A search for coherent sites of star formation in M 31 galaxy

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Scientific objectives

A *coherent site of star formation* is defined as a group of stars which has formed simultaneously at a spatially restricted location in a galaxy. We used UBV stellar photometry of M 31 from the ground-based Local Group Survey (Massey et al. 2006) to construct color-magnitude (CMD) and color-color (CCD) diagrams. Stellar samples were selected along the isochrones with solar metallicity. Then, we searched for groups in the sight-plane to delineate sites of coherent star formation of different age and size.
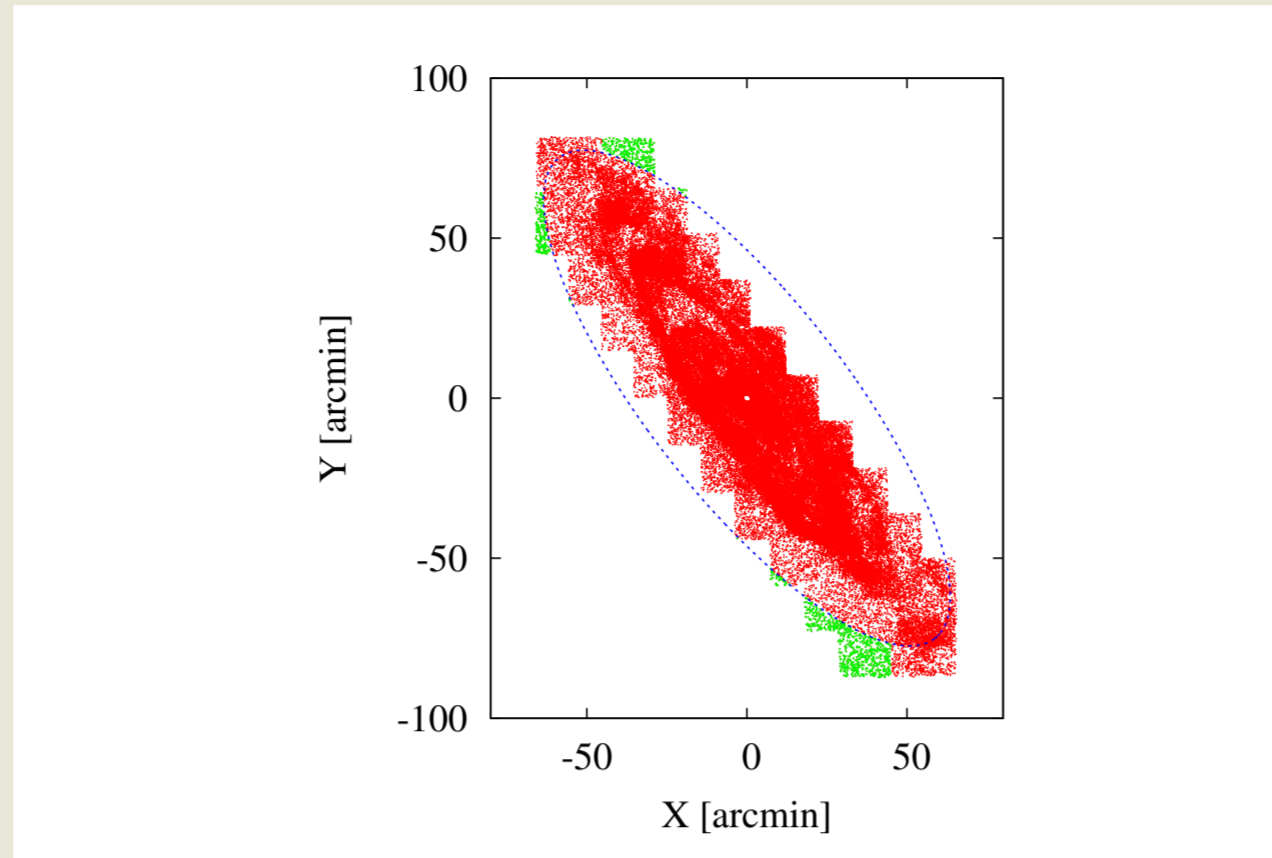

Fig. 1: Optical disk of M 31 (red mosaic fields) and the regions (green) selected to estimate the foreground contamination in this direction. The isophote at brightness level 25^m arcmin^{-2} in B is shown (blue dotted line).

Example: Selected stars along the isochrone $\lg(t) = 5.30$ and estimates of the foreground contamination.

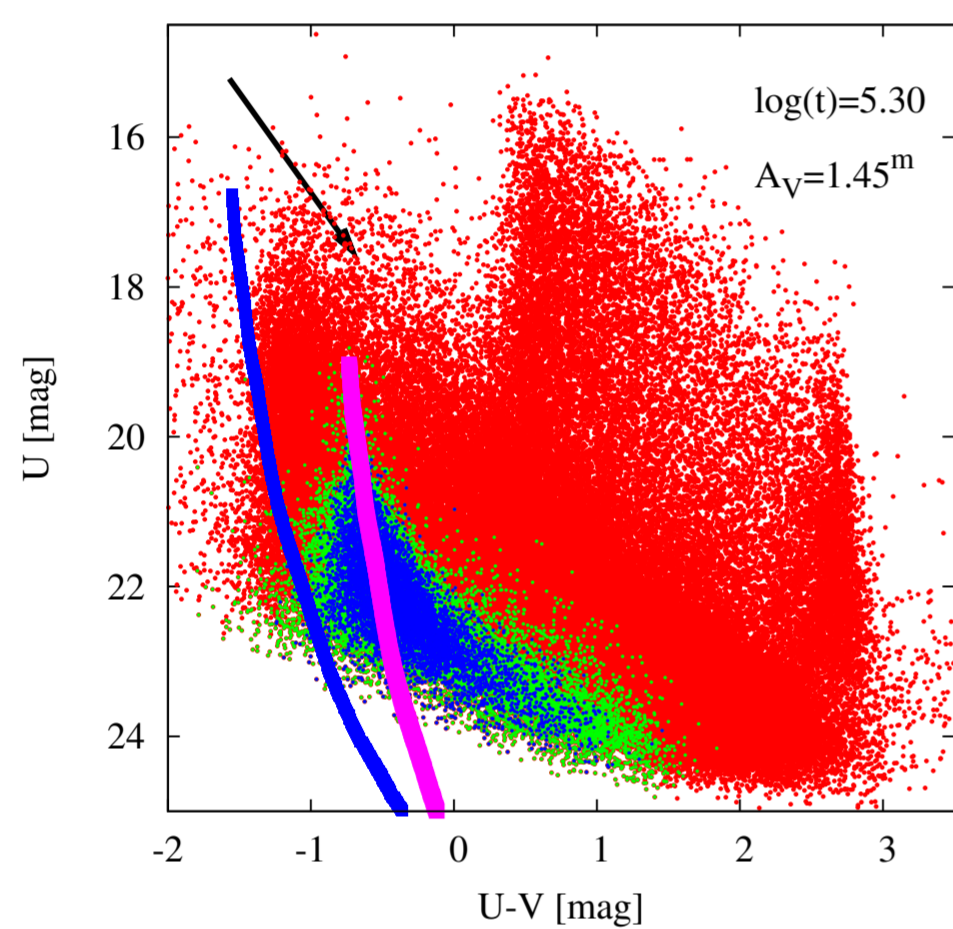|	Within 3σ on CMD	Within 1σ on CCD
Stars from M 31	31 832	19 505
Foreground	272	96
Contamination	0.85%	0.50%

Fig. 2: CMD of all stars with UBV photometry in M 31 (red) and of the samples of stars within 3σ (green) and 1σ (blue) from the isochrone $\lg(t) = 5.30$ with $A_V = 1^m45$ (pink line). The zero-extinction isochrone ($A_V = 0^m$; blue line) and the reddening vector (arrow) are also shown.
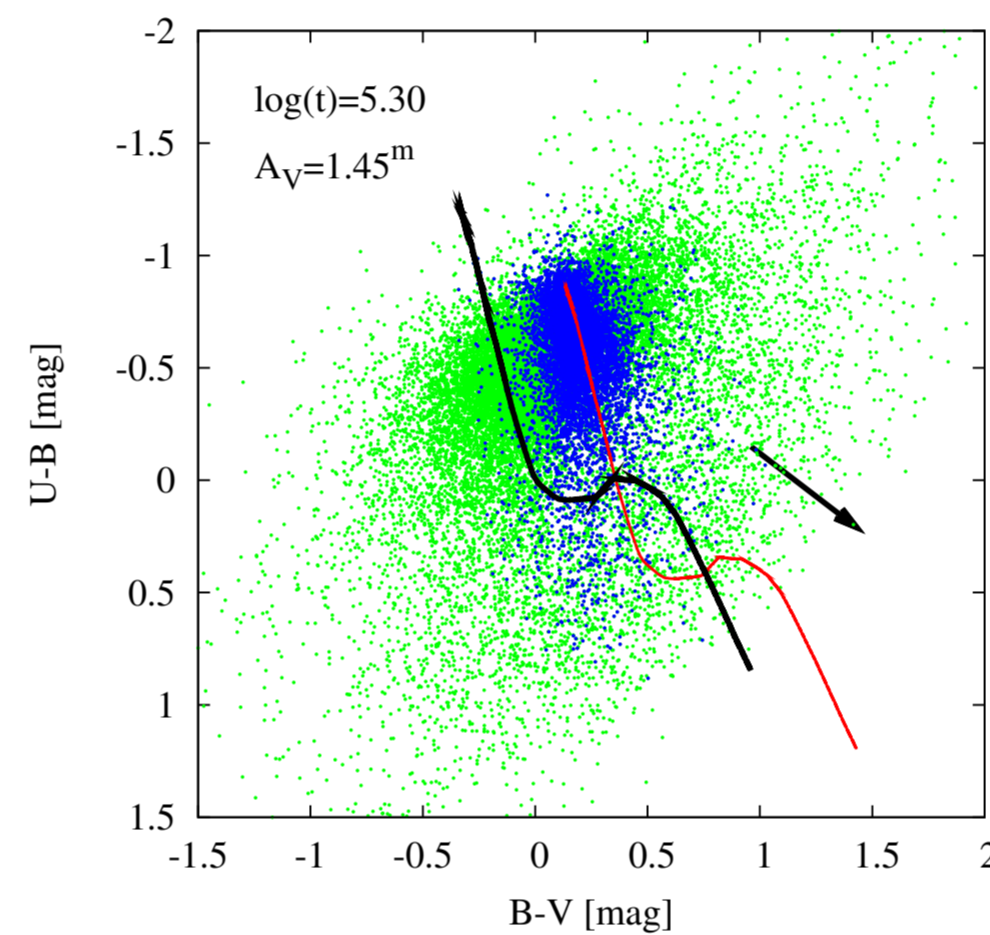

