Hα- imaging galaxies in the Local Volume

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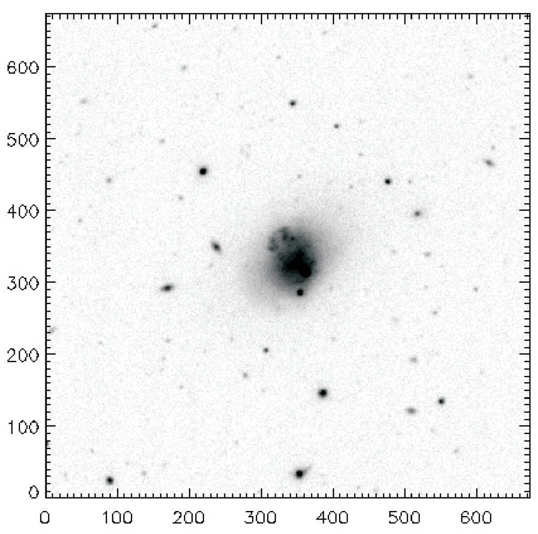
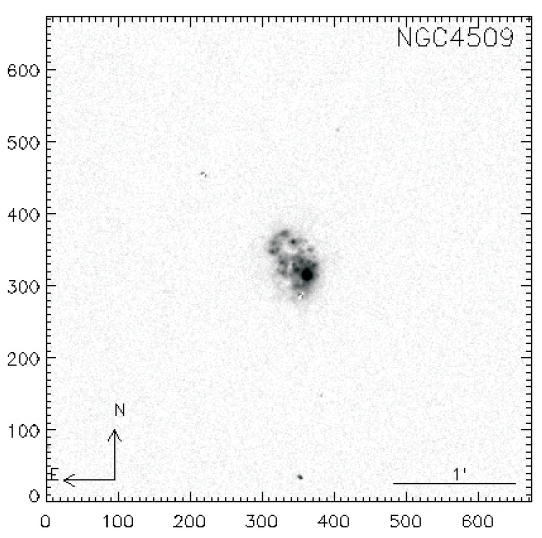
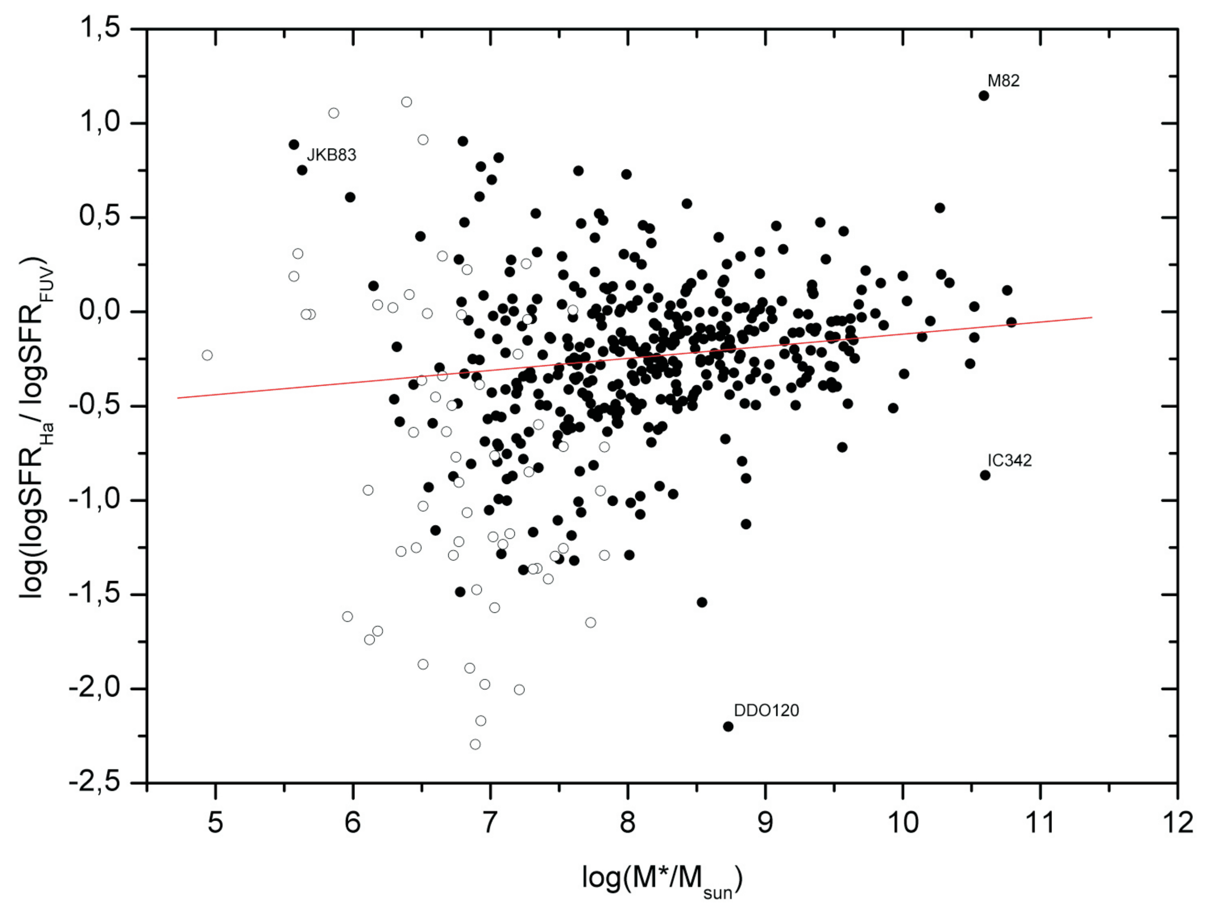
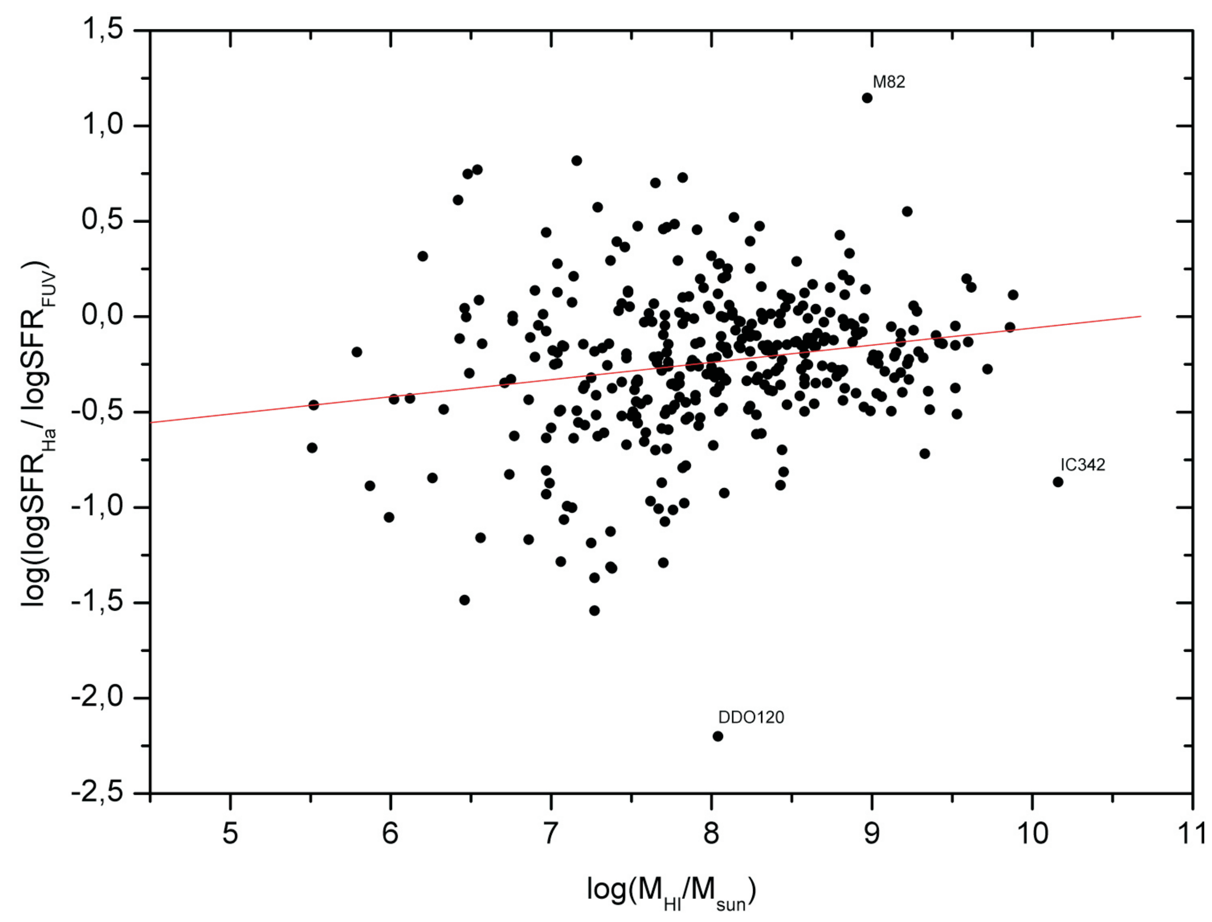
Over the last decade observations of nearby galaxies aimed at determining their star-formation rate (SFR) from Hα emission flux have been carried out at the Special Astrophysical Observatory (SAO) of the RAS. Hα-images for a total of more than 300 nearby galaxies were acquired with the 6-mtelescope of the SAO RAS within the framework of our Hα-survey program. Our survey, combined with other similar surveys, makes up more than 500-object sample of LV galaxies with measured Hα. Most of these galaxies have their ultraviolet fluxes measured with GALEX space telescope, making it possible to estimate the star-formation rates in galaxies on the time scale of about ~100 Myr, which is about one order of magnitude longer than the time interval gauged by star-formation rate estimates based on Hα emission. A comparison of the two star-formