Star-Forming Regions in Dwarf Galaxies of the Local Volume

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We present the H$\alpha$ flux measurements for 44 nearby dwarf galaxies, derived from the observations at the 6-m BTA telescope. H$\alpha$ fluxes were used to determine the rate of integral star formation of galaxies, SFR. For the observed galaxies the value of log SFR lies in the range from 0 to $-8 \ [M_\odot/yr]$. The specific star formation rate for all the sample galaxies does not exceed the limit of log SSFR = $-9.2 \ [yr^{-1}]$. A burst of star formation was detected in the center of a nearby dwarf galaxy UGC 2172.

1. INTRODUCTION

Over the past 10 years, the 6-meter BTA telescope of the Special Astrophysical Observatory has imaged 300 galaxies of the Local Volume with distances $D \sim 10$ Mpc in the Balmer H$\alpha$ line. This number greatly exceeds the total number of H$\alpha$ images of nearby galaxies, acquired at other observatories. The results of our observations are published in a series of papers [1–7]. Well-exposed H$\alpha$ images of nearby galaxies give an overview of the structure of star forming regions with the characteristic linear resolution of the order of 10–30 pc and determine the integral rate of star formation in the timeline of about 10 Myr. A comparison of the pattern of star-forming regions, where the young stars are concentrated, with the distribution of neutral hydrogen provides an opportunity to determine more accurately the conditions required for the conversion of gas into stars.

It should be emphasized that about 75% of the Local Volume population are dwarf galaxies, where chaotic turbulent motions dominate over the ordered Keplerian motions typical for massive spirals. The depth of the potential well in dwarf galaxies is not large and velocities of about 50 km/s can exceed the parabolic escape velocity which also imposes an imprint on the features of star formation in dwarf systems. Because of the shallow depth of the potential well, many dwarf galaxies easily lose their gas component, passing through the dense regions of the halo of massive neighbors. This makes them sensitive indicators of the dynamical and physical conditions in galaxy groups of different multiplicity.

The summary of observational data on the star formation rate in approximately 600 Local Volume galaxies was presented in the Updated Nearby Galaxy Catalog [8], and a collection of H$\alpha$ images of nearby galaxies is contained in the Local Volume Galaxy Database [9] at the website http://www.sao.ru/1vlvgdb. In this paper, we present the H$\alpha$ images and SFR estimates for other 44 Local Volume galaxies, which (except for three) are dwarf objects with the absolute magnitudes $M_B$ fainter than $-17^m$.

2. OBSERVATIONS AND DATA REDUCTION

The images of galaxies in the line of H$\alpha$ and in the nearby continuum were made from October 2008 to December 2012 with a typical seeing of
The observations were performed in the primary focus of the 6-m BTA telescope with the SCORPIO focal reducer [10] equipped with a CCD chip 2048 × 2048 px in the 2 × 2 binning mode. With the scale of 0′′185 per pixel, the CCD provides a field of view sized 6′1 × 6′1. The images in Hα + [N II] are obtained through a narrow-band interference filter with bandwidth $\Delta \lambda = 75$ Å and $\lambda_{\text{eff}} = 6555$ Å. For the images in the continuum, we used medium-bandwidth filters SED 607 with $\Delta \lambda = 167$ Å, $\lambda_{\text{eff}} = 6063$ Å and SED 707 with $\Delta \lambda = 707$ Å, $\lambda_{\text{eff}} = 7036$ Å. Typical exposure time was $2 \times 600$ s in Hα and $2 \times 300$ s in the continuum. Given a small range of line-of-sight velocities of galaxies, $V \leq 600$ km/s, we managed with the same Hα filter.

We used a standard procedure of data reduction. The original images had bias subtracted and then flat-field corrected. After the removal of traces of cosmic ray particles and sky background subtraction, the images for each object were combined. Finally, all the images in the continuum were normalized to the Hα image using 7–20 field stars and then subtracted. From the continuum-subtracted Hα images, we have measured the integral Hα fluxes of galaxies using the images of the spectrophotometric standard stars [11], which were taken at the same nights as the objects. The formal measurement accuracy of the integral fluxes was about 10%.

