Ages of Young Stars: Bayesian Extinction Fitting & Taurus

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Overview

1) Introduction - Justifications, Taurus

2) Extinction fitting

3) Application to Taurus, age fitting, implications

Introduction

- Why are we interested?
  - Stellar ages give us timescales
  - Disk lifetime, planet formation, YSO lifetimes
  - Star formation rates, masses

Wide-Field Data

- Wide-field surveys offer easy access to consistent cluster photometry
- Isochronal age/mass straightforward to determine
- Need to account for extinction

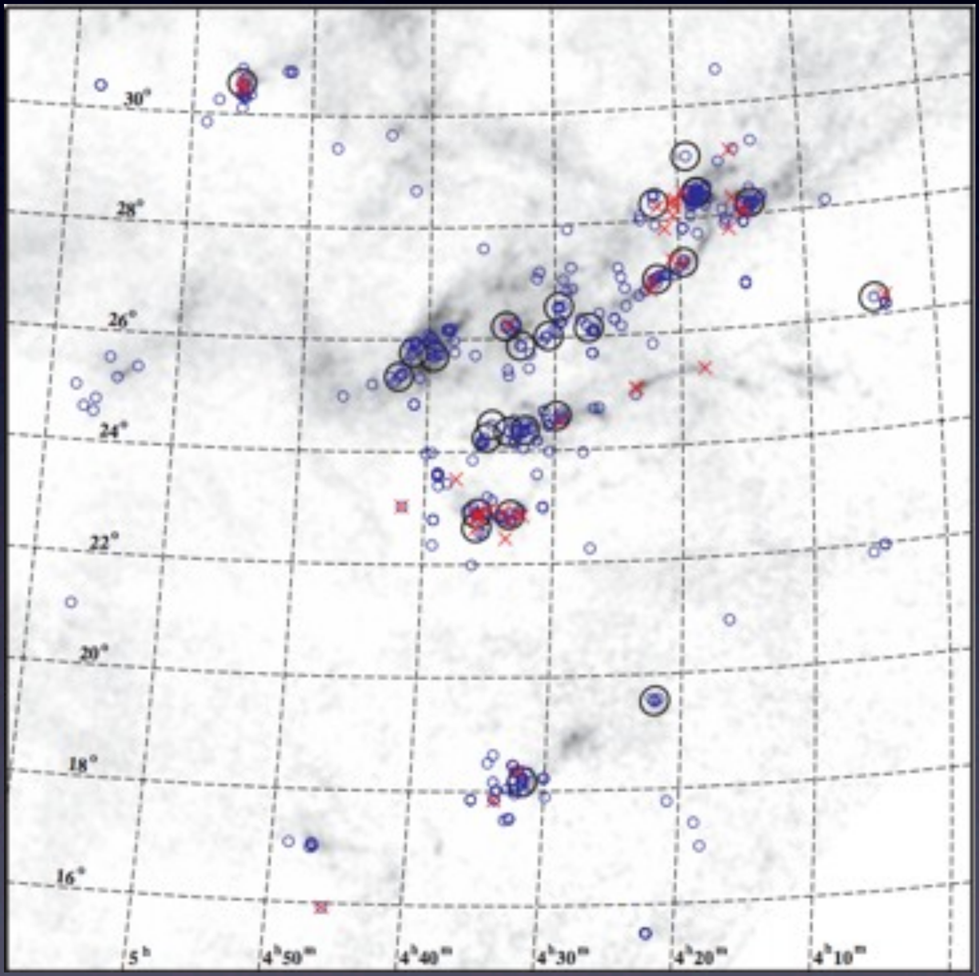
Taurus

- Young, nearby star forming region
- Age estimates range, usually 1-2Myr
- Large area: >200 square degrees
- Disk fraction: ~70%

