

A tale of two nearby dwarf irregular galaxies WLM and IC 2574 - as revealed by UVIT

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Abstract.

We present an ultra-violet study of two nearby dwarf irregular galaxies WLM and IC 2574, using the Far-UV and Near-UV data from the Ultra-Violet Imaging Telescope (UVIT). We used the F148W band Far-UV images and identified 180 and 782 young star-forming clumps in WLM and IC 2574, respectively. The identified clumps have sizes between 7 - 30 pc in WLM and 26 - 150 pc in IC 2574. We noticed more prominent hierarchical splitting in the structure of star-forming regions at different flux levels in IC 2574 than WLM. We found that the majority of the clumps have elongated shapes in the sky plane with ellipticity (ϵ) greater than 0.6 in both the galaxies. The major axis of the identified clumps is found to show no specific trend of orientation in IC 2574, whereas in WLM the majority are aligned along south-west to north-east direction. We estimated (F148W–N242W) colour for the clumps identified in WLM and noticed that the younger ones (with (F148W–N242W) < –0.5) are smaller in size (< 10 pc) and are located mostly in the southern half of the galaxy between galactocentric radii 0.4 - 0.8 kpc.

Keywords. galaxies: dwarf irregular - galaxies: individual - galaxies: star formation - ultra-violet

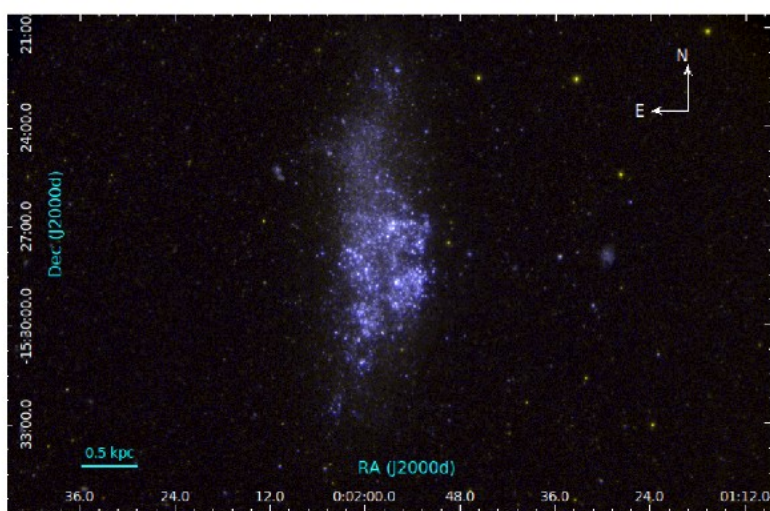


Figure 1. UVIT colour composite image of the galaxy WLM. The FUV F148W and the NUV N242W bands are shown in blue and yellow colour respectively.

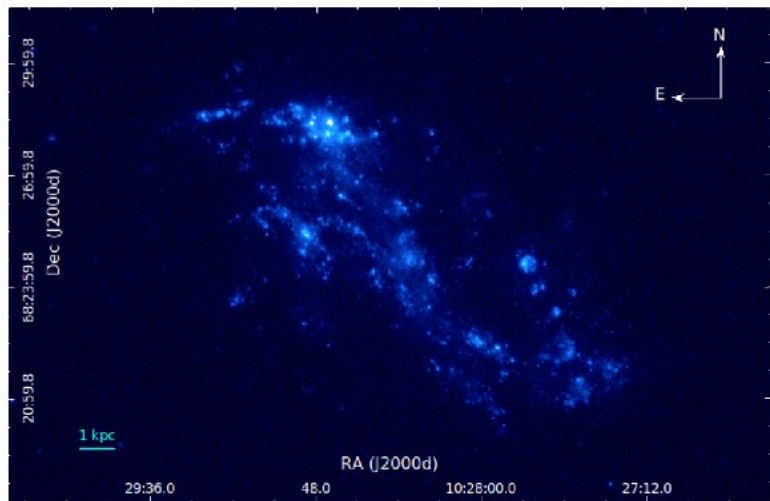


Figure 2. UVIT F148W band image of the galaxy IC 2574.

