Constraining the Stellar Birthrate and Mass Function using UKIDSS

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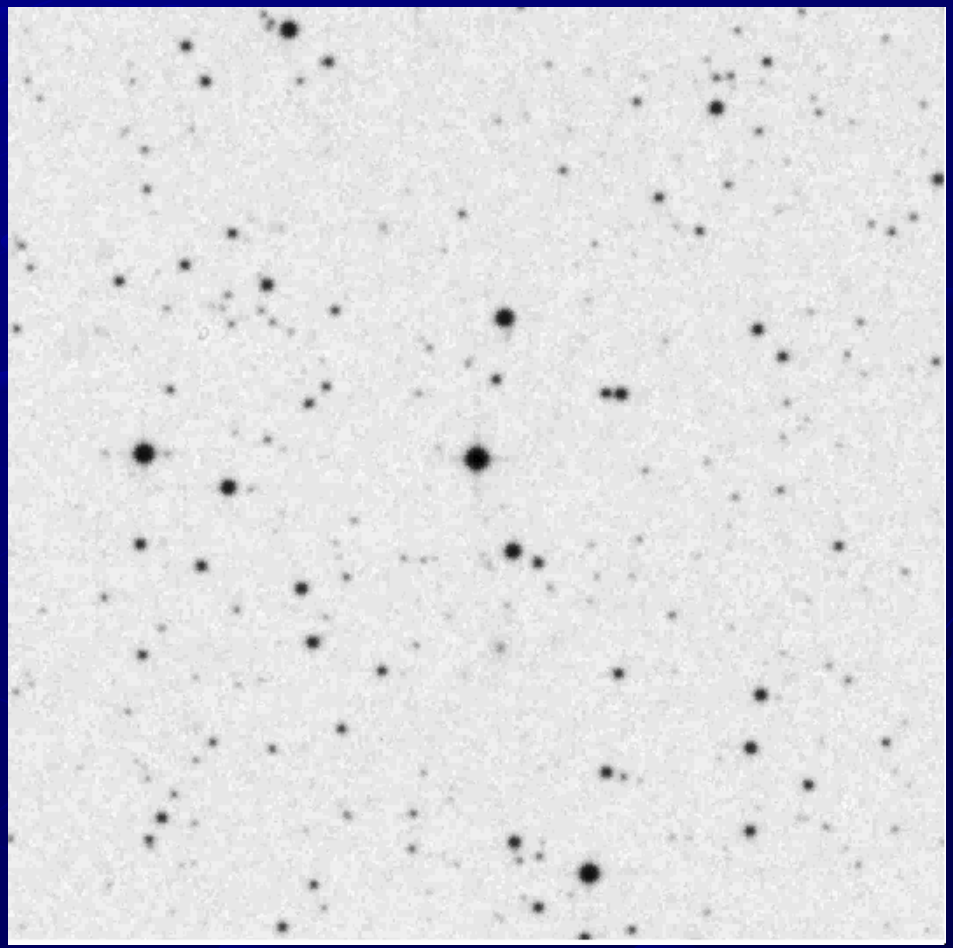
Cool Dwarfs

- M, L, T and Y? dwarfs
- Mass Function & Birthrate poorly constrained
- Interesting spectral properties
- Many being missed by current surveys
- UKIDSS LAS provides a solution

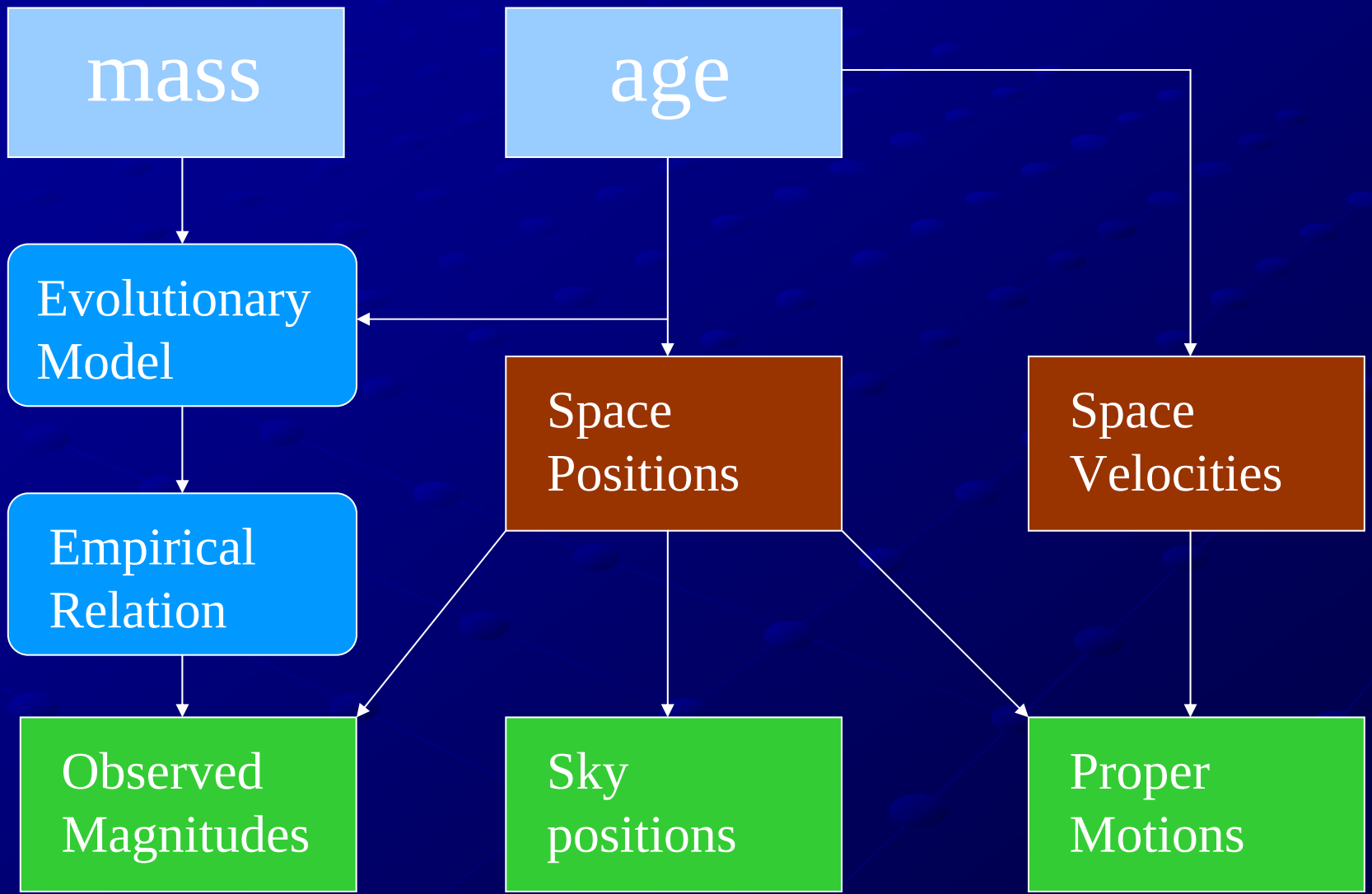


The Initial Mass Function & Birthrate

$$\xi(m) = \frac{dn}{d \log_{10} m} \propto m^{-\alpha} \qquad b(t) \propto e^{-t/\tau}$$

- Constrained to a 1.35 at intermediate masses
- Flattens off at lower masses and may even decline
- Birthrate found to be roughly constant or fluctuating