3. RESULTS OF OBSERVATIONS

The Appendix shows a mosaic of images of 44 galaxies we have observed. The left-hand side images in each pair represent the total exposure in the Hα line and in the continuum, and the right-hand side images correspond to the “Hα–continuum” difference. The lower corners of right-hand side images specify the angular scale and orientation “North–East.”

After the subtraction of the continuum, many images in the line of Hα reveal the “stubs” of stars, caused by the difference in seeing, as well as the saturation effect in bright stars or abnormal color indices in some stars. This limits the accuracy of finding the integral Hα flux of galaxies, especially in the objects of low surface brightness or in the galaxies located at low galactic latitudes, where the Galactic background stars abound.

For each galaxy represented in the mosaic (see the Appendix), we identified the integral flux in the line of Hα or its upper limit in the units of erg/(cm$^2$ s). The observed $F_{\text{H}\alpha}$ flux, corrected for the extinction of light in the Galaxy according to [12], was used to estimate the integral SFR, following the relation of Kennicutt [13]

$$\log \text{SFR} = \log F_{\text{H}\alpha} + 2 \log D + 8.98.$$  

Here $D$ is the distance to the galaxy in Mpc, and the SFR value is expressed in units of $M_\odot$/yr.

We neglected the internal absorption in the dwarf galaxy itself as well as the contribution from the nearby Hα emission doublet [N II], since both of these effects are small for the galaxies of low luminosities [14, 15].

An overview of data on the galaxies we observed is presented in the table. Its columns contain: (1) the name of the galaxy; (2) equatorial coordinates for the epoch J2000.0; (3)–(5) integral apparent magnitude, morphological type, and the distance (Mpc), according to the UNGC catalog [8]; (6), (7) the logarithm of the observed flux in the lines of Hα + [N II] and its measurement error; (8) the logarithm of the integral SFR; (9), (10) dimensionless parameters $P = \log(SFR \times T_0/M_\star)$ and $F = \log(1.85 M_{\text{H}1}/SFR \times T_0)$, which characterise the evolutionary status of the galaxy, having a stellar mass $M_\star$ and hydrogen mass $M_{\text{H}1}$, at the cosmic timescale of $T_0 = 13.7 \times 10^9$ yrs; the values of $M_\star$ and $M_{\text{H}1}$ are adopted from the UNGC catalog [8]. The three last columns of the table list the values of $\log F_{\text{H}\alpha}$ and $\log \text{SFR}_{\text{H}\alpha}$ from the summary of [16], determined by other authors. For comparison, the last column of our table shows the SFR estimates obtained in [17] from the ultraviolet flux (FUV) measured by the GALEX space telescope [18].

4. FEATURES OF SOME OBSERVED GALAXIES

As we can see from the table, about 3/4 of this sample are irregular dwarf galaxies of Ir, Im ($T = 10,9$) types and blue compact BCD galaxies ($T = 9$). The
## Parameters of 44 nearby dwarf galaxies