Table 1. Properties of WLM

Property	Value	Reference
RA	00 01 57.8	Gallouet et al. (1975)
DEC	-15 27 51.0	Gallouet et al. (1975)
Distance	0.995 Mpc	Urbaneja et al. (2008)
Metallicity	0.003	Urbaneja et al. (2008)
$\log M_*(M_\odot)$	6.88	Lee et al. (2006)
Major axis	5.7'	de Vaucouleurs et al. (1991)
Inclination	69°	de Vaucouleurs et al. (1991)
PA of major axis	181°	de Vaucouleurs et al. (1991)

Table 2. Properties of IC 2574

Property	Value	Reference
RA	10 28 23.5	Skrutskie et al. (2006)
DEC	+68 24 43.7	Skrutskie et al. (2006)
Distance	3.79 Mpc	Dalcanton et al. (2009)
Metallicity (Z)	0.006	Cannon et al. (2005)
$\log M_*(M_\odot)$	8.39	Lee et al. (2006)
Major axis	6.7'	de Vaucouleurs et al. (1991)
Inclination	63°	Pasquali et al. (2008)
PA of major axis	55°	Pasquali et al. (2008)

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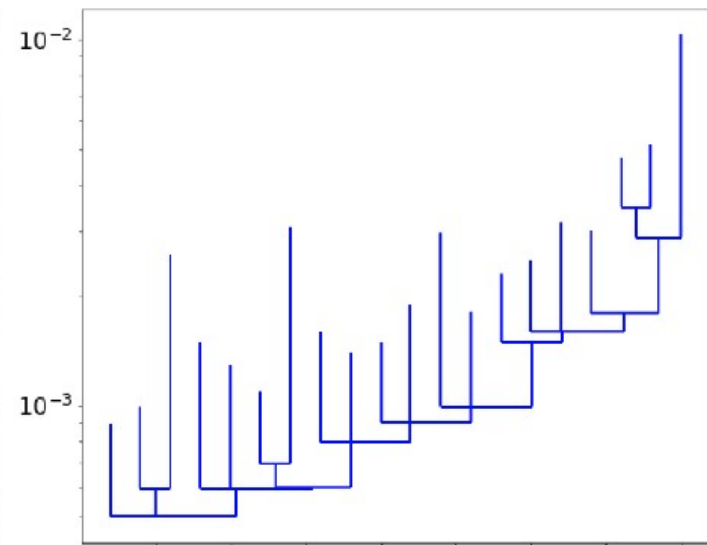
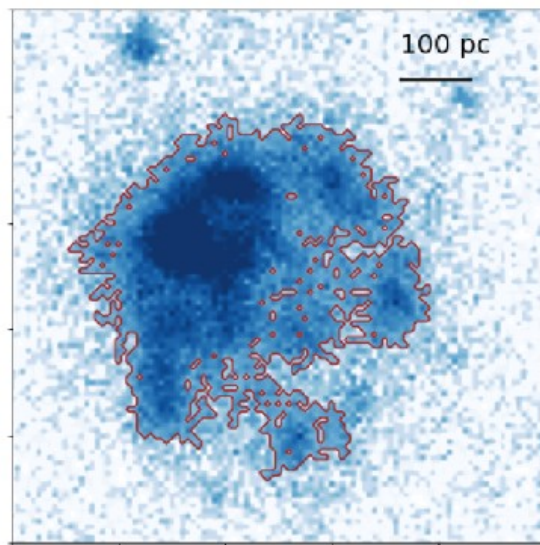
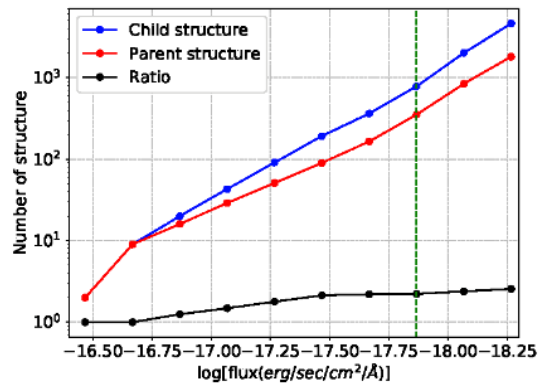
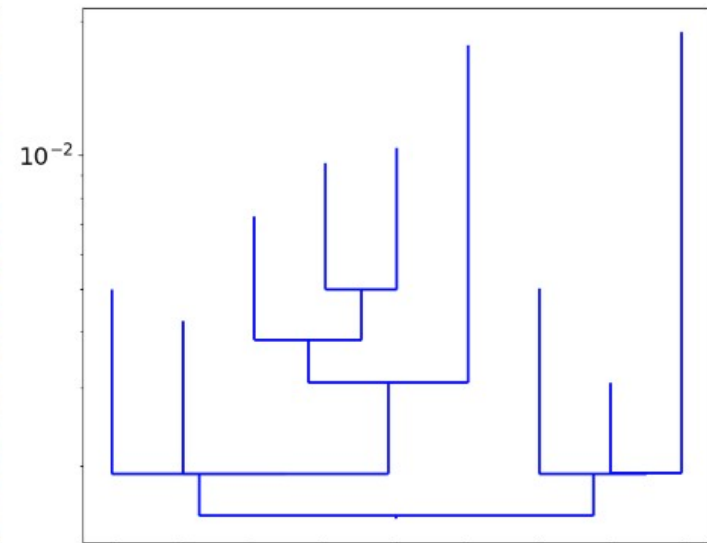
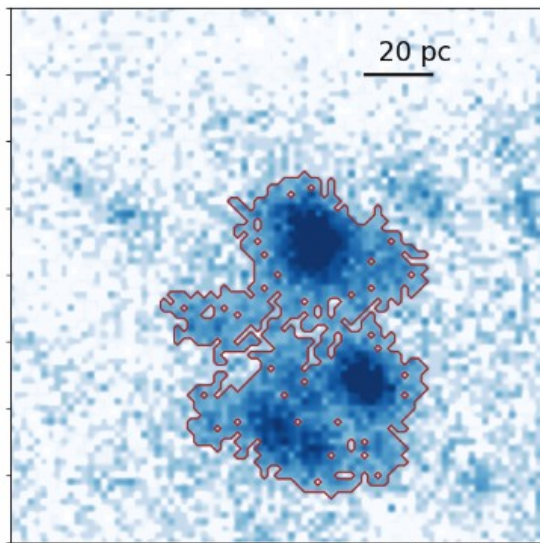
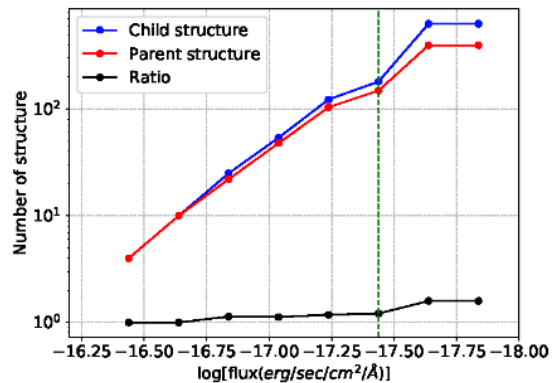


