Astronomy & Astrophysics manuscript no. aa_example
August 21, 2026
©ESO 2026

Letter to the Editor

Serendipitous discovery of an almost-dark galaxy in the Virgo Cluster

Minh Ngoc Le[1,2,3,⋆], Ignacio Trujillo[1,2], Sergio Guerra Arencibia[1,2], Ignacio Ruiz Cejudo[1,2], Junais[4], Mireia Montes[7], Johan H. Knapen[1,2], Željko Ivezić[5], Michael H.F. Wilkinson[6], Reynier Peletier[3], Miquel Serra-Ricart[8,1,2], and Miguel R. Alarcon[8,1,2]

[1] Instituto de Astrofísica de Canarias, Vía Láctea S/N, E-38205 La Laguna, Spain
[2] Departamento de Astrofísica, Universidad de La Laguna, E-38206 La Laguna, Spain
[3] Kapteyn Astronomical Institute, University of Groningen, P.O. Box 800, 9700AV Groningen, The Netherlands
[4] Leibniz-Institut für Astrophysik Potsdam (AIP), An der Sternwarte 16, 14482 Potsdam, Germany
[5] Department of Astronomy and the DiRAC Institute, University of Washington, 3910 15th Avenue, NE, Seattle, WA 98195, USA
[6] Bernoulli Institute of Mathematics, Computer Science and Artificial Intelligence, University of Groningen, Groningen, The Netherlands
[7] Institute of Space Sciences (ICE, CSIC), Campus UAB, Carrer de Can Magrans, s/n, E-08193 Barcelona, Spain
[8] Light Bridges, Observatorio del Teide, Carretera del Observatorio s/n, E-38500 Guimar, Tenerife, Canarias, Spain

August 21, 2026

arXiv:2608.19326v1 [astro-ph.GA] 19 Aug 2026

ABSTRACT

Analogues of extreme Local Group galaxies with very low surface brightness and large effective radii must exist elsewhere, still hidden due to current detection limits. We report the serendipitous discovery of a low-mass almost-dark galaxy TTT J1237327+143535 in the Virgo Cluster, observed using the Two-meter Twin Telescope at the Teide Observatory. TTT J1237327+143535 has a central surface brightness of 27.9 ± 0.2 mag arcsec^{-2} in the g'-band, an effective radius of 0.9 ± 0.1 kpc, and a total stellar mass of $(2.2 \pm 0.4) \times 10^6$ M$_\odot$. Its effective radius and absolute magnitude are similar to those of galaxies And XXI and And XXIII. The discovery of this extremely low surface brightness, extended, low-mass galaxy suggests the existence of a significant population of almost-dark galaxies in the Virgo Cluster. An in-depth analysis of the Next Generation Virgo Cluster survey, as well as upcoming Rubin Data Releases and the 10-year Rubin Legacy Survey of Space and Time are expected to reveal large samples of this extreme galaxy population, which offers insights on galaxy formation in extreme conditions.

Key words. Galaxies: dwarf – Galaxies: clusters: individual: Virgo

1. Introduction

There is still no consensus within the scientific community on what "almost-dark" galaxies are. One working definition is to classify as such those galaxies not detected by traditional sky surveys, such as the Sloan Digital Sky Survey (SDSS, York et al. 2000). In practical terms, an almost-dark galaxy is one whose central surface brightness in the r-band is fainter than 26 mag arcsec^{-2}. Well-known examples of this type of galaxy include Nube (Montes et al. 2024) and RCP 32 (Román et al. 2021).

Almost-dark galaxies found in deeper surveys than the SDSS, such as Stripe 82 (e.g. Fliri & Trujillo 2016) and DECaLS (Dey et al. 2019), have effective radii similar to those of ultra-diffuse galaxies (UDGs), with $r_e > 1$ kpc (van Dokkum et al. 2015), but are significantly fainter by a factor of more than 10. Current galaxy simulations cannot reproduce galaxies with this combination of characteristics (see e.g. Sales et al. 2022 and Rey et al. 2025). This raises many unanswered questions on the formation, abundance, and environments where those galaxies stay.

Star counting techniques allow the detection of very low surface brightness galaxies in the Local Group, but their effective radii are in general significantly smaller ($r_e < 1$ kpc, McConnachie 2012). Galaxies of this type should certainly also exist outside the Local Group. However, their small apparent extensions and low surface brightness would make them indistinguishable from the background of high-redshift galaxies. Nonetheless, there are some galaxies in the Local Group such as And XXI and And XXIII that having low surface brightness their effective radius is around 1 kpc. In this article, we report the discovery of one of these almost-dark galaxies (TTT J1237327+143535) in the Virgo Cluster. While it is not the first galaxy with very low surface brightness found in this cluster, TTT J1237327+143535 is one of the most extreme ones to date, compared to other galaxies reported in Mihos et al. 2015, 2017, Ferrarese et al. (2020) and Lim et al. (2020).