Credit:NOAO/AURA/NSF

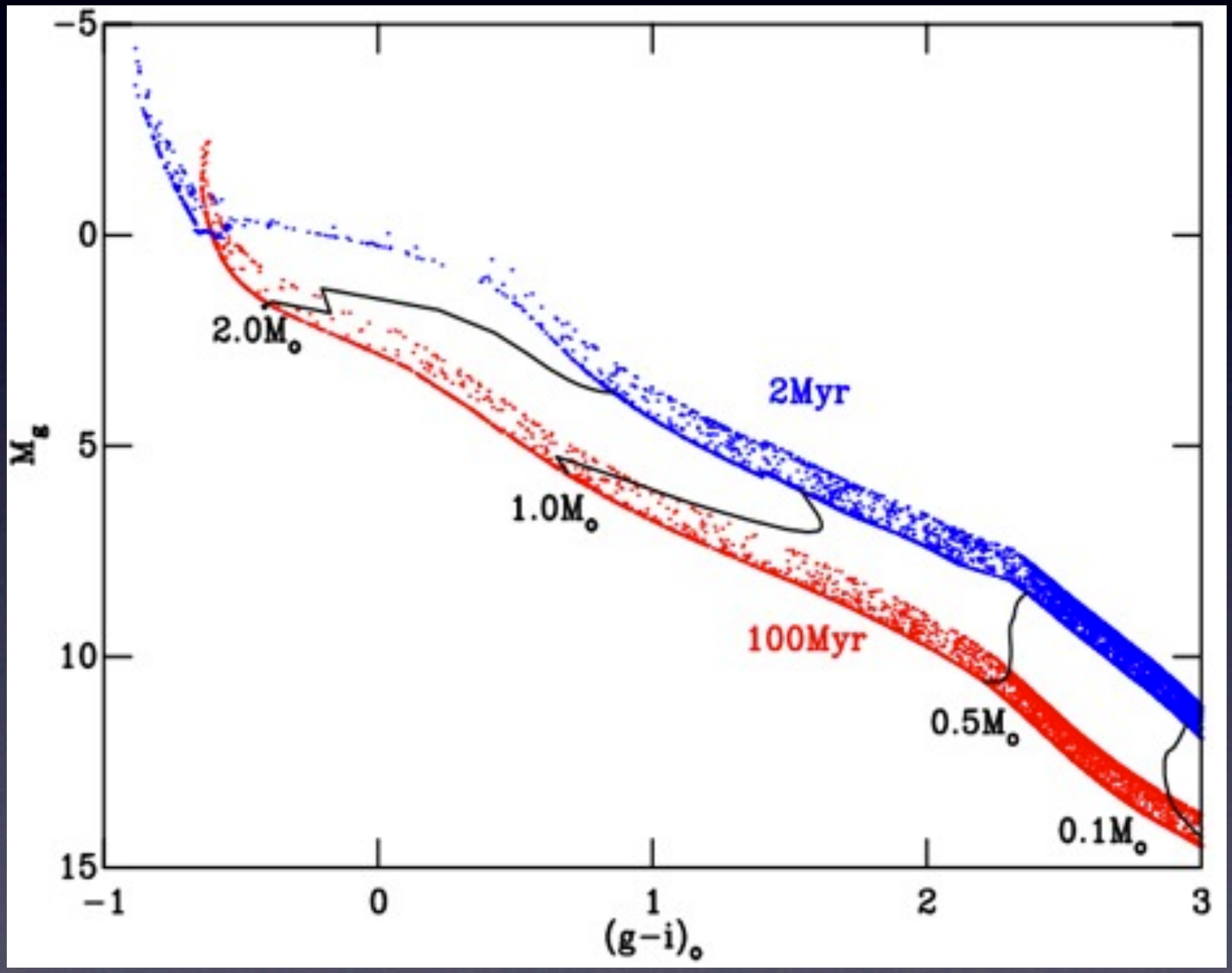
Taurus

- Taurus partly covered by SDSS
- Also have INT data
- High levels of differential extinction



Luhman et al. (2009)

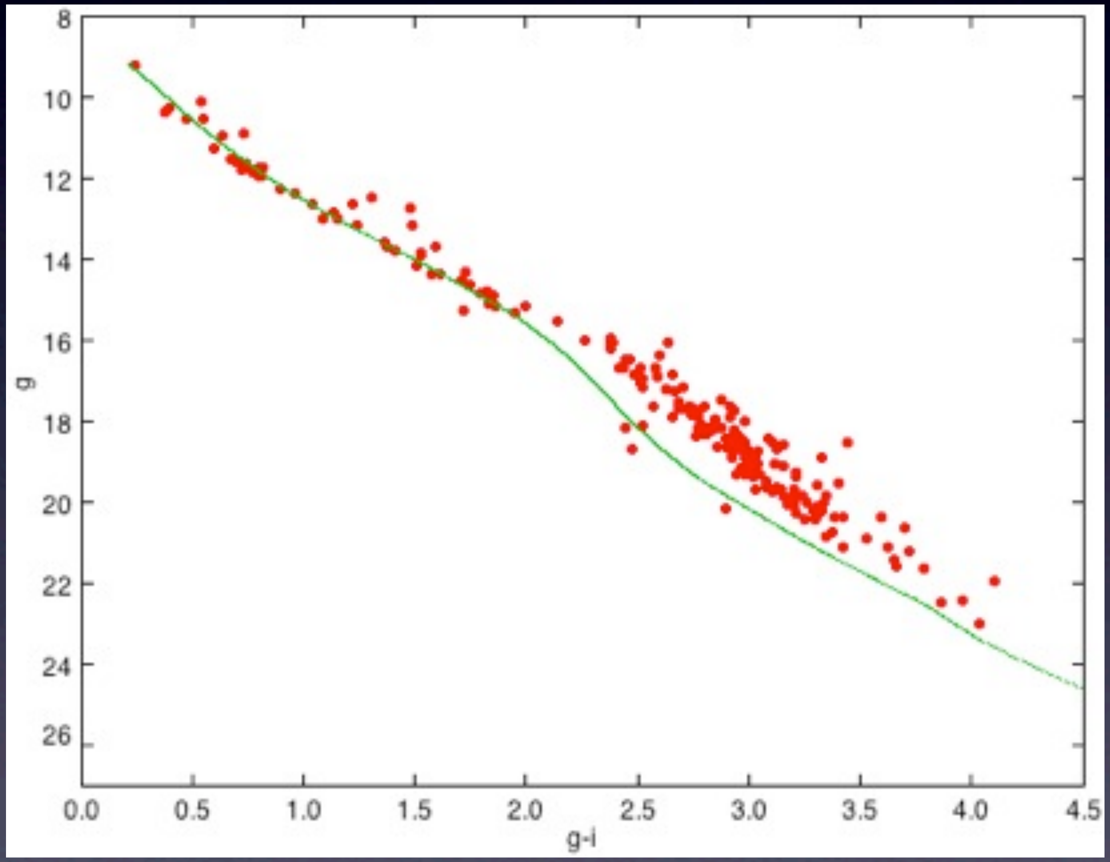
Semi-empirical Models



Soderblom et al. (2013)

Semi-empirical Models

- Baraffe et al. (1998) and Dotter et al. (2008)
- Use semi-empirical T_{eff}-Colour relationships
- Interior models unchanged
- New age scale defined in Bell et al. (2013)