Fig. 3: CCM of the stellar samples within 3σ (green) and 1σ (blue dots) from the isochrone $\lg(t) = 5.30$ with $A_V = 1^m45$ (red line). The zero-extinction isochrone ($A_V = 0^m$; black line) is plotted for comparison.
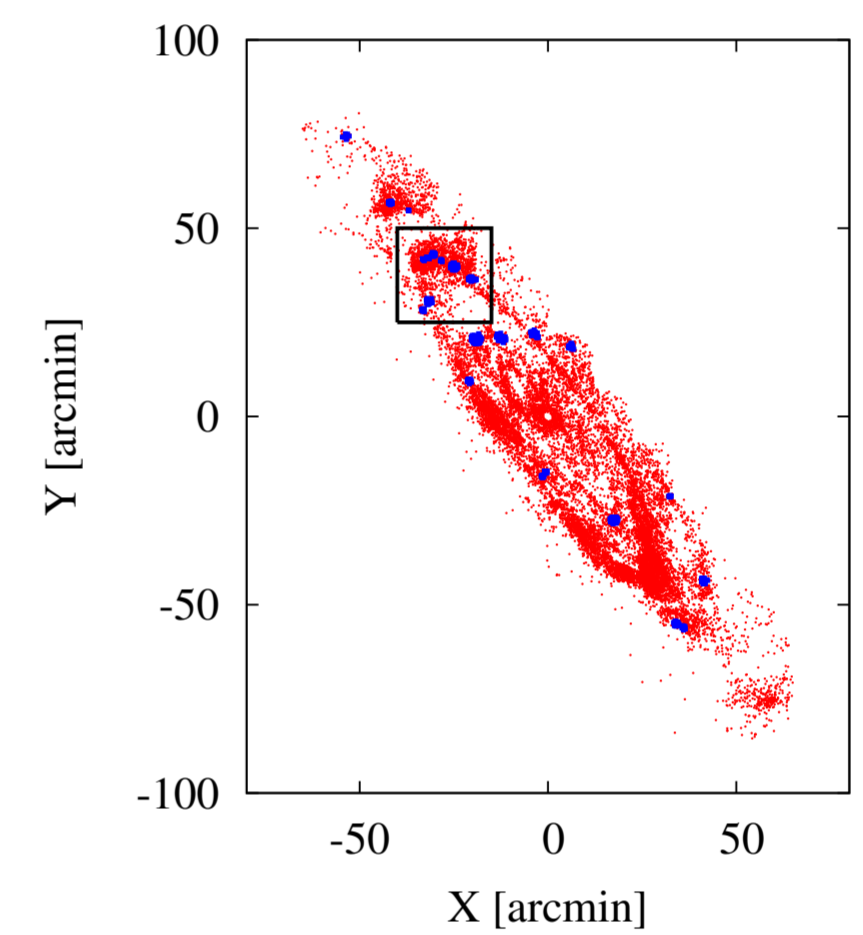

Fig. 4: Spatial distribution of all stars within 3σ from the isochrone with $\lg(t) = 5.30$ with $A_V = 1^m45$ on CMD and CCD. The most crowded groups of stars (blue dots) are shown; the location of the 16th group (G16) is in the frame (solid black line).
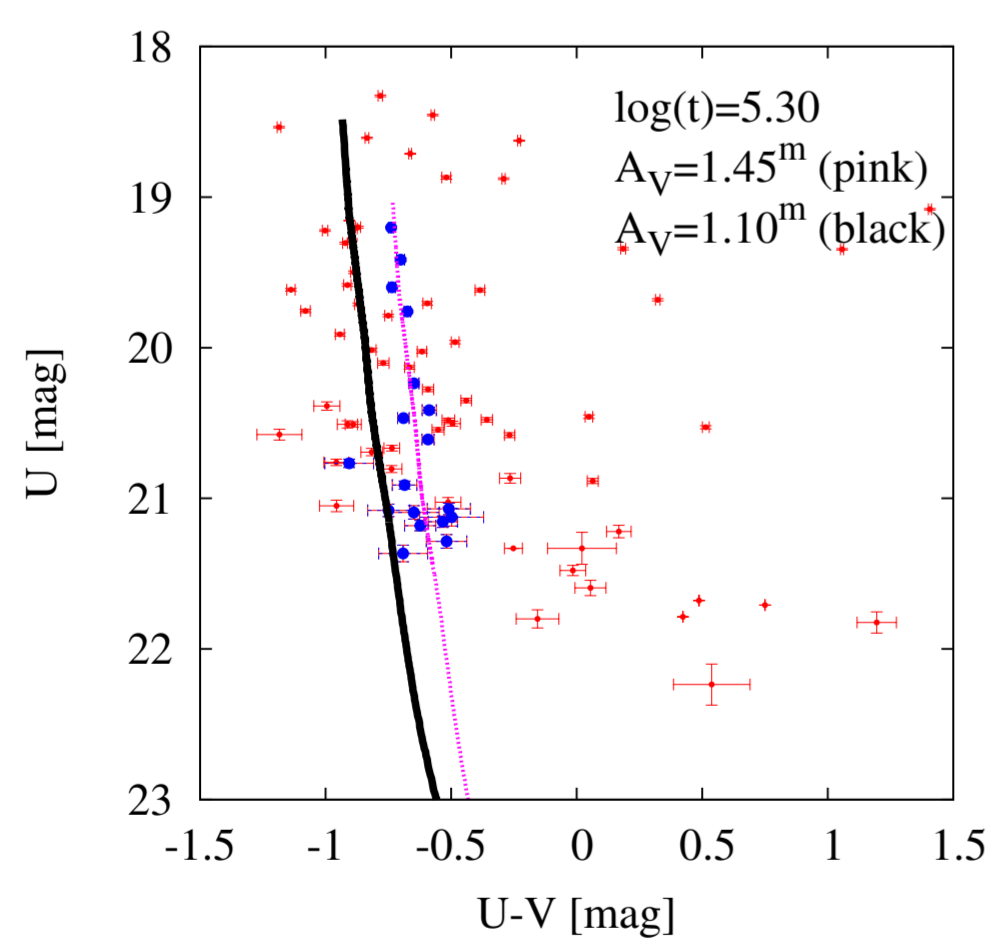