2. Discovery imaging

The almost-dark galaxy TTT J1237327+143535 was discovered while constructing a control field for the galaxy Malin 1 with TTT3 (the first 2-m telescope of the TTT facility), a Ritchey-Chrétien 2-m telescope located at Teide Observatory, using g'-, r'-, and i'-band standard Sloan filters, manufactured by Baader Planetarium. For the g'- and r'-band observations, the instrument used was FERVOR-M with the sensor BSI sCMOS

⋆ Corresponding author: lmngoc1509@gmail.com

IMX455 (Alarcon et al. 2023), with a FOV of 10.2′ x 6.8′ and a pixel scale of 0.194″ pix^{-1} (3 × 3 binning). For the i'-band, the instrument used was COLORS with the sensor BSI e2v CCD42-40 BEX2-DD, a FOV of 7.85′ x 7.85′ and a pixel scale of 0.23″.

The observations were conducted between April and June of 2025. The exposure times for the g'-, r'-, and i'-band were 6.5, 7.8, and 5 hours, respectively. The full-width half maximum for point-like sources on the stacked images is 1.3″, 1.1″, and 1.5″, and the typical sky brightness during the observations was 21.7, 20.85, and 20.3 mag arcsec^{-2} for g'-, r'-, and i'-band, respectively. The surface brightness limits achieved in the final images are 30.3, 29.6, and 29.2 mag arcsec^{-2} (in areas equivalent to 10″ × 10″ at a 3σ level) for the respective bands. The 5σ point source limits are at 26.2, 25.4, and 24.8 mag for g'-, r'-, and i'-band in apertures with radii of 1.5″. To preserve the faint signal present in the data, we used a low-surface-brightness-compliant pipeline. A thorough explanation of the observational and reduction strategy is in Junais et al. (2025).

Figure 1 shows a colour image combining the g'-, r'-, and i'-band images of the almost-dark galaxy TTT J1237327+143535 (centre box and zoom-in), together with the UDG neighbour SMDG J1237307+143906 (upper box) reported in the SMUDGes survey (Zaritsky et al. 2023). Giving their positions in the sky (at a projected distance of 0.77 Mpc to M87) and their extension, we assume that both the almost-dark galaxy and the UDG neighbour are associated with the Virgo Cluster, at D = 16.17 Mpc, with statistical error of ±0.25 Mpc and systematical error of ±0.47 Mpc (Anand et al. 2025).

3. Physical properties

We derive the physical properties of the almost-dark galaxy TTT J1237327+143535 and its neighbour SMDG J1237307+143906 by first running the source detection algorithm MTO2 (Hashem Faezi et al. 2024) to detect and mask all the other sources in a region of 5′ × 5′ around the galaxy. We then use Photutils (Bradley et al. 2026) to find the galaxy centre by fitting isophotes on the masked image, and GALFIT (Peng et al. 2010) to fit the galaxy with a Sérsic model and derive the Sérsic index, effective radius, ellipticity, and position angle.

TTT J1237327+143535 has a rather flat radial surface brightness profile with Sérsic index $n = 0.54 \pm 0.03$ while the neighbour has a slightly steeper profile with $n = 0.75 \pm 0.01$. The two galaxies have a similar effective radius of around 12″, which corresponds to 1 kpc at the distance of the Virgo Cluster. Other properties of these objects are listed in Tab A.1.

We follow Schlegel et al. (1998) and Schlafly & Finkbeiner (2011) to apply an extinction correction for each band. TTT J1237327+143535 (Fig A.3, top panel, squares) has an extremely faint central surface brightness of 27.9 mag arcsec^{-2} and 26.9 mag arcsec^{-2} in g'- (blue) and r'-band (orange), respectively. SMDG J1237307+143906 (circles), in comparison, has a central surface brightness of 25.4 mag arcsec^{-2} and 24.8 mag arcsec^{-2} in g'- and r'-bands, two magnitudes brighter than its almost-dark neighbour. The almost-dark galaxy has a median extinction-corrected colour of $(g'-r')_0 = 0.6 \pm 0.1$ within r_e. The UDG neighbour is also similarly red, with $(g' - r')_0 = 0.58 \pm 0.04$.

From these colours, we derive a colour-mass-to-light ratio for the g'-band of $\log_{10}(M_\star/L) = m \times (g' - r')_0 + b$, assuming a Kroupa initial mass function (Kroupa 2001) and values of $m = 2.029$ and $b = -0.984$ from Roediger & Courteau (2015). Following Bakos et al. (2008), the stellar mass density profile is obtained as $\log_{10}\Sigma_\star(r) = \log_{10}(M_\star/L) - 0.4[\mu_{g'}(r) - m_{g',\odot}] + 8.629$, where the absolute magnitude of the Sun is $m_{g',\odot} = 5.11$ mag. To avoid the effect of the noisy outskirts of TTT J1237327+143535, we integrate the surface mass density up to its effective radius, then multiply by two to obtain the total stellar mass.