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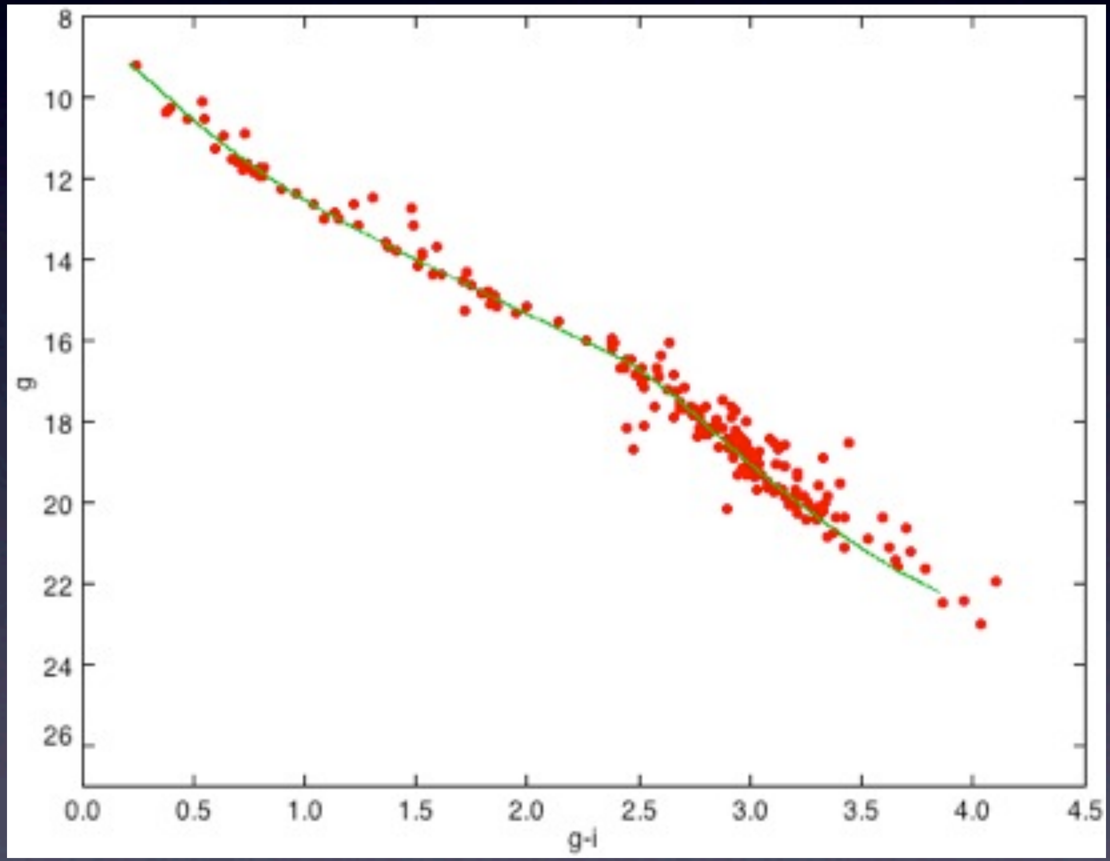

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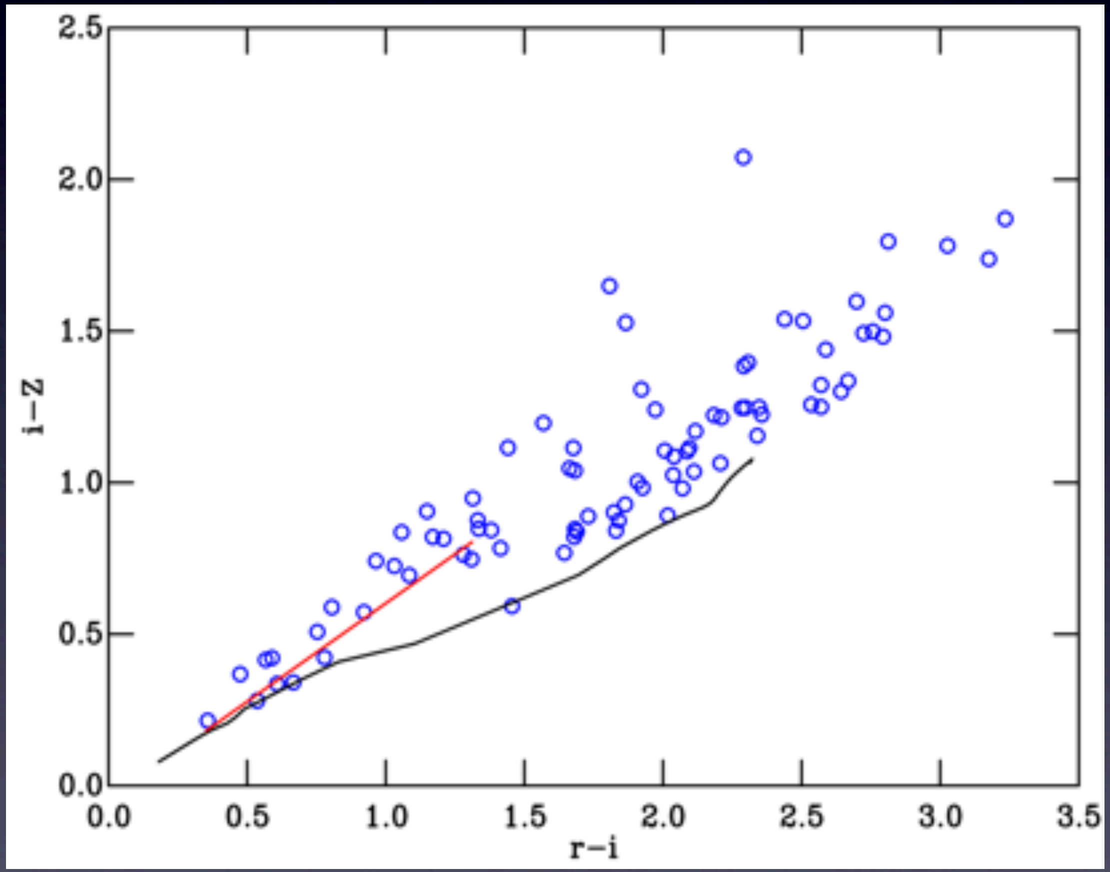
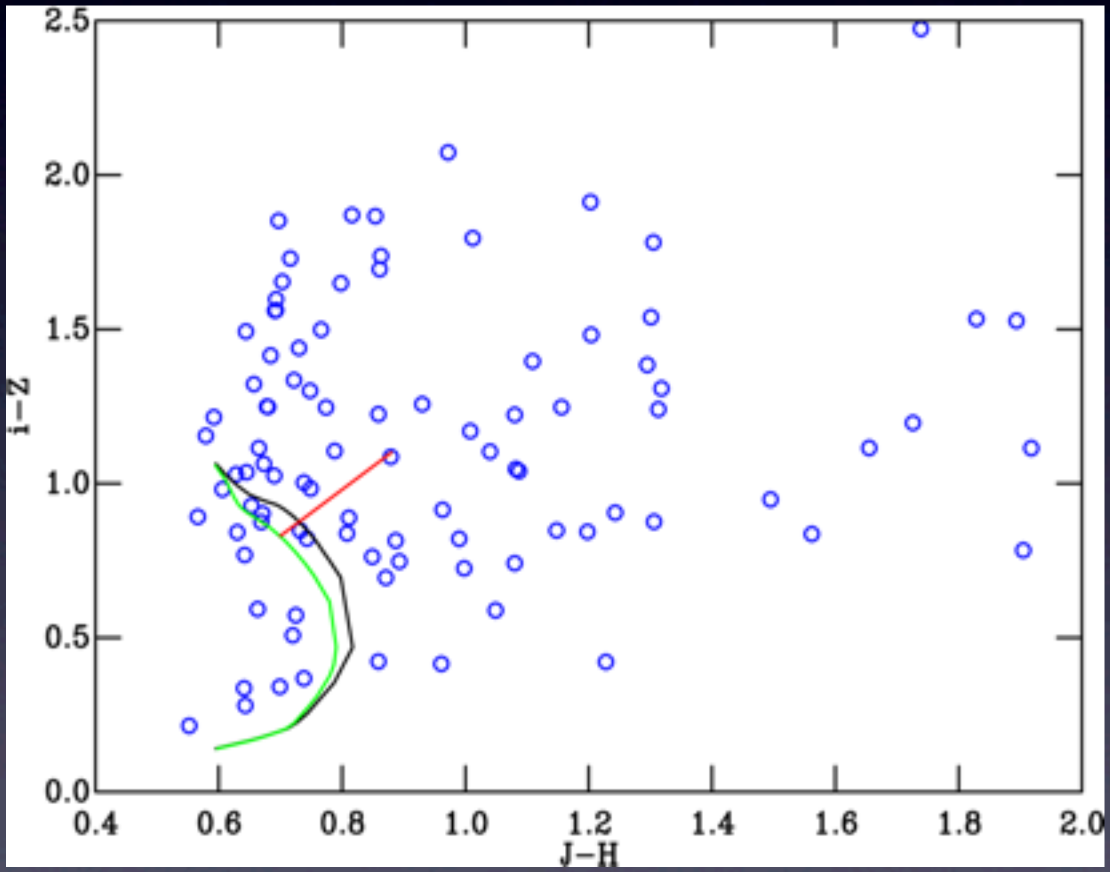
Dereddening

- Reddening vectors usually parallel to sequence
- Colours are degenerate - unable to deredden photometrically



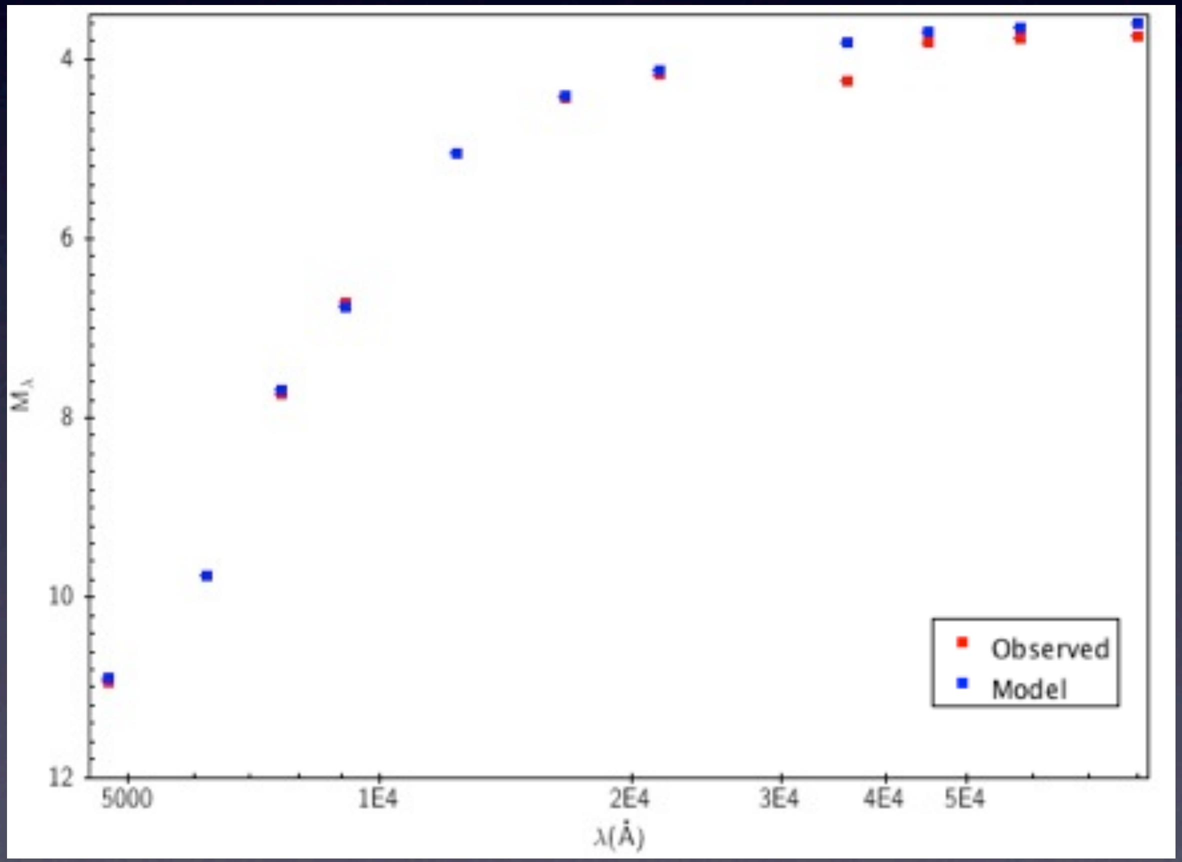
Dereddening

- In *i-Z*, *J-H* CCD degeneracy is broken due to water opacity
- Effects of discs minimised
- Reddening vector perpendicular to sequence



A Bayesian Approach

- Grid of models over range of age, binary mass ratio
- Choose A_V, use Fitzpatrick(1999) law to convert to A_λ
- Limit to iZJH filters if dealing with discs



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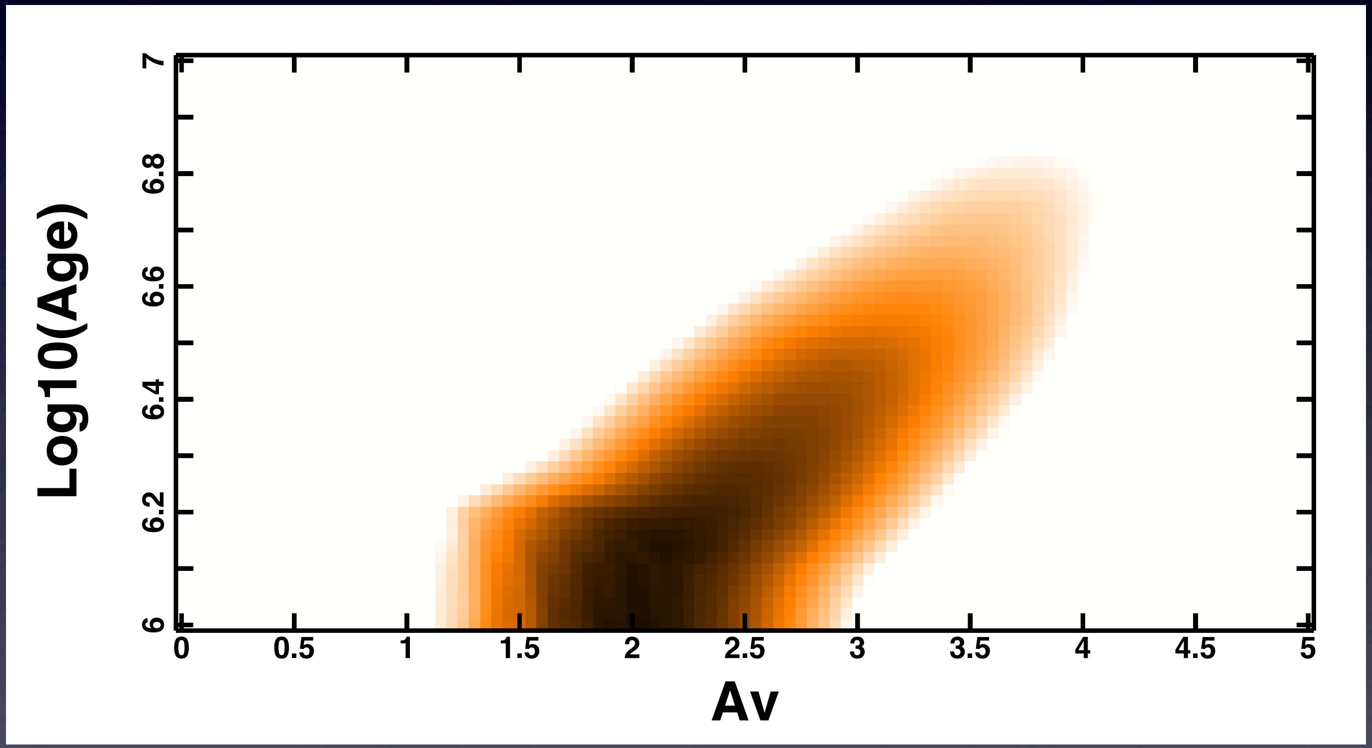

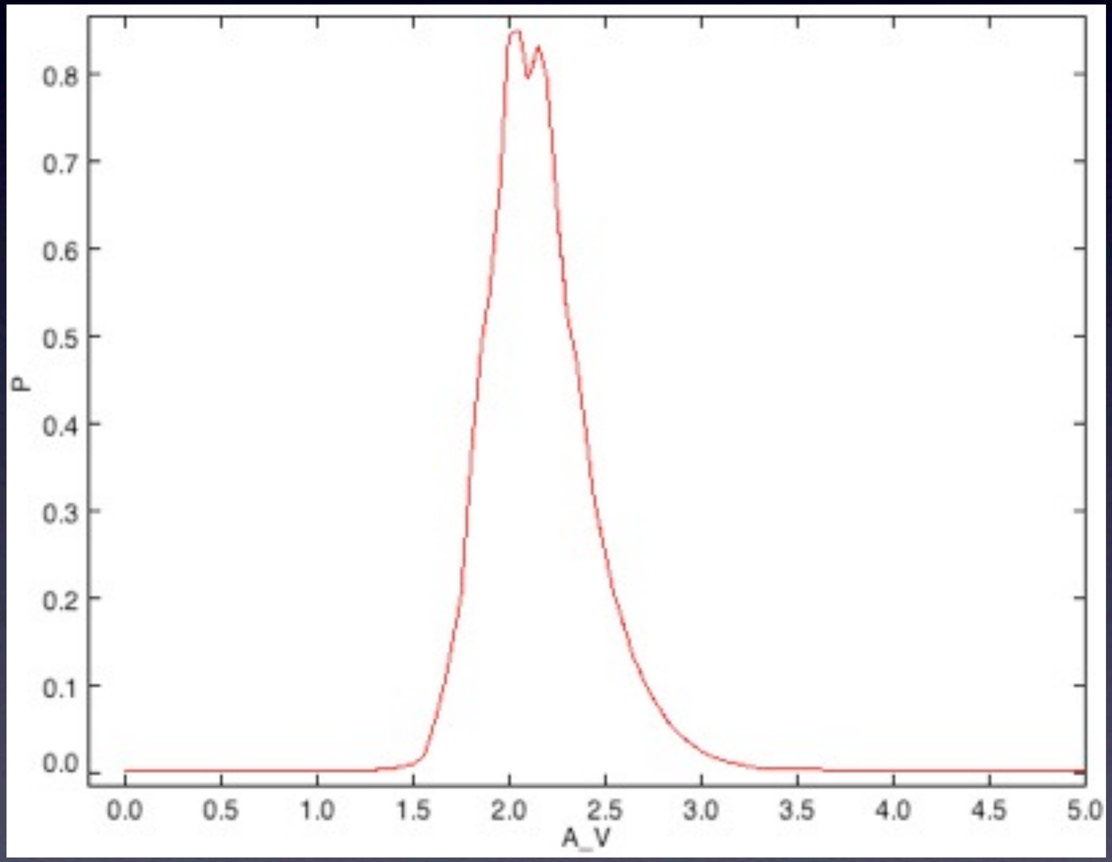

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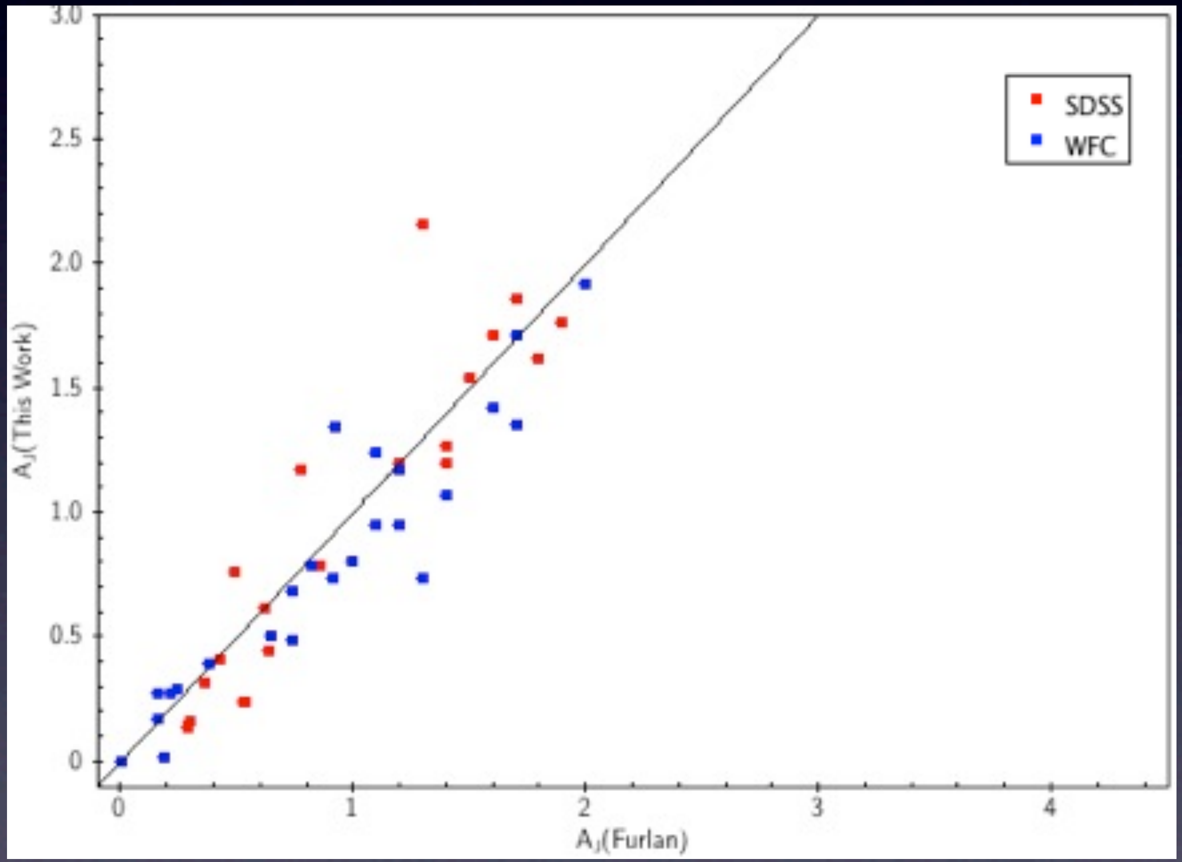

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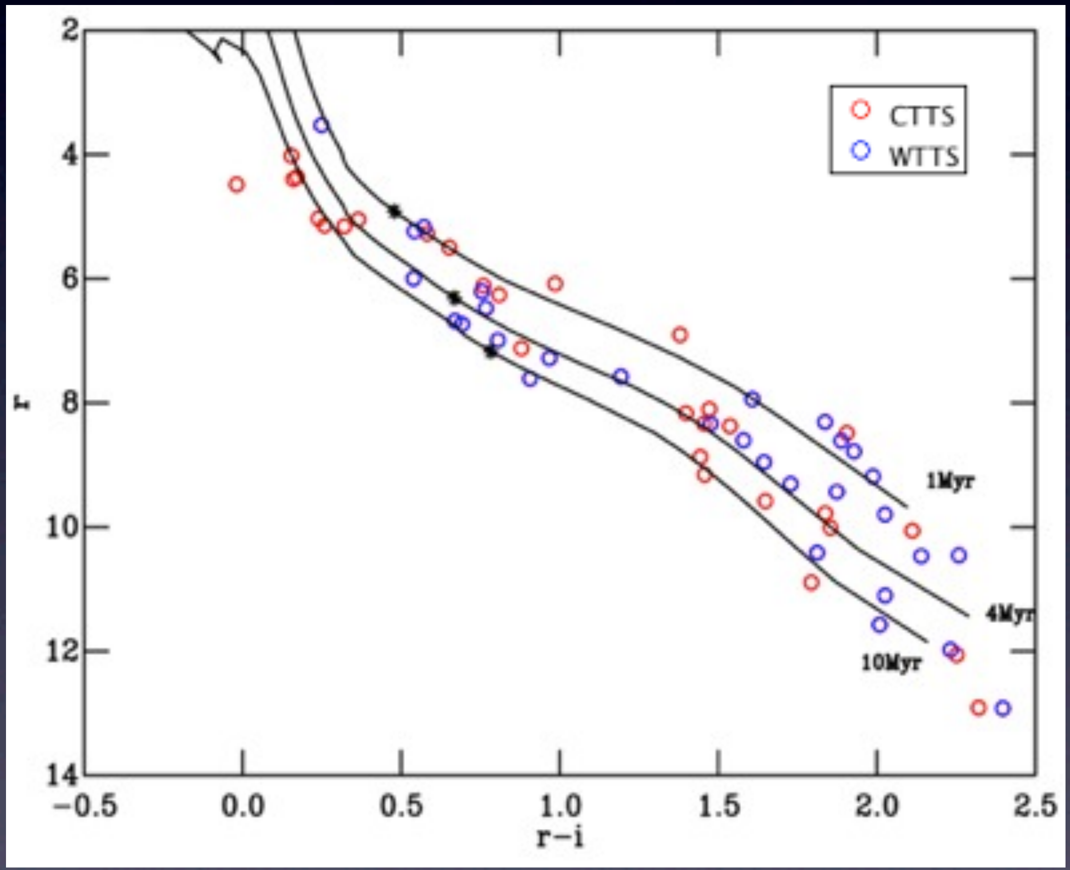
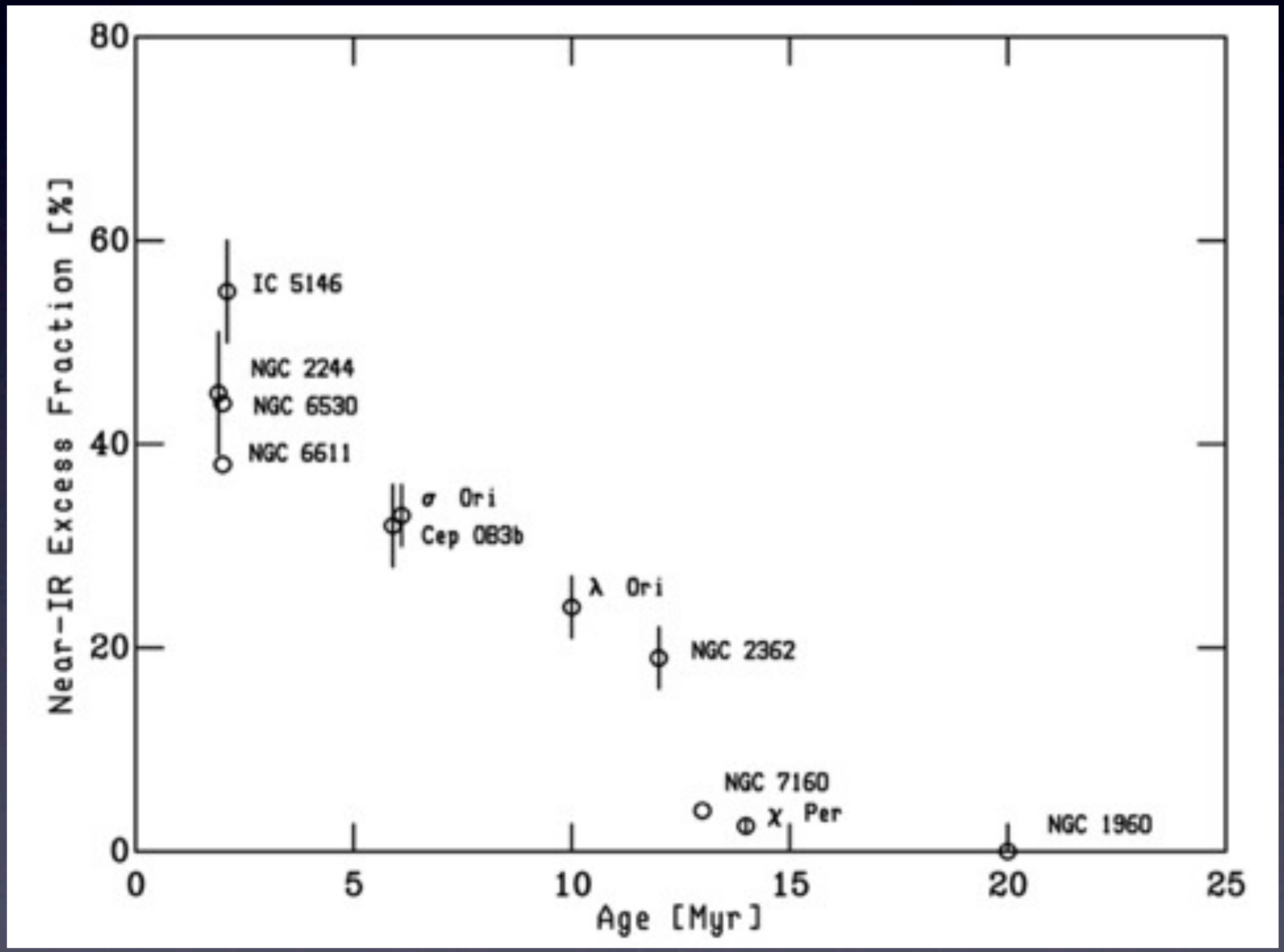
Age of Taurus