Figure 3. Number of child and parent structures identified in WLM (top panel) and IC 2574 (bottom panel) for varying threshold flux. The black lines show the ratio of child and parent structures. The vertical green dashed lines signify the value of threshold flux selected for each galaxy.

Результаты: расположение, размеры, форма и ориентация выделенных областей.

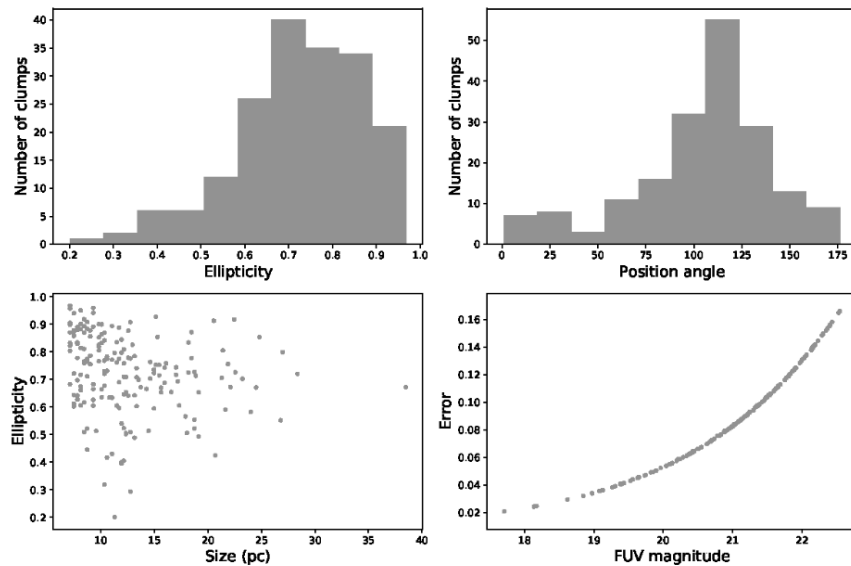


Figure 7. The properties of the star-forming clumps identified in the galaxy WLM. Top-left: Histogram of the ellipticity identified clumps, Top-right: Histogram of the position angle of identified clumps, Bottom-left: The size and the ellipticity of the clumps, Bottom-right: Observed FUV magnitude of the clumps and the corresponding error.