We find that both galaxies have very low surface mass densities. SMDG J1237307+143906 (Fig A.3, bottom panel, circles) has the central mass surface density of 5 $M_\odot$ pc^{-2} which drops down to almost 0.1 $M_\odot$ pc^{-2} at around two times its effective radius (∼ 2 kpc). Its total stellar mass is about 10^7 $M_\odot$. In the almost-dark galaxy (squares in Fig.A.3), even at its centre the surface mass density is below 1 $M_\odot$ pc^{-2}. TTT J1237327+143535 has a central surface mass density of 0.8 $M_\odot$ pc^{-2}, dropping to 0.1 $M_\odot$ pc^{-2} at the outskirts. It has a total stellar mass of 2×10^6 $M_\odot$, five times less massive than its UDG neighbour.

4. Discussion

The distance to the almost-dark galaxy TTT J1237327+143535 is unknown. There are two reasons to support the assumption that it is associated with the Virgo Cluster. Firstly, the sky separation between TTT J1237327+143535 and the giant elliptical galaxy M87 at the centre of the Virgo Cluster is 2.74°, corresponding to 0.77 Mpc at the Virgo distance. Thus, it is located within the virial radius of the Virgo Cluster (r_{vir} = 1.55 Mpc, from Ferrarese et al. 2012). Secondly, the fact that we do not resolve the stellar populations of TTT J1237327+143535 is proof of its position beyond the Local Group (within 3 Mpc, McConnachie 2012). On the other hand, it is unlikely that TTT J1237327+143535 is further away than the Virgo Cluster. In fact, if it were at about 30 Mpc, its effective radius could be twice the current radius, and its total stellar mass would be 3.5 times higher than the values measured at the Virgo distance. Such an object with a central surface brightness of 28 mag arcsec^{-2} would be even harder to explain with current simulations of galaxy formation and evolution.

We find no signal from the HI spectrum at the position of TTT J1237327+143535 from the ALFALFA survey, yielding an upper limit to the HI mass of 10^7 $M_\odot$ at the Virgo Cluster distance (Giovanelli et al. 2007). Besides, there is also no Hα reported at the same location when cross-matched with the VESTIGE survey (Boselli et al. 2018). A galaxy with such faint surface brightness and relatively red colour may indeed be HI-poor and have no recent star-forming activity.

TTT J1237327+143535 is a remarkable object with an extremely low density of baryonic matter, as reflected in its low surface brightness and low stellar surface mass density. It is clearly distinguished as the most extended galaxy among those dwarfs and UDGs with similar absolute magnitude in the Local Volume (left panel, Fig 2). It is about twice as large in effective radius as the other dwarfs with `certain` membership in the Virgo Cluster (middle panel, Fig 2). Similar to other almost-dark galaxies, Nube and RCP 32, they all have large effective radii compared to galaxies of the same magnitudes. Besides, its effective radius is comparable to the UDGs (as defined in van Dokkum et al. 2015) and is 100 times fainter. Current state-of-the-art simulations (e.g Rey et al. 2025) can reproduce galaxies at the same magnitude as TTT J1237327+143535 with half or even one-third of its effective radius. Thus, a larger sample of similarly faint and extended galaxies will provide an observational constraint on the physical mechanisms responsible for the extensive radii of this population.

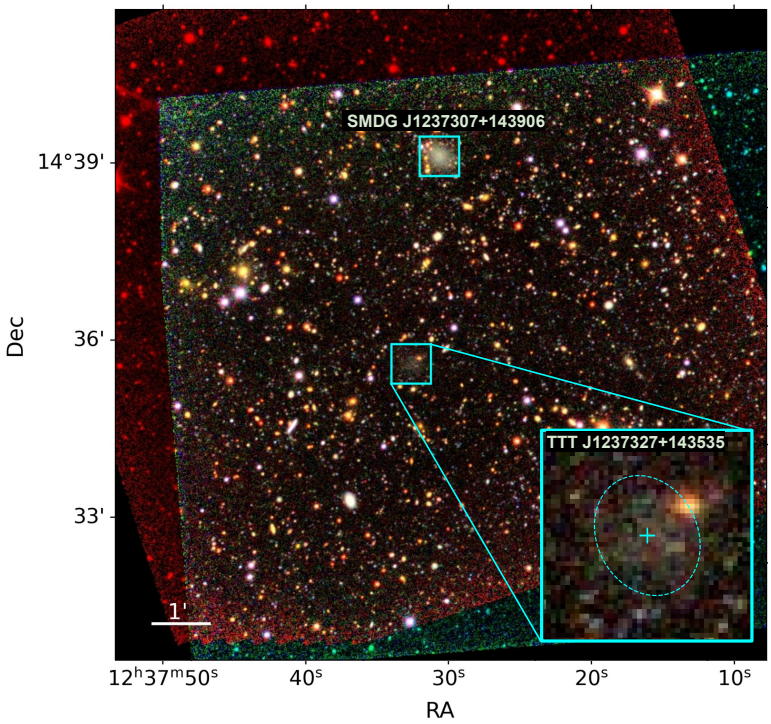


Fig. 1: Colour image (combined g', r', and i' filters, using *astscript-color-faint-gray* (Infante-Sainz & Akhlaghi 2024)) of the almost-dark galaxy TTT J1237327+143535 (centre and zoom-in, the cross marks the centre of the object and the dashed ellipse shows the half-light radius) and the neighbour SMDG J1237307+143906 (top). The boxes mark the area of 40″ × 40″ (3 kpc × 3 kpc at the Virgo Cluster distance) around these objects.

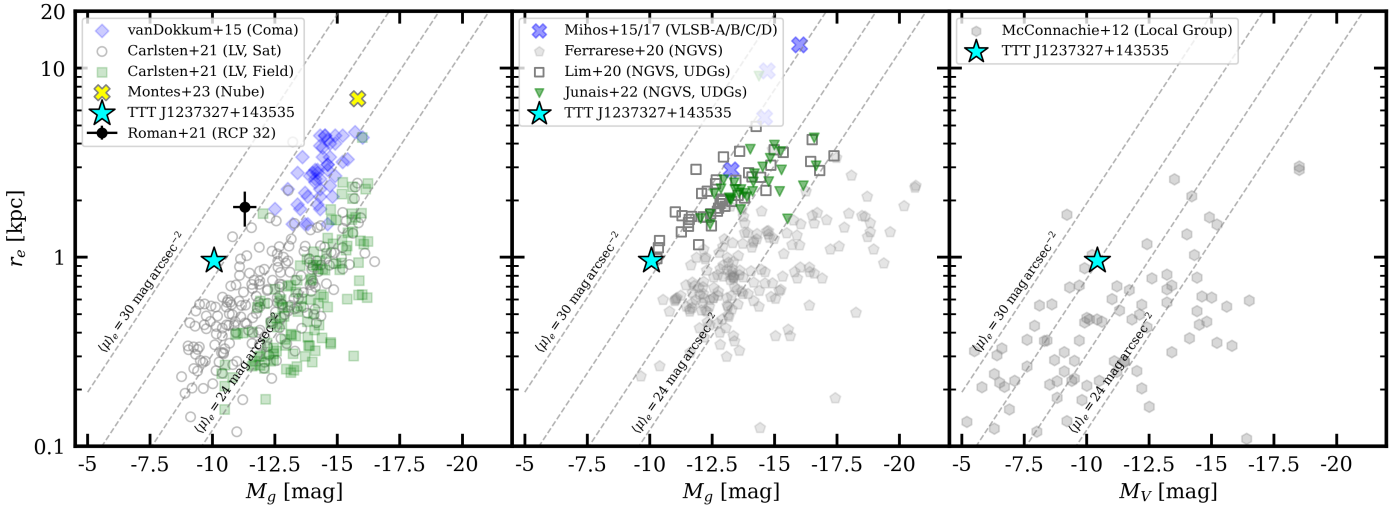


Fig. 2: **Left panel**: the absolute magnitude in $g-$band and effective radius of the almost-dark galaxy TTT J1237327+143535 (marked as cyan star), compared to UDGs in the Coma Cluster (van Dokkum et al. 2015, diamonds), satellite (open circles) and field (squares) dwarfs in Local Volume (D ≤ 12 Mpc, Carlsten et al. 2021), and to the other two almost-dark galaxies Nube (cross) and RCP 32 (black circle with errorbar). **Middle panel**: as Left panel, compared to other objects in the Virgo Cluster from the NGVS survey: galaxies with `certain` membership within 0.3 Mpc from M87 (Ferrarese et al. 2020, pentagons), UDGs in (Junais et al. 2022, triangles), and in (Lim et al. 2020, squares). We also show comparison to the LSBs found with the Burrell Schmidt Deep Virgo Survey (Mihos et al. 2015, 2017, blue crosses). **Right panel**: the absolute magnitude in the $V-$band – effective radius of TTT J1237327+143535 (cyan star), compared to galaxies in the Local Group (D ≤ 3 Mpc, McConnachie 2012, hexagons). The gray dashed lines show the corresponding effective surface brightness at each magnitude – size. Error bars of the measurement for TTT J1237327+143535 are small and not visible in the plot.

TTT J1237327+143535 occupies a position on the effective radius–magnitude space that remains genuinely rare even in the deepest existing surveys of the Virgo Cluster (middle panel,

Fig.2). The Next Generation Virgo Cluster Survey (NGVS) — one of the most comprehensive LSB surveys of Virgo to date, covering 104 degrees square — UDGs catalog (Lim et al. 2020) reveals only three objects (NGVSUDG-22, NGVSUDG-A06, NGVSUDG-A12) with comparable properties, all at the extreme faint end of their sample and are marked as those close to the NGVS detection and completeness limit (50% complete at $M_g = -9.6$). TTT J1237327+143535, discovered independently, naturally complements and reinforces the NGVS UDGs sample by confirming that objects in this extreme parameter space exist. Finding a galaxy with those extreme properties by chance, in an observation independent of the NGVS survey, reinforces the idea that there is a population of extended, low-mass, low-surface-brightness objects in the Virgo Cluster. It is worth emphasizing how difficult it is to find an object with these characteristics. Although the NGVS deep imaging covers the location of TTT J1237327+143535, the galaxy is not included in the NGVS catalog.

We do not expect any globular cluster (GC) associated with TTT J1237327+143535. The point-source limit of our data corresponds to $M_g \sim -5$ mag at the Virgo distance, which is 2 mag fainter than the peak of GCLF ($M_g \sim -7.2$ mag, as in Lim et al. 2020). However, due to the limitations of ground-based imaging in separating GCs from contaminants, and to avoid the assumption of the universal GCLF, especially for low-mass, low surface brightness galaxies such as TTT J1237327+143535, space-based follow-up with u-band coverage (the most effective wavelength range for discriminating GC candidates from stars, Muñoz et al. 2014) would enable a robust characterisation of the GC system of this almost-dark galaxy.

Compared to dwarf galaxies in the Local Group from McConnachie (2012), TTT J1237327+143535 has a similar absolute magnitude and effective radius as the faint and low-mass end of that sample (right panel, Fig 2)[1]. The closest Local Group analogous to our almost-dark galaxy are the And XXI and And XXIII satellites of Andromeda. Finding by chance an analog to the satellites And XXI and And XXIII in the Virgo Cluster suggests the existence of a significant population of extremely faint and low-mass galaxies beyond the Local Group. This population remains undetected due to the current survey surface brightness limits. Dedicated search in optical surveys such as the LBT Imaging of Galactic Halos and Tidal Structures survey (Trujillo et al. 2021 and Zaritsky et al. 2024), the NGVS survey (Ferrarese et al. 2012), Euclid (Euclid Collaboration et al. 2025), Vera Rubin Legacy Survey of Space and Time (LSST) (Ivezić et al. 2019) and Roman Space Telescope (Montes et al. 2023) will certainly reveal more about this very faint population.

5. Conclusions

In this letter, we report the discovery of the almost-dark galaxy TTT J1237327+143535 in the Virgo cluster. This galaxy has an extremely low central surface brightness, of 28 mag arcsec^{-2} in the g'-band, an effective radius of 1 kpc, and a total stellar mass of 2×10^6 M$_\odot$. These properties make TTT J1237327+143535 remarkable in comparison to dwarfs and UDGs beyond the Local Group and in the Virgo Cluster. The galaxy is similar to the two satellite galaxies And XXI and And XXIII in the Local Group.

The serendipitous discovery of TTT J1237327+143535 suggests that there are more objects with similar properties at distances beyond the Local Group. Upcoming surveys with wide-area coverage and similar depth will potentially detect many more almost-dark galaxies. Finding more galaxies of this type can help answer how galaxies form and evolve under extreme physical conditions.

Acknowledgements. Co-funded by the European Union (MSCA Doctoral Network EDUCADO, GA 101119830, Widening Participation, ExGal-Twin, GA 101158446, and UNDARK, GA 101159929). MNL thanks Betsey Adams, Javier Roman, and Dennis Zaritsky for helpful discussions. IT and ICR acknowledge grant PID2022-140869NB-I00 and IAC project P/302302, financed by MCIN. J acknowledges the Alexander von Humboldt Foundation through a Humboldt Research Fellowship. MM acknowledges grants RYC2022-036949-I financed by the MICIU/AEI/10.13039/501100011033 and by ESF+, and program Unidad de Excelencia María de Maeztu CEX2020-001058-M, financed by MCIN/AEI/10.13039/501100011033, and by the MaX-CSIC Excellence Award MaX4-SOMMA-ICE. JHK acknowledges grants PID2022-136505NB-I00, funded by MCIN/AEI/10.13039/501100011033 and EU, ERDF. This work is part of grant CEX2025-001609-S, awarded to the IAC under the Severo Ochoa Centre of Excellence program and funded by MICIU/AEI/10.13039/501100011033. The research utilized Observing Time Rights and Indefeasible Computer Rights in the PEI "GALAXDIF25", with storage and computing capacity at ASTRO POC's EDGE, in collaboration with Hewlett Packard Enterprise and VAST DATA.

References

Alarcon, M. R., Licandro, J., Serra-Ricart, M., et al. 2023, PASP, 135, 055001
Anand, G. S., Tully, R. B., Cohen, Y., et al. 2025, ApJ, 982, 26
Bakos, J., Trujillo, I., & Pohlen, M. 2008, ApJ, 683, L103
Boselli, A., Fossati, M., Ferrarese, L., et al. 2018, A&A, 614, A56
Bradley, L., Sipőcz, B. M., Robitaille, T. P., et al. 2026, Photutils
Carlsten, S. G., Greene, J. E., Greco, J. P., Beaton, R. L., & Kado-Fong, E. 2021, ApJ, 922, 267
Dey, A., Schlegel, D. J., Lang, D., et al. 2019, AJ, 157, 168
Euclid Collaboration, Mellier, Y., Abdurro'uf, et al. 2025, A&A, 697, A1
Ferrarese, L., Côté, P., Cuillandre, J.-C., et al. 2012, ApJS, 200, 4
Ferrarese, L., Côté, P., MacArthur, L. A., et al. 2020, ApJ, 890, 128
Fliri, J. & Trujillo, I. 2016, MNRAS, 456, 1359
Giovanelli, R., Haynes, M. P., Kent, B. R., et al. 2007, AJ, 133, 2569
Hashem Faezi, M., Peletier, R., & Wilkinson, M. H. F. 2024, IEEE Access, 12, 72288
Infante-Sainz, R. & Akhlaghi, M. 2024, Research Notes of the American Astronomical Society, 8, 10
Ivezić, Ž., Kahn, S. M., Tyson, J. A., et al. 2019, ApJ, 873, 111
Junais, Boissier, S., Boselli, A., et al. 2022, A&A, 667, A76
Junais, Ruiz Cejudo, I., Guerra Arencibia, S., et al. 2025, A&A, 702, A136
Kroupa, P. 2001, MNRAS, 322, 231
Lim, S., Côté, P., Peng, E. W., et al. 2020, ApJ, 899, 69
McConnachie, A. W. 2012, The Astronomical Journal, 144, 4
Mihos, J. C., Durrell, P. R., Ferrarese, L., et al. 2015, ApJ, 809, L21
Mihos, J. C., Harding, P., Feldmeier, J. J., et al. 2017, ApJ, 834, 16
Montes, M., Annibali, F., Bellazzini, M., et al. 2023, arXiv e-prints, arXiv:2306.09414
Montes, M., Trujillo, I., Karunakaran, A., et al. 2024, A&A, 681, A15
Muñoz, R. P., Puzia, T. H., Lançon, A., et al. 2014, ApJS, 210, 4
Peng, C. Y., Ho, L. C., Impey, C. D., & Rix, H.-W. 2010, AJ, 139, 2097
Rey, M. P., Taylor, E., Gray, E. I., et al. 2025, MNRAS, 541, 1195
Roediger, J. C. & Courteau, S. 2015, Monthly Notices of the Royal Astronomical Society, 452, 3209
Román, J., Castilla, A., & Pascual-Granado, J. 2021, A&A, 656, A44
Sales, L. V., Wetzel, A., & Fattahi, A. 2022, Nature Astronomy, 6, 897
Schlafly, E. F. & Finkbeiner, D. P. 2011, ApJ, 737, 103
Schlegel, D. J., Finkbeiner, D. P., & Davis, M. 1998, ApJ, 500, 525
Trujillo, I., D'Onofrio, M., Zaritsky, D., et al. 2021, A&A, 654, A40
van Dokkum, P. G., Abraham, R., Merritt, A., et al. 2015, ApJ, 798, L45
York, D. G., Adelman, J., Anderson, Jr., J. E., et al. 2000, AJ, 120, 1579
Zaritsky, D., Donnerstein, R., Dey, A., et al. 2023, ApJS, 267, 27
Zaritsky, D., Golini, G., Donnerstein, R., et al. 2024, AJ, 168, 69

[1] V-band magnitude is converted from g', r' via $V = g' - 0.5784(g' - r') - 0.0038$, following https://classic.sdss.org/dr4/algorithms/sdssUBVRITransform.php#Lupton2005.

Appendix A: GALFIT and surface brightness profile

We use GALFIT to fit g'-band images and find the effective radius, position angle, ellipticity, and Sérsic index of the almost-dark galaxy TTT J1237327+143535 (Fig A.1) and its neighbour SMDG J1237307+143906 (Fig A.2). Because the g'-band is deeper than the r'-band, we report g'-band values; r'-band values are consistent within error bars. Properties are summarized in TabA.1.