Simulation Method

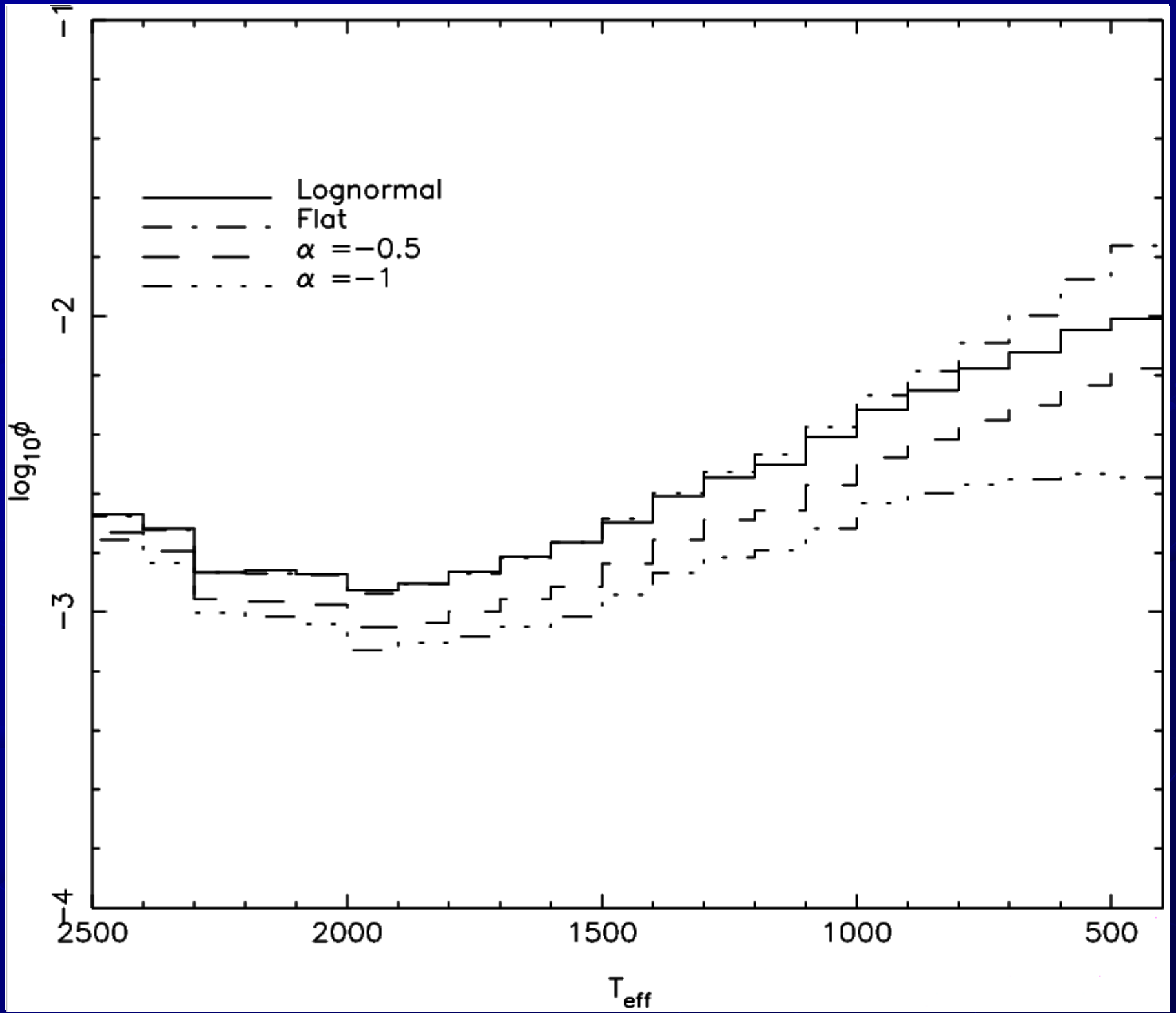


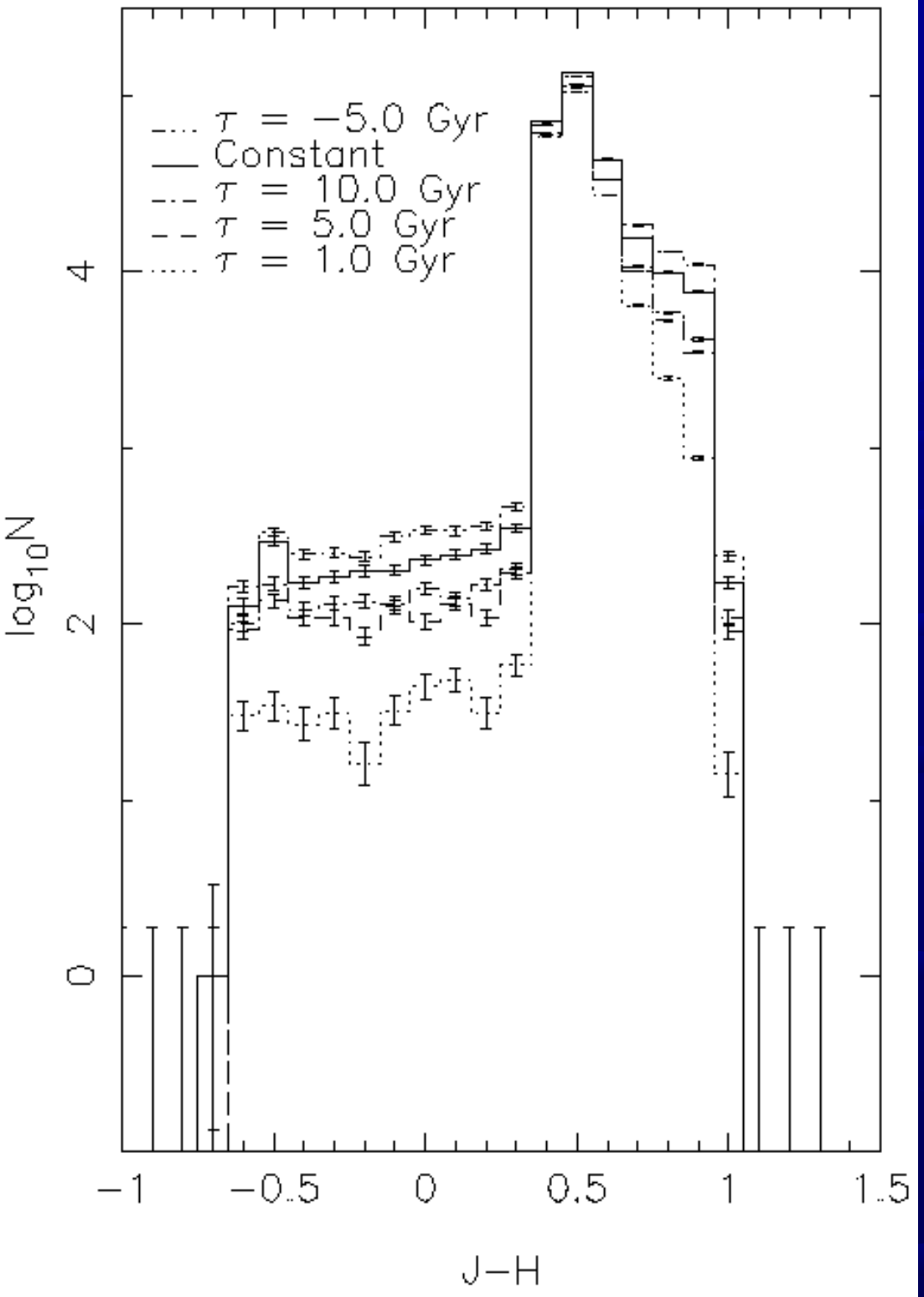
Photometric Simulations

- Models and observations not perfectly matched
- Use observational data (from Leggett) to produce empirical Luminosity-Temperature relations
- Combine these with a temperature calculated from the Baraffe COND models
- No observational data cooler than T8
- Forced to use models alone for Y dwarf colours

Astrometric Simulations

- Each object is given a random position in the Galactic Plane
- Its coordinate perpendicular to the Galactic Plane is drawn from an exponential distribution with a scale length dependent on the age
- Velocities are drawn from distributions dependent on the age