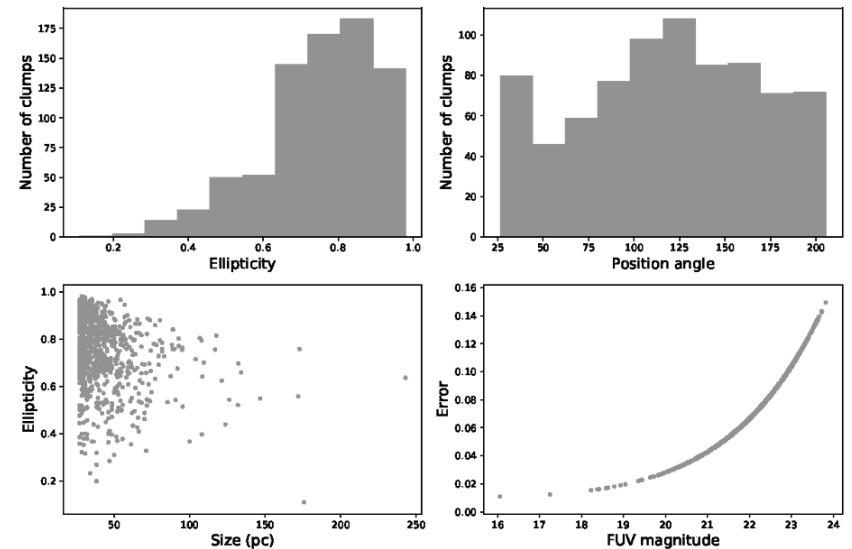


Figure 8. The properties of the star-forming clumps identified in the galaxy IC 2574. Each figure denotes the same as mentioned in Figure 7.

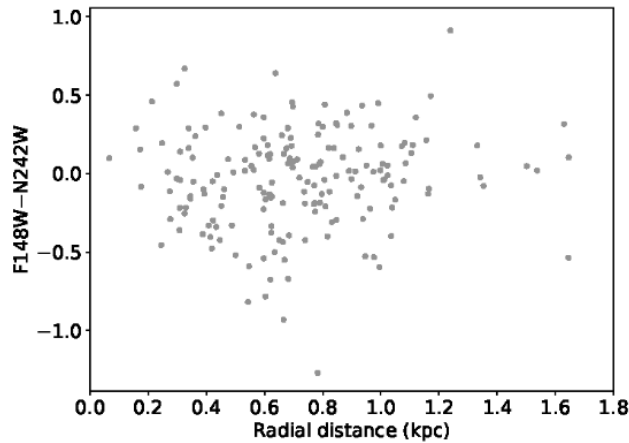


Figure 9. The (F148W-N242W) colour and the galactocentric distance of the clumps identified in the galaxy WLM.

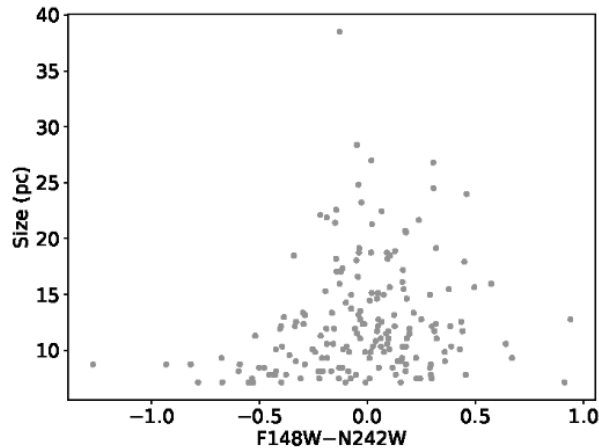


Figure 10. The (F148W-N242W) colour and the size of the clumps identified in WLM.

The key results of the study are summarized below.

1. We studied the characteristics of FUV-bright star-forming clumps in two nearby dwarf irregular galaxies WLM and IC 2574 using UVIT imaging observations.
2. The identified clumps have a size between $\sim 7 - 30$ pc in WLM and $\sim 26 - 150$ pc in IC 2574. The average size of the clumps is larger in the galaxy IC 2574, which is bigger and massive than WLM.
3. We found that the hierarchical splitting of star-forming regions is more prominent in IC 2574 than WLM.
4. The young star-forming clumps identified in both the galaxies are mostly observed to be elongated in shape.
5. We did not find any specific orientation of the clump major axis in IC 2574, whereas in WLM the majority of the clumps are oriented along south-west to north-east direction.
6. The youngest star-forming clumps in WLM are detected between radii 0.4 kpc to 0.8 kpc. Both the central and outer parts of the galaxy are relatively less active in recent times.