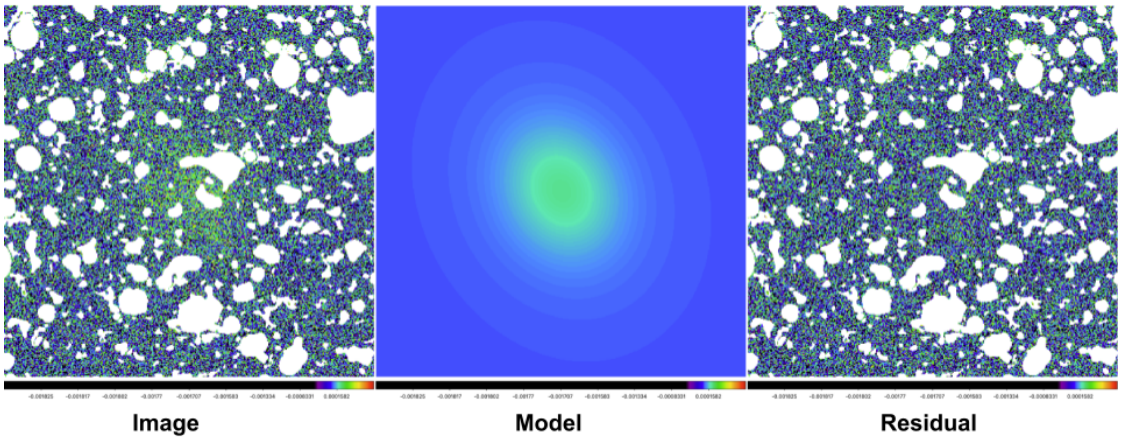


Fig. A.1: The almost-dark galaxy TTT J1237327+143535 in g'-band (left), model in GALFIT (center), and the residual (right).

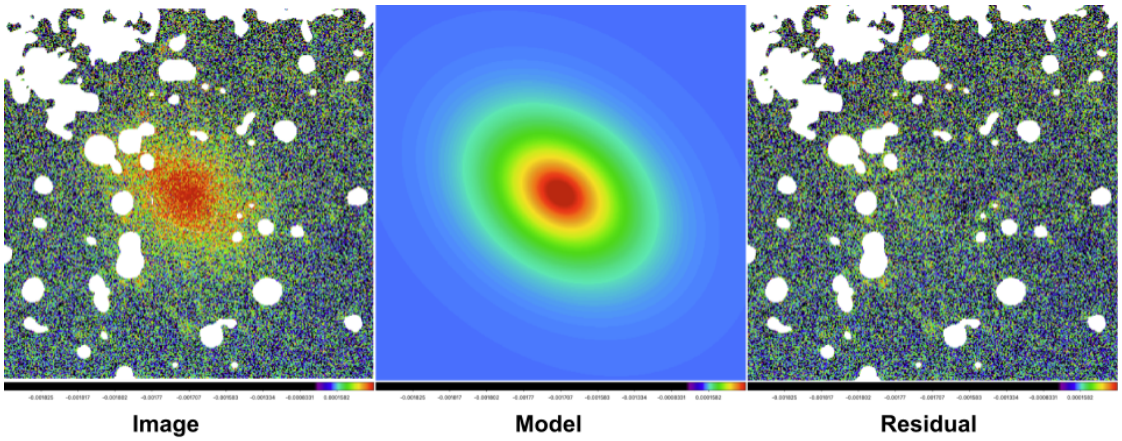


Fig. A.2: The UDG neighbour SMDG J1237307+143906 in g'-band (left), model in GALFIT (center), and the residual (right).