| Name       | J2000.0        | $B_t$  | $T$  | $D$  | log $F_{\text{obs}}$ | Err  | log SFR | P   | F   | log $F_{\text{hit}}$ | log SFR$_{H\alpha}$ | log SFR$_{FUV}$ |
|------------|----------------|--------|------|------|--------------------|------|---------|-----|-----|---------------------|--------------------|------------------|
| UGC 12894  | 000022.5+392944 | 16.80  | 10   | 8.5  | $-13.23 \pm 0.01$  | $-2.29$ | 0.27    | 0.35 | $-13.42 \pm 0.03$  | $-2.48$           | $-2.03$          |
| AGC 748778 | 000634.4+153039 | 18.90  | 10   | 5.4  | $-15.27 \pm 0.24$  | $-4.76$ | $-0.90$ | 1.41 | $-12.19 \pm 0.04$  | $-1.91$           | $-1.89$          |
| UGC 00064  | 000744.0+405232 | 15.50  | 10   | 9.6  | $-12.52 \pm 0.01$  | $-1.51$ | 0.47    | 0.22 | $-12.73 \pm 0.06$  | $-1.74$           | $-1.67$          |
| UGC 1561   | 020405.0+241228 | 14.51  | 9    | 7.2  | $-12.88 \pm 0.01$  | $-1.89$ | $-0.28$ | $-0.13$ | $-12.90 \pm 0.04$ | $-1.91$           | $-1.89$          |
| DDO 019    | 022500.2+360216 | 15.80  | 10   | 9.3  | $-12.83 \pm 0.01$  | $-1.84$ | 0.28    | 0.30 | $-12.73 \pm 0.06$  | $-1.74$           | $-1.67$          |
| Halogas    | 022720.0+335730 | 18.00  | 10   | 9.3  | $-13.80 \pm 0.02$  | $-2.81$ | 0.20    | 0.07 | $-12.92 \pm 0.05$  | $-1.40$           | $-1.33$          |
| DDO 025    | 023318.2+332928 | 13.96  | 8    | 9.3  | $-12.69 \pm 0.01$  | $-1.69$ | $-0.42$ | 0.23 | $-12.41 \pm 0.05$  | $-1.50$           | $-1.50$          |
| DDO 024    | 023343.0+403141 | 13.68  | 8    | 9.8  | $-12.59 \pm 0.01$  | $-1.58$ | $-0.40$ | 0.44 | $-12.51 \pm 0.11$  | $-1.50$           | $-1.50$          |
| UGC 02172  | 024210.8+432119 | 14.60  | 10   | 9.3  | $-11.95 \pm 0.01$  | $-0.94$ | 0.88    | $-1.05$ | $-12.91 \pm 0.05$ | $-1.40$           | $-1.33$          |
| KKH 22     | 034456.6+720532 | 18.00  | 10   | 3.5  | $-15.25 \pm 0.14$  | $< -4.82$ | $< -1.49$ | $> 1.42$ | $-12.92 \pm 0.05$ | $-1.50$           | $-1.50$          |