Fig. 5: CMD for all stars (red symbols) in G16 with the best-fit isochrone $\lg(t) = 5.30$ with $A_V = 1^m10$. The stars within 3σ interval from the same isochrone but with $A_V = 1^m45$ are plotted with blue symbols.
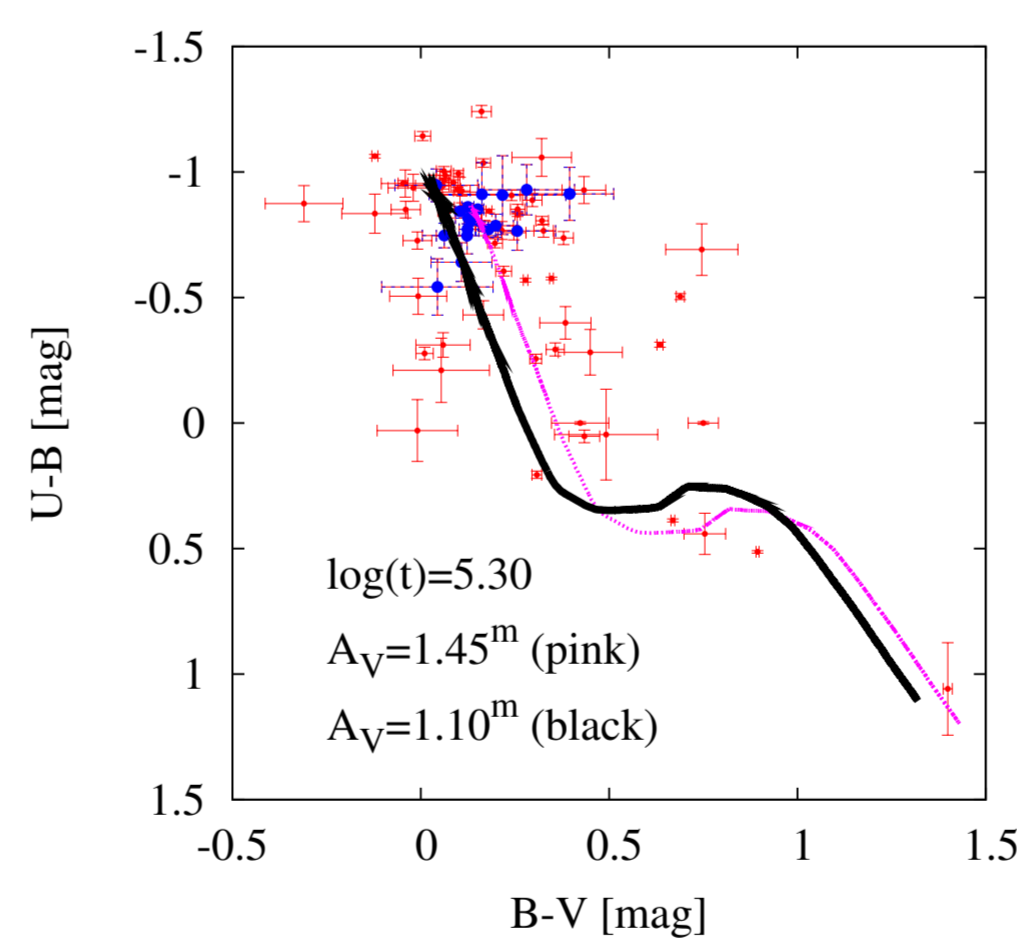