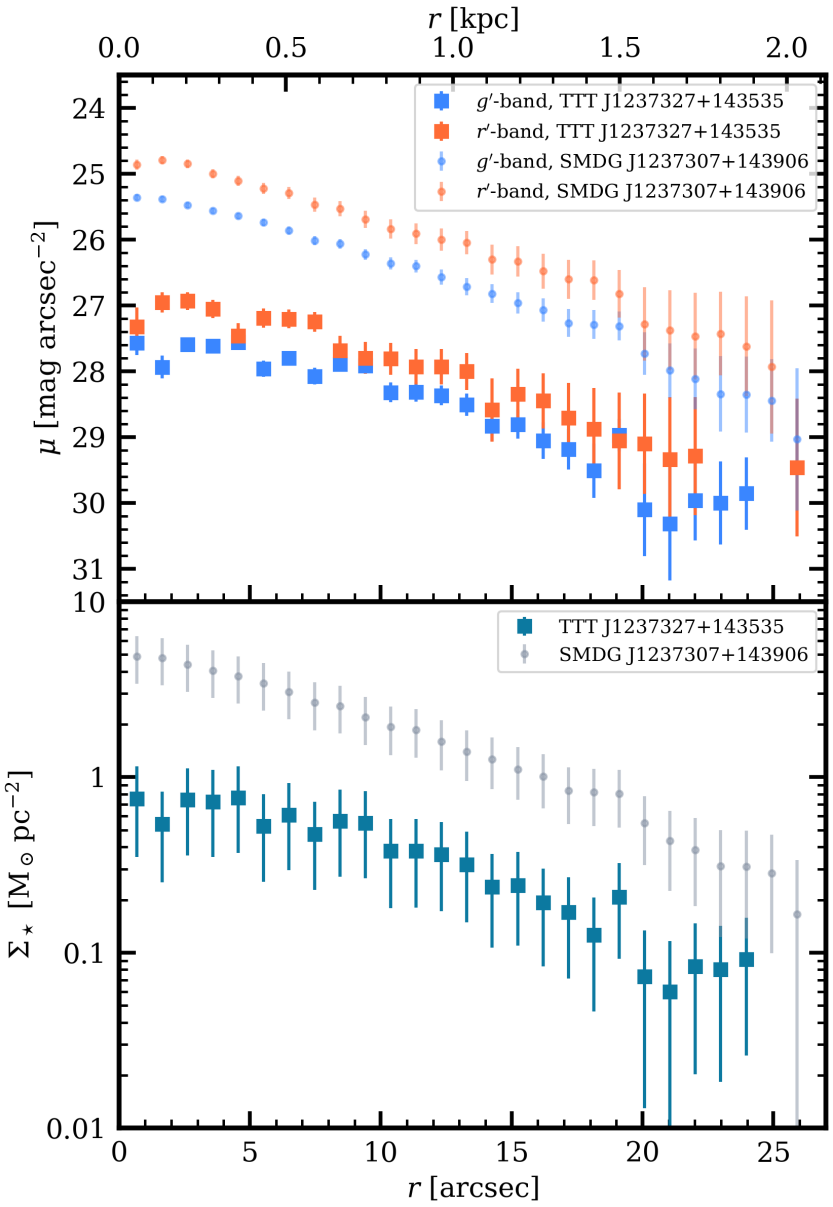


Fig. A.3: **Top panel:** Surface brightness profiles in g'-band (blue) and r'-band (orange) of the almost-dark galaxy TTT J1237327+143535 (squares), compared to its UDG neighbour SMDG J1237307+143906 (circles). The surface brightness profiles are corrected of Galactic extinction. **Bottom panel:** Surface mass density profiles of the almost-dark galaxy (squares) and its UDG neighbour (circles).

Table A.1: Properties[(a)] of the almost-dark galaxy TTT J1237327+143535 and its neighbour SMDG J1237307+143906

	TTT J1237327+143535	SMDG J1237307+143906	SMDG J1237307+143906 [(b)]
RA [°]	189.3861	189.3779	189.3779
DEC [°]	14.5932	14.6517	14.6517
r_e [″]	11.9 ± 0.5	12.2 ± 0.1	$12.99^{+3.25}_{-0.52}$
r_e [kpc]	0.93 ± 0.04	0.96 ± 0.01	–
n	0.54 ± 0.03	0.75 ± 0.01	$0.85^{+0.17}_{-0.04}$
b/a	0.81 ± 0.03	0.74 ± 0.01	0.76 ± 0.04
PA [°]	26.2 ± 6.5	53.1 ± 0.9	43.5 ± 5.77
$\mu_{0,g}$ [mag arcsec^{-2}]	27.88 ± 0.15	25.36 ± 0.02	$25.31^{+0.05}_{-0.23}$
$\mu_{0,r}$ [mag arcsec^{-2}]	26.93 ± 0.11	24.80 ± 0.03	$24.70^{+0.05}_{-0.23}$
$\langle\mu_g\rangle_e$ [mag arcsec^{-2}]	28.14 ± 0.11	26.08 ± 0.02	–
$\langle\mu_r\rangle_e$ [mag arcsec^{-2}]	27.52 ± 0.11	25.44 ± 0.02	–
$(g'-r')_0$ [(c)]	0.60 ± 0.10	0.58 ± 0.04	–
g [mag]	21.07 ± 0.04	19.06 ± 0.01	$18.91^{+0.05}_{-0.41}$
r [mag]	20.43 ± 0.04	18.40 ± 0.01	$18.30^{+0.05}_{-0.36}$
$M_\star$ [$M_\odot$]	$(2.16 \pm 0.38) \times 10^6$	$(1.02 \pm 0.10) \times 10^7$	–

Notes. [(a)] The effective radius r_e, Sérsic index n, axis ratio b/a, position angle PA, and total magnitude in both bands are from the fit results using GALFIT. The central and mean effective surface brightness values are corrected for Galactic extinction. [(b)] Results by Zaritsky et al. (2023) using data from DECaLS, show consistency with our measurements of SMDG J1237307+143906. [(c)] Median Galactic extinction correct $(g'-r')_0$ colour within r_e of the galaxies and bootstrap errors.