Survey for Transiting Extrasolar Planets in Stellar Systems (STEPSS)

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Properties of Known Companions

Piling up at P=3d 
Migration?

Paucity of Giant, Close-In Planets 
Related to BD Desert?
Properties of Known Companions

Frequency Increases with Metallicity

Nature or Nature?

47 Tuc?

Reid (2002)
Why Stellar Systems?

• **Advantages:**
  
  * Primaries have common properties
  * Explore the effects of:
    * Stellar Density
    * Age
    * Metallicity $[\text{Fe/H}]>0$
      (Open clusters)
  * Primaries have known properties
  * Statistics easy.
  * Compact systems
  * Point-and-shoot

• **Disadvantages:**
  
  * Relatively Faint Stars
  * Follow-up difficult
  * Small Number of Stars
  * Difficult to probe $f<5\%$

• **Requirements:**
  
  * Many (20) Consecutive Nights
  * Large FOV
  * Modest Aperture
Specifics

- MDM 2.4m
- 8192x8192 4x2 Mosaic CCD
- 25x25 arcmin²
- 0.18”/pixel
- Fall 2001
- 19 nights
- NGC 1245
- 1 Gyr
- [Fe/H]~0.0
NGC 1245

4-5 minute sampling

15 nights with data

9 full nights

0 photometric nights
NGC 1245

Saturate at I=16
Sensitive to Jupiter-size for G0-M0 primaries

6881 objects
- 259 variable
- 519 saturated
- 652 blended
- 43 too faint
5408 pass all cuts

~2500 cluster members
Window Probability: 
\[ <P_W >_{3-11} = 15\% \]

Transit Probability: 
\[ <P_T >_{3-11} = 8\% \]

Total Probability: 
\[ P_{tot} = f_{3-10} P_T P_W \]

Number of transits: 
\[ N_{exp} = N_{*} P_{tot} \]

Expect \(~3\) transits for \( f_{3-10} = 10\% \)
NGC 1245

Period = 3.2 days, Depth ~ 4% Grazing Binary
STEPSS - Results & Future Prospects

NGC 1245
[Fe/H]=??
\( f_{3-10} \leq 10\% \)

NGC 2099
[Fe/H]=0.05
37 nights: \( f_{3-10} \leq 3\% \)

NGC 2682 (M67)
[Fe/H]=0
20 nights in February

Future:
1-2 Clusters/Year
Metallicity
determinations

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Metallicity vs. Fraction [%] plot with data points for different clusters.