Fig. 6: CCD for all stars (red symbols) in G16 with the best-fit isochrone $\lg(t) = 5.30$ with $A_V = 1^m10$. The notations are the same like in the previous Figure.
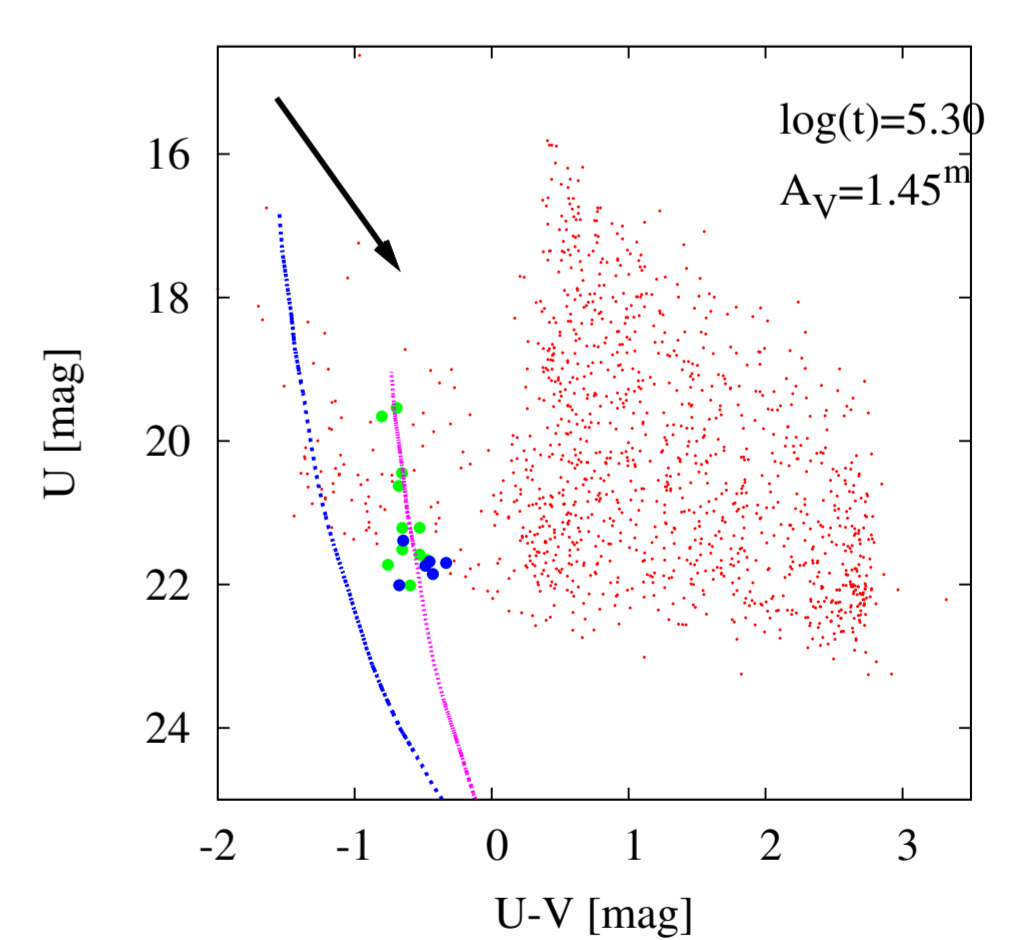

Fig. 7: CMD for all stars (red) with UBV photometry in the foreground field (green on Fig. 2). Sixteen stars (green) are found within 3σ from the isochrone $\lg(t) = 5.30$ with $A_V = 1^m45$ (pink line) and only 6 stars (blue) – within 3σ from this isochrone both on CMD and CCD. The zero-extinction isochrone is plotted (blue line) and the reddening vector (black arrow) are shown.

Summary

► We use UBV photometry from the Local Group Survey (Massey et al. 2006) to construct color-magnitude and color-color diagrams for regions in M 31 that are selected as compact groups of stars.
► We ploted isochrones with solar metallicity and for different values of the extinction on the CMD and CCD of the selected group of stars (an example is the group G16) to search for sites of coherent star formation.