Lognormal
Flat
α =−0.5
α =−1
log10φ
−1
−2
−3
−4
2500
2000
1500
1000
500
Teff



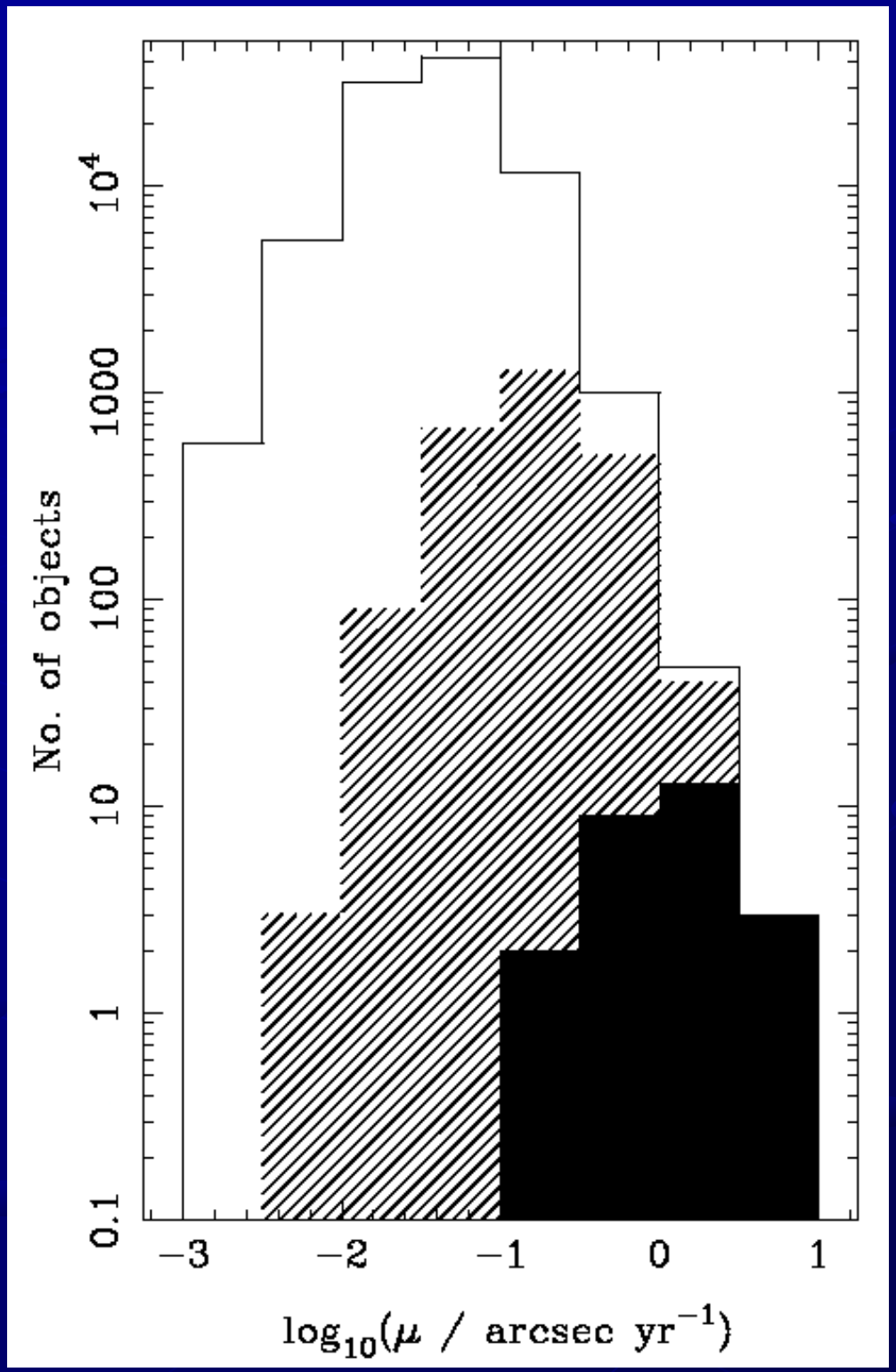
No of Y dwarfs

Constant Birthrate

a = -1	7
a = -0.5	35
a = 0	17
Lognormal	27

Lognormal IMF

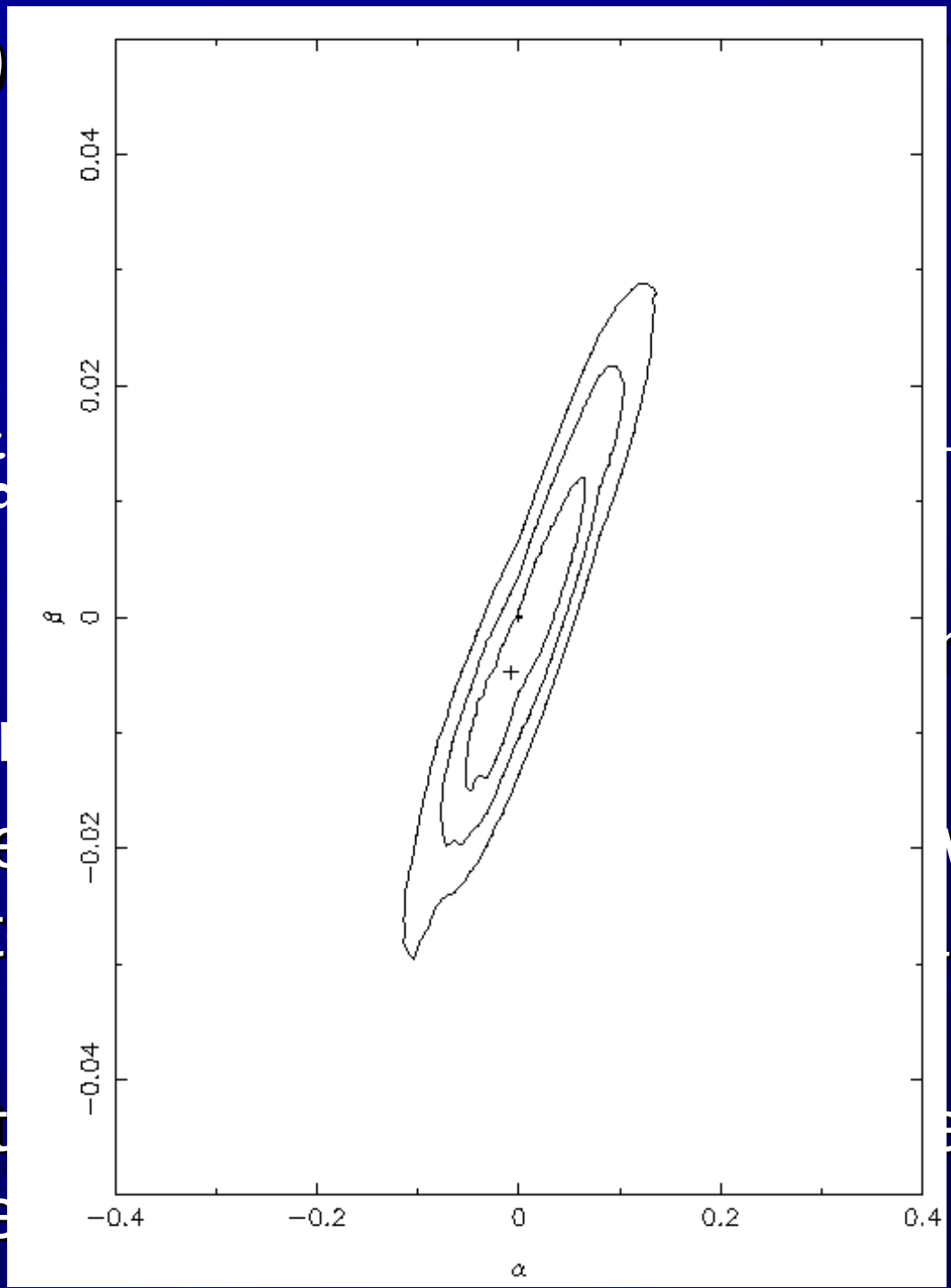
t=-20	20
Constant	27
t=20	16
t=10	19


No. of objects
0.1
1
10
100
1000
10^4
−3
−2
−1
0
1
$\log_{10}(\mu$ / arcsec $\mathrm{yr}^{-1})$

Co ing

ξ -βt

- Simulate nge of values fo
- Fit anothe w α and β using χ^2 t lues of α and β
- Use this t es of α and β in the fitte



Conclusions

- There will be significant numbers of cool dwarfs found in the UKIDSS LAS
- Tens of cool Y dwarfs should be found
- These could be used to constrain the IMF and Birthrate
- With further work constraints could be set on the (close) binarity