Implications - Disc Fraction



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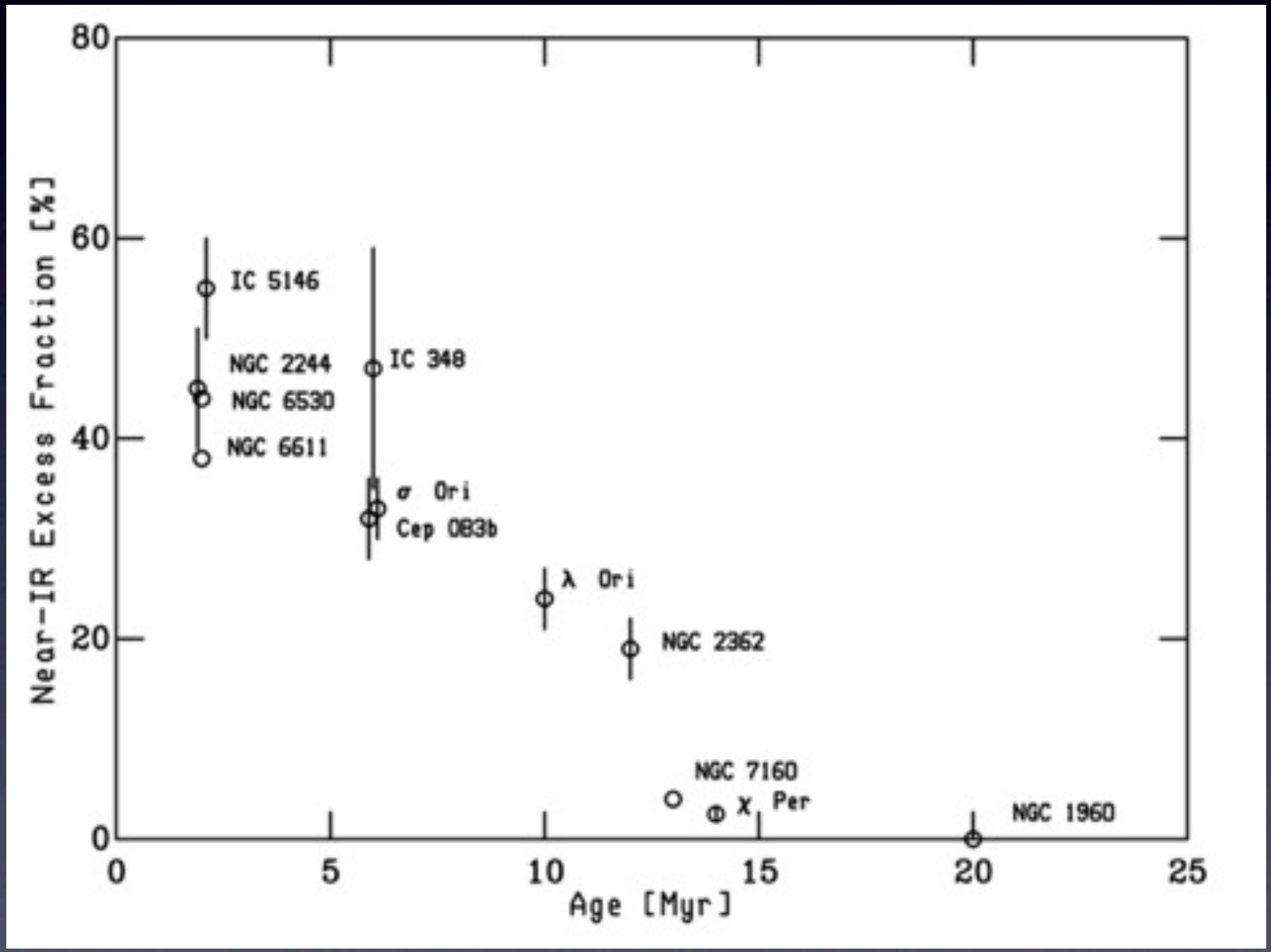

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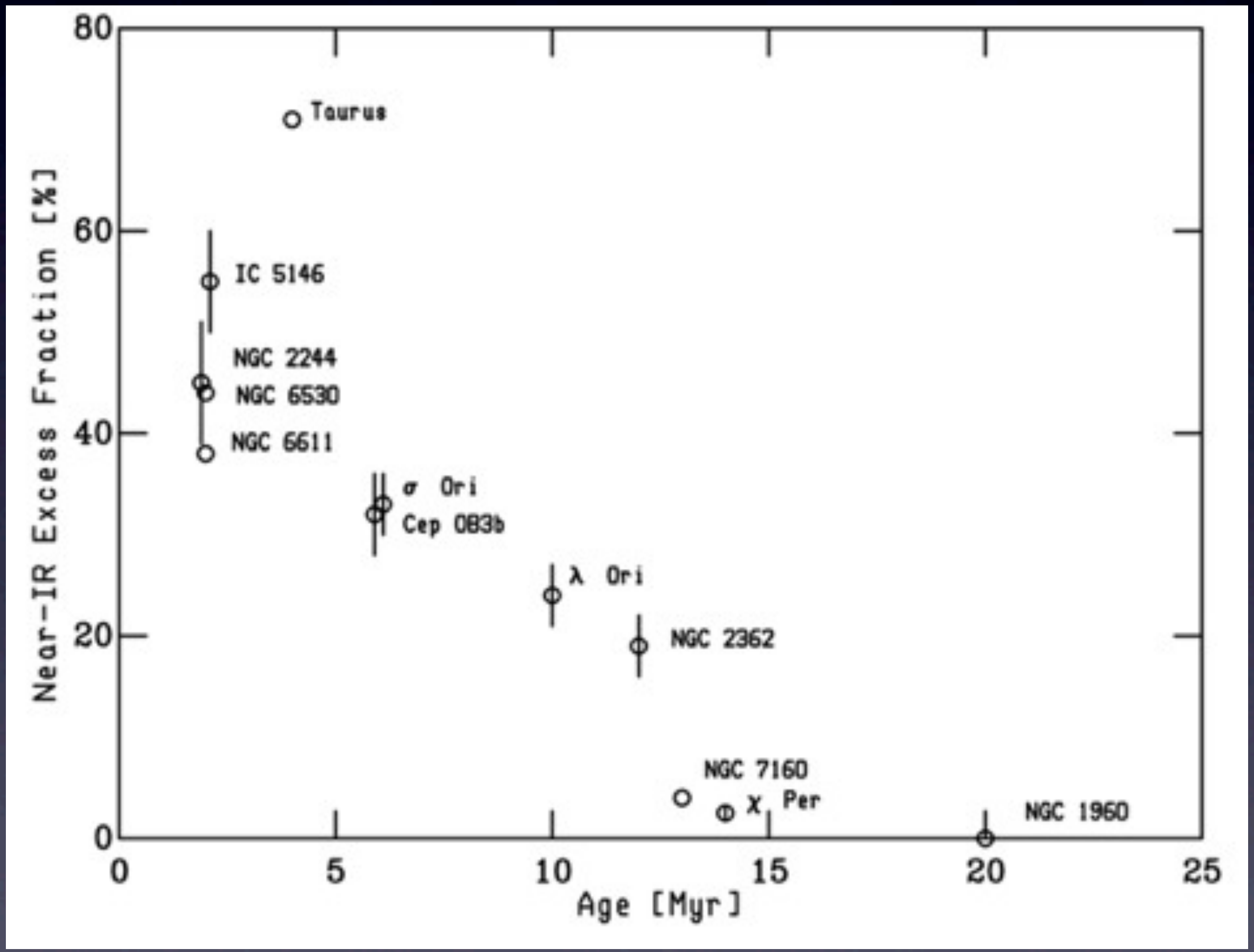

Conclusions

- Using a Bayesian method we can derive robust, consistent extinctions from photometry
- Taurus older than commonly quoted (3-4Myr)
- Consequently, it appears disks may survive longer in low density region