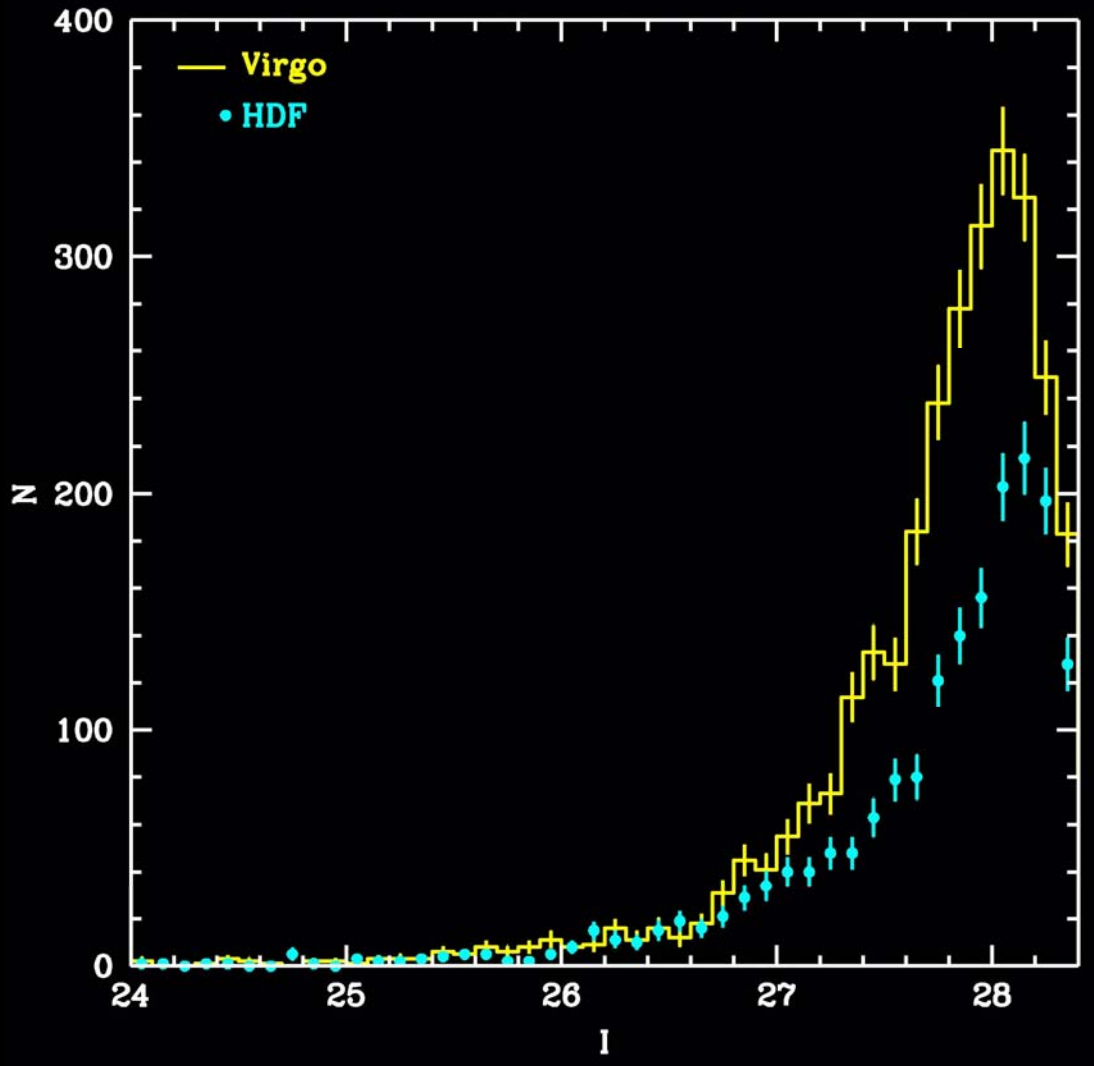


(from Rosie Wyse)

Nearby Stellar Populations



Hibbard & van Gorkom (1996)



Ferguson, Tanvir & von Hippel (1998)

The Next Steps

At this meeting, and in the coming weeks, we need to:

- Decide how to combine the existing work into a single high profile project ✓
- Figure out what calculations, simulations, etc, need to be made to make the case. ✓
- Carry out the calculations, simulations, etc. (✓)
- Figure out what our bottom line is for the lowest specification telescope that is worth building (optical? aperture?)
- Write the case.

Telescope Specifications

To carry out this programme, we require:

- A site from which Virgo or Fornax is visible
- Telescope diameter > 50 metres
- Operates at optical and near infrared wavelengths
- Diffraction limited down to optical wavelengths (*R* band?)
    - — over a relatively small field (1 arcminute?)
- A big CCD camera