| UGC 03501  | 063838.4+491530 | 16.70  | 10   | 15.5 | $-13.73 \pm 0.02$  | $-2.26$ | $-0.28$ | 0.71 | $-12.82 \pm 0.05$  | $-1.50$           | $-1.50$          |
| KKH 38     | 064754.9+473050 | 17.40  | 10   | 19.3 | $-13.58 \pm 0.23$  | $-1.95$ | 0.16    | 0.82 | $-12.82 \pm 0.05$  | $-1.50$           | $-1.50$          |
| HIZSS 003 B| 070024.7−041318 | 18.00  | 10   | 1.6  | $-13.52 \pm 0.01$  | $-3.09$ | $-0.32$ | 0.48 | $-13.66 \pm 0.08$  | $-3.23$           | $-3.23$          |
| HIZSS 003 A| 070029.3−041230 | 19.00  | 10   | 1.6  | $-14.60 \pm 0.09$  | $-4.17$ | $-1.40$ | 1.55 | $-12.82 \pm 0.05$  | $-1.50$           | $-1.50$          |
| AGC 174585 | 073610.3+095911 | 17.90  | 10   | 6.1  | $-14.17 \pm 0.03$  | $-3.58$ | $-0.18$ | 0.40 | $-12.82 \pm 0.05$  | $-1.50$           | $-1.50$          |
| KKH 40     | 074656.4+511746 | 16.60  | 10   | 7.0  | $-13.38 \pm 0.02$  | $-2.66$ | 0.07    | 0.27 | $-12.82 \pm 0.05$  | $-1.50$           | $-1.50$          |
| AGC 174605 | 075021.7+074740 | 18.00  | 10   | 6.0  | $-14.53 \pm 0.05$  | $-3.97$ | $-0.49$ | 0.86 | $-12.82 \pm 0.05$  | $-1.50$           | $-1.50$          |
| NGC 2541   | 081440.1+490342 | 12.26  | 7    | 12.4 | $-11.56 \pm 0.01$  | $-0.28$ | 0.37    | $-0.06$ | $-11.68 \pm 0.02$ | $-0.41$           | $+0.09$          |
| UMa II     | 085130.0+630748 | 14.80  | $-2$ | 0.0  | $< -15.23 \pm 0.14$ | $< -3.22$ | $> 2.10$ | $-1.50$ | $-12.82 \pm 0.05$ | $-1.50$           | $-1.50$          |
| UGC 04787  | 090734.9+331636 | 14.60  | 8    | 20.3 | $-12.86 \pm 0.01$  | $-1.19$ | $-0.32$ | 0.16 | $-12.82 \pm 0.07$  | $-1.15$           | $-0.82$          |
| LV J 0913+1937 | 091339.0+193708 | 17.40  | 10   | 4.4  | $-13.58 \pm 0.04$  | $-3.26$ | 0.21    | $-0.14$ | $-12.82 \pm 0.05$ | $-1.50$           | $-1.50$          |
| UGC 04879  | 091602.2+525024 | 13.80  | 9    | 1.3  | $-13.60 \pm 0.03$  | $-4.34$ | $-1.19$ | 0.46 | $-13.70 \pm 0.18$  | $-4.44$           | $-3.29$          |
Parameters of 44 nearby dwarf galaxies. (Contd.)

| Name           | J 2000.0 | $B_t$ | $T$   | $D$   | log $F_{\text{obs}}$ | Err   | log SFR | P    | F    | log $F_{\text{lit}}$ | log SFR$_{\text{H\alpha}}$ | log SFR$_{\text{FUV}}$ |
|----------------|----------|-------|-------|-------|----------------------|-------|---------|------|------|----------------------|----------------------------|--------------------------|
| (1)            | (2)      | (3)   | (4)   | (5)   | (6)                  | (7)   | (8)     | (9)  | (10) | (11)                | (12)                       | (13)                     |
| UGC 04932      | 091934.1+510633 | 15.17 | 8     | 20.6  | −13.26 ±0.03         | −1.61 | −0.16   | 0.47 | −   | −                     | −                          | −1.26                    |
| UGC 04998      | 092512.1+682259 | 15.00 | 9     | 8.2   | −13.61 ±0.02         | −2.74 | −1.31   | −0.09 | −13.27 ±0.09 | −2.40                       | −2.55                    |
| NGC 2903-H1-1  | 093039.9+214325 | 18.20 | 10    | 8.9   | −13.84 ±0.02         | −2.93 | 0.28    | −0.51 | −   | −                     | −                          | −3.54                    |
| LV J 1018+4109 | 101822.2+410957 | 18.40 | −1    | 11.1  | < −15.33 ±0.26       | < −4.25 | < −1.82 | −   | −   | < −4.28               |                            |                          |
| NGC 3239       | 102504.9+170949 | 11.73 | 8     | 7.9   | −11.29 ±0.01         | −0.45 | 0.17    | −0.53 | −11.32 ±0.03 | −0.47                       | −0.40                    |
| LeG 06         | 103955.7+135428 | 18.30 | 10    | 10.4  | < −15.36 ±0.26       | < −4.31 | < −1.21 | > 1.30 | −   | −                     | −                          | −3.55                    |
| LeG 19         | 104654.8+124717 | 17.80 | −1    | 10.4  | < −15.34 ±0.28       | < −4.30 | < −2.08 | −   | −   | < −4.43               |                            |                          |
| KDG 078        | 112954.0+522414 | 16.70 | 10    | 8.8   | < −15.35 ±0.25       | < −4.45 | < −1.82 | > 1.33 | −   | −                     | −                          | −4.46                    |
| LV J 1217+4703 | 121710.1+470349 | 18.50 | 10    | 7.8   | < −15.37 ±0.21       | < −4.59 | < −1.12 | > 1.16 | −   | −                     | −                          | −4.89                    |
| KK 138         | 122158.4+281434 | 18.70 | 10    | 6.3   | < −15.26 ±0.23       | −2.82  | −0.10   | 0.15 | −   | −                     | −                          | −2.67                    |
| LV J 1228+4358 | 122844.9+435818 | 14.20 | 10    | 4.0   | < −15.22 ±0.23       | < −5.01 | < −2.70 | −   | −   | < −5.13               |                            |                          |
| KK 152         | 123324.9+332105 | 16.30 | 10    | 6.9   | −13.70 ±0.02         | −3.02  | −0.33   | 0.70 | −   | −                     | −                          | −2.48                    |
| UGCA 292       | 123840.0+324560 | 16.07 | 10    | 3.6   | −12.65 ±0.01         | −2.54  | 0.86    | 0.11 | −12.76 ±0.01 | −2.65                       | −2.59                    |
| BTS 146        | 124002.1+380002 | 17.50 | 10    | 8.5   | −15.47 ±0.11         | −4.62  | −1.63   | 1.72 | −   | −                     | −                          | −3.44                    |
| KDG 192        | 124345.0+535732 | 16.60 | 10    | 7.4   | −13.38 ±0.04         | −2.65  | 0.11    | 0.67 | −   | −                     | −                          | −2.42                    |
| LV J 1243+4127 | 124355.7+412725 | 17.20 | 10    | 6.1   | −15.12 ±0.07         | −4.55  | −1.39   | 1.71 | −   | −                     | −                          | −3.33                    |
| KK 191         | 131339.7+420239 | 18.20 | 10    | 6.0   | < −15.29 ±0.24       | < −4.74 | < −1.16 | > 1.08 | −   | −                     | −                          | −4.96                    |
| KDG 235        | 170025.3+701724 | 16.80 | 10    | 10.6  | −13.80 ±0.06         | −2.74  | −0.25   | 0.74 | −14.45 ±0.19 | −3.39                       | −2.48                    |
| ALFA ZOA       | 195211.8+142824 | 16.90 | 9     | 7.1   | −14.00 ±0.02         | −3.08  | −0.59   | 0.27 | −   | −                     | −                          | −                      |
| KK 258         | 224043.9−304759 | 16.30 | −3    | 2.0   | −14.37 ±0.08         | −4.78  | −1.70   | 0.57 | −   | −                     | −                          | −4.58                    |
| Pisces II      | 225831.0+055709 | 17.20 | −3    | 0.1   | −15.01 ±0.07         | −7.45  | −2.02   | −   | −   | −                     | −                          | −7.56                    |
remaining quarter of the sample accounts for late-type dwarf spirals Sdm, Sm ($T = 7, 8$) and dwarf spheroidal systems ($T < 0$). For the irregular and BCD galaxies the presence of one or several emission knots is typical. In some cases, compact HII-regions are immersed in a diffuse emission environment of various contrast. Some irregular galaxies of low surface brightness (e.g., KKH 22, KDG 78) do not exhibit notable Hα fluxes. Let us describe some of the most interesting objects in the studied sample.

**UGC 2172.** This irregular galaxy with an absolute magnitude of $M_B = -15.69$ is in its starburst activity phase. A bright star is projected to the north-west from its center. The major emission from UGC 2172 is concentrated in its central area, from which the low-contrast arcuate filaments are stretching to the periphery. According to the structure of the emission arcs, this galaxy is similar to a nearby example of a starburst galaxy, NGC 1569.

**HIZSS 03 A+B.** A tight pair of irregular galaxies with the distance between the centers of $1.4$, or $0.7$ kpc. It lies almost exactly in the plane of the Galaxy at the latitude of $b = -0^\circ 1$. Despite the strong extinction, Silva et al. [19] have determined the distance to the pair of $1.67$ Mpc with the tip of the red giant branch method. According to the observations in the line of HI 21 cm [20], the components of the pair are well resolved kinematically and have the radial velocity difference of $35$ km/s. In the western, more compact component, the emission in Hα was for the first time discovered by Massey et al. [21]. Apparently, this pair of dwarf galaxies is the closest representative of a binary system in the phase immediately before the merger.

**NGC 2541.** This late-type ($S_{dm}$) spiral galaxy has the absolute magnitude of $M_B = -18.71$ which makes it the brightest in the considered sample. The Hα image reveals an ensemble of compact star-forming regions organized in a flocculent spiral structure.

**UMa II.** A spheroidal dwarf companion of our Galaxy of extremely low surface brightness, recently discovered by stellar counts [22]. Having an angular diameter of about $25^\prime$, our Hα image of the object could only cover the central region of UMa II.

**NGC 2903-H I-1.** A blue compact satellite of a giant spiral galaxy NGC 2903, discovered within the extragalactic HI Arecibo Legacy Fast ALFA (ALFALFA) survey [23]. With the absolute magnitude of $M_B = -11.68$ it can be considered an intergalactic HII-region on the distant outskirts of the disk of NGC 2903.

**NGC 3239** = **Arp 263** = **VV 095.** An interacting pair of irregular galaxies with two curved tails and powerful star-forming regions. Active state of this exotic system is obviously caused by the ongoing processes of dynamic merging of its components.

**LV J 1228+4358.** A dwarf spheroidal galaxy possessing a very low surface brightness, with structure distorted by the tidal influence of the NGC 4449 galaxy. Found by Karachentsev et al. [24] and studied in detail by Martinez-Delgado [25].

**UGCA 292.** A ragged blue galaxy of low luminosity ($M_B = -11.79$), looming in the shape of an arc over a bright star. UGCA 292 contains a large amount of neutral hydrogen and is cataloged as one of the lowest metallicity objects in the CVn I cloud [26].

**ALFA ZOA J 1952+1428.** A compact blue galaxy in the Zone of Avoidance (ZOA) of the Milky Way, detected in the blind HI survey at Arecibo [27]. Located near the center of the Local Tully Void, it is an extremely isolated object of the Local Volume.

**KK 258 = ESO 468-020.** An isolated dwarf galaxy of intermediate type between dIr and dSph. Our image, taken not far above the technical horizon of the 6-m BTA telescope (Dec $\simeq -31^\circ$), reveals one compact Hα emission near the center of the galaxy.

**Pisces II.** A dwarf ($M_B = -4.4$) spheroidal satellite of our Galaxy, discovered by Belokurov et al. [28]. In the optical contour of this dwarf, there is a possible emission point source, which is likely to be a red star.

5. DISCUSSION AND CONCLUSIONS

Among the 44 galaxies we observed, $F_{H\alpha}$ fluxes for 13 objects were also measured by other authors. Figure 1 shows the relationship between our $F_{H\alpha}$ estimates and literature data. The figure shows that the scatter of values relative to the line of log $F_{H\alpha}(6-m) = \log F_{H\alpha}$ (others) slightly increases with decreasing flux. If we exclude the low surface brightness galaxy KDG 235, for which the Hα flux in [16] is measured with low accuracy, then the mean difference of $\log F_{H\alpha}(6-m) - \log F_{H\alpha}$ (others) will amount to $-0.01 \pm 0.05$, and the standard deviation of the difference will be equal to 0.16. The last value is two times greater.
than the RMS sum of individual flux measurement errors (0.08). It is clear that the hard-to-control transparency variations during the observations, as well as the differences between the methods applied by various authors when taking into account the diffuse components of Hα emission, lead to the twofold difference between the external and internal flux measurement errors.

As follows from the data of the last column of the table, most of the galaxies we observed have their SFRs estimated from the UV fluxes measured by the Galaxy Evolution Explorer satellite (GALEX). A comparison of independent values of log SFR is shown in Fig. 2, where the solid circles correspond to our measurements of the Hα flux, the crosses—to the Hα data of other authors, and open circles represent the upper limit for the observed star formation rate. For the majority of dwarf galaxies, the Hα flux underestimates the SFR value as compared to the FUV flux. This well-known fact was discussed in detail by various authors, in particular in [15] and [17]. According to Pflamm-Altenburg et al. [29], conditions of formation of the most massive stars in dwarf and normal spiral galaxies are somewhat different. An empirical normalization SFR$_{\text{Hα}} \simeq$ SFR$_{\text{FUV}}$, which has been made for the spirals, is not fulfilled for the dwarf systems, and at log SFR $\sim -5$ the scatter of estimates can be more than one order. This feature is also visible in Fig. 2. Note, however, that cases exist (for instance, a blue compact galaxy NGC 2903-H I-1) when the SFR estimate from the Hα flux proved to be greater than that from the FUV flux. It is intriguing that for the extremely faint spheroidal companions of the Milky Way like UMa II and Pisces II, the upper levels of SFR from Hα and FUV fluxes turned out to be close to each other at log SFR $\sim -8$. A similar situation is already noted for the low-mass companions of M 31 and M 81 [7]. In the case of Pisces II, two faint FUV sources and one Hα source fall into the optical path of the galaxy. However, they do not coincide with each other by the coordinates, probably being the artifacts (background stars.

**Figure 1.** Comparison of integral Hα flux estimates with observations at the 6-m telescope and data of other authors.
Figure 2. Comparison of the integral SFR estimates in galaxies obtained from the H\textalpha flux and the flux in the far ultraviolet (FUV). Galaxies with an estimate of the upper limit of SFR are marked with open circles. The crosses denote the SFR values from the H\textalpha flux measured by other authors.

As follows from the diagnostic diagram “Past–Future” (Fig. 3), the majority of objects in our sample are located near the origin \{P = 0, F = 0\}. This means that at the observed SFR, the galaxy has time to reproduce its stellar mass on the cosmological scale \(T_0\), while the gas reserves in it are sufficient to maintain the observed SFR for still another Hubble time \(T_0\). However, there are several galaxies significantly deviating from the majority. As we have noted above, the UGC 2172 galaxy is currently in the state of starburst activity. Its observed SFR is now almost an order of magnitude higher than the average for the given mass, and its gas reserves will be exhausted in time of only about \(T_0/10\). In the case of a metal-poor dIr galaxy UGCA 292, SFR is also very high, but the gas reserves are sufficient to maintain the observed SFR on the entire Hubble timescale. The BCD galaxy UGC 4998...
Figure 3. The diagnostic “Past–Future” diagram for the observed galaxies. The galaxies with the upper SFR limit are shown by open circles.

reveals tiny faint star-forming regions in its central part. In the past, the average star formation rate in UGC 4998 was an order of magnitude more intense than that currently observed.

Analyzing the sample of 627 galaxies of the Local Volume with SFR estimates both from the Hα and FUV fluxes, we noted in [17] that the specific star formation rate (SSFR) per stellar mass unit $\frac{\dot{M}_*}{M_*}$ does not exceed the upper limit of $\log \text{SSFR}_{\text{max}} \simeq -9.4 \, [\text{yr}^{-1}]$ in 99% of the sample objects. Among the 44 galaxies we have considered, there are only two of the most active, UGC 2172 and UGCA 292, which slightly exceed the said limit, having their $\log \text{SSFR}$ of $-9.26$ and $-9.27 \, [\text{yr}^{-1}]$ respectively. However, the error in determining the stellar mass of such faint galaxies by their luminosity can reach up to 50%.

The presence of the maximum (quasi-Eddington) limit for the SSFR is an important parameter that characterizes the process of conversion of gas into stars during the present epoch.

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