



Hunting for young Exoplanets in Stellar Associations using TESS

E. E. Manthopoulou,
D. Nardiello, M. Montalto, & G. Piotto



Stellar Associations (SAs)

- SAs are loose star clusters usually formed by a small number of stars
- Ages of SAs' members can be derived with high accuracy using theoretical models
- SAs' members in our sample have ages that span between (1-680) Myr



Exoplanets in SAs

- For the vast majority of exoplanets' hosts the age is not well constrained
- The understanding of the formation and evolution mechanisms of exoplanets needs an accurate knowledge of the age of the host star
- Searching for exoplanets in SAs offers the unique opportunity of mapping planetary systems at different stages in their early life

Finding exoplanets in SAs: a difficult task

- **TESS** has observed many SAs, but the resolution of the instrument sometime makes these objects hard to analyse.
- We adopted the PATHOS pipeline to extract high-precision light curves from the FFIs for **11380 members** in **41 SAs**.
- We injected simulated transits of planets with radii $(0.8-28)R_{\text{Earth}}$ in the observed light curves to probe the detection efficiency of our pipeline and used a logistic regression model to classify the detected signals.
- We validated the transiting objects of interest in our sample through a series of vetting tests (e.g. odd/even, secondary transit depth, analysis of the centroid and of different photometric apertures).

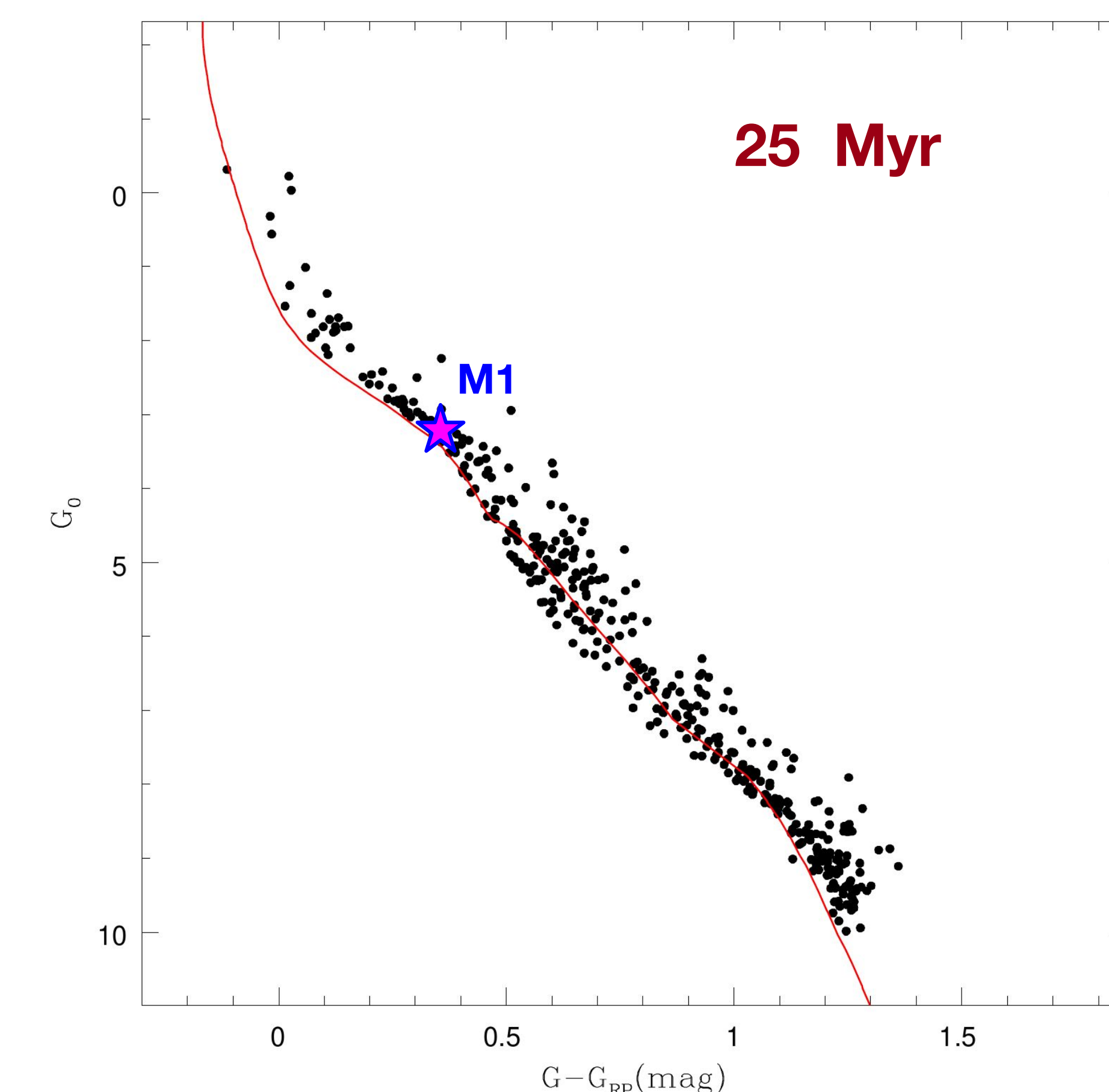
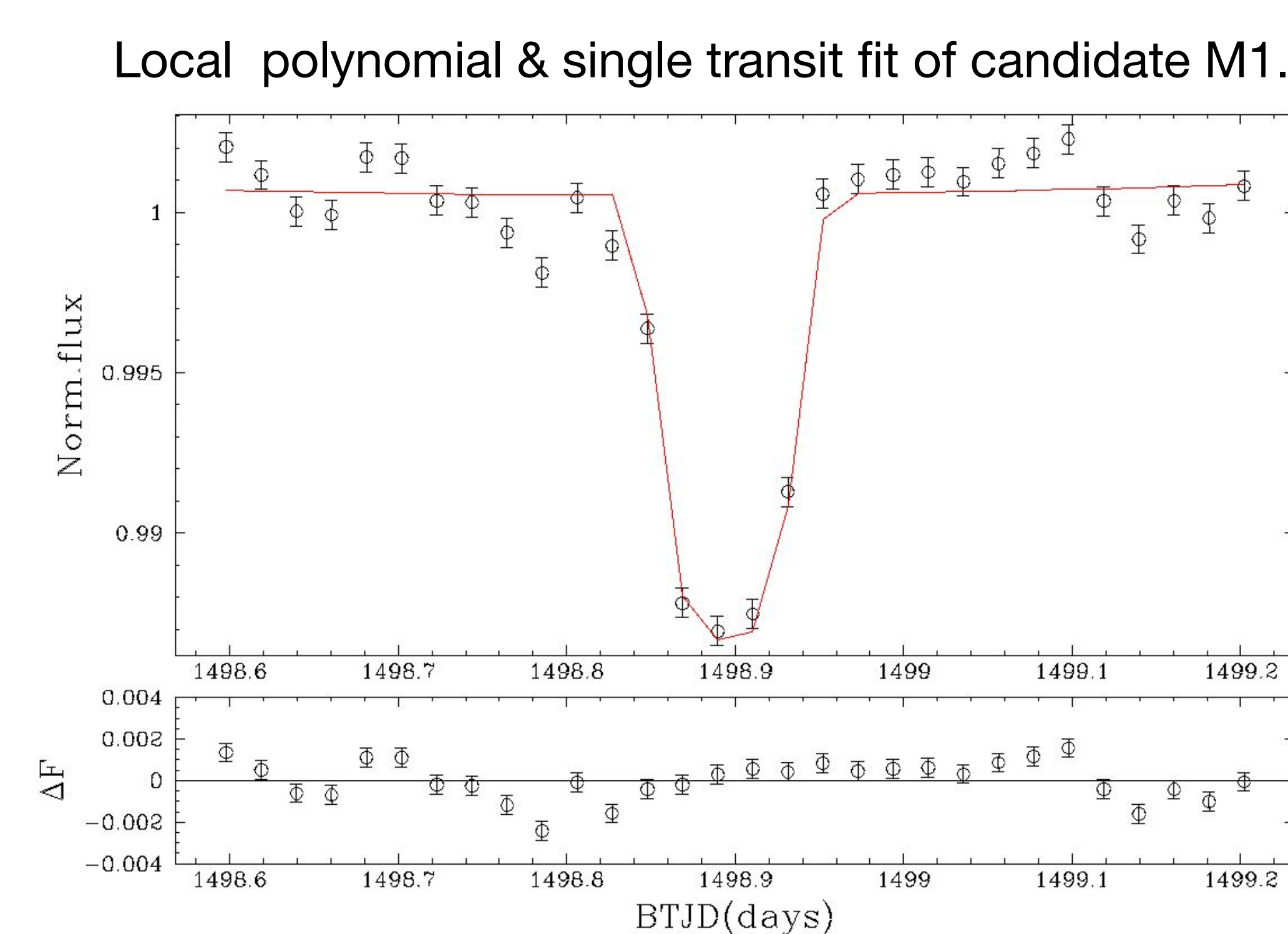
Contact information

Email: elenievangelia.manthopoulou@phd.astro.unipd.it

My DFA@UNIPD page: <https://bit.ly/3ePKYdr>

Candidate Exoplanets in SAs

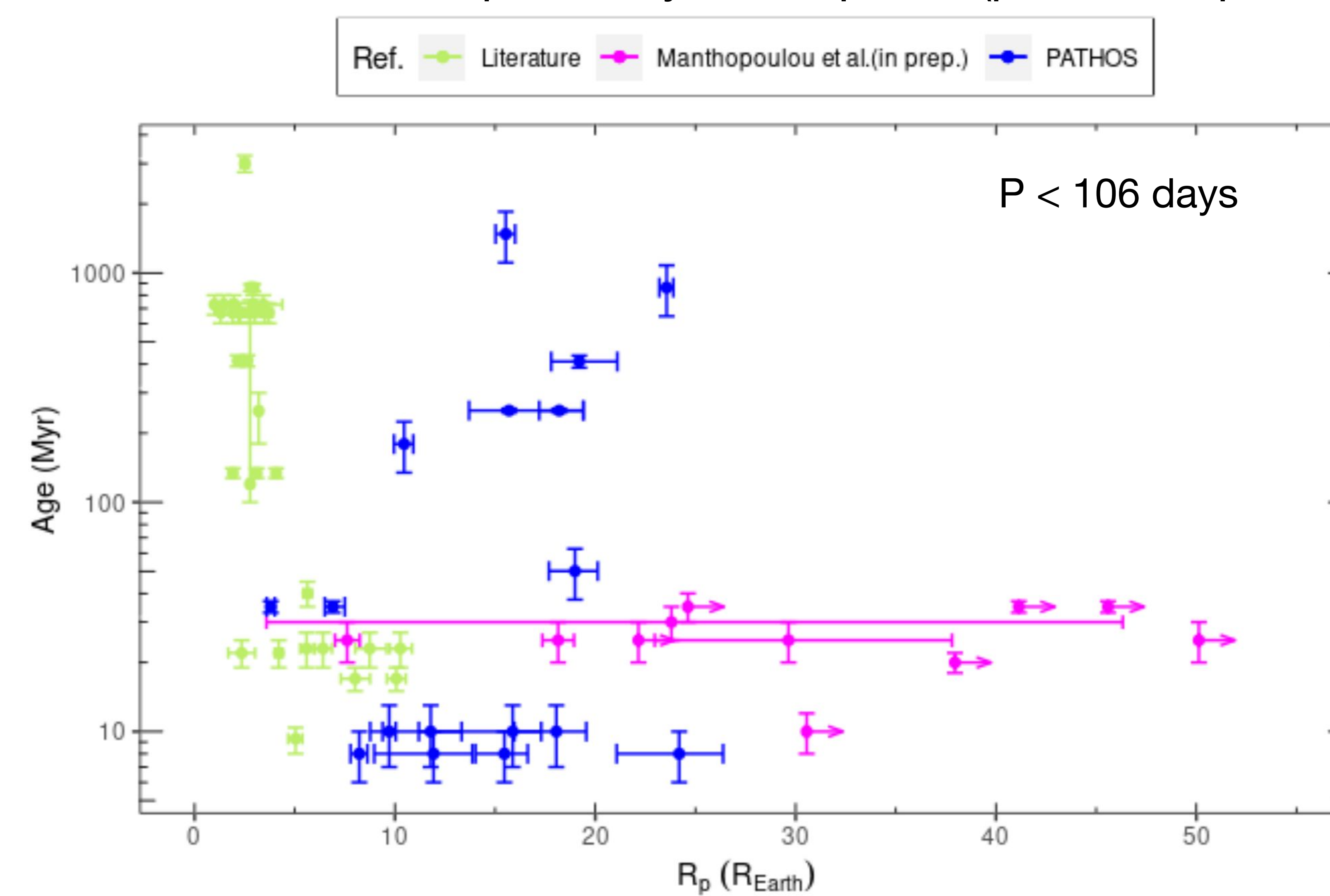
- **11 candidate exoplanets** discovered with ages between 10 and 50 Myr.
- All the candidates are giant planets with $R_p > 7x R_{\text{Earth}}$.
- 2 candidates are also TOIs



Age vs. R_p

We analysed the relation between stellar age and R_p also including data from the literature (see figure), which can allow us to study the evolution of the atmosphere of young, short-period exoplanets.

- No peculiar trend for $R_p > 1 \times R_{\text{Jupiter}} \sim 11 \times R_{\text{Earth}}$
- For $R_p < 11 \times R_{\text{Earth}}$:
 - older planets ($>100-200$ Myr) are concentrated at $R_p < 4 \times R_{\text{Earth}} \sim 1 \times R_{\text{Neptune}}$
 - young planets (<100 Myr) have radii $4x R_{\text{Earth}} < R_p < 11 \times R_{\text{Earth}}$
 - hint of evolution of the exoplanetary atmosphere (photo-evaporation)



Future perspectives

- Estimation of the frequency of exoplanets in SAs (and also stellar clusters) as a function of the age
- Analysis of the results with a view to exoplanet formation and evolution

More info on the
ESPG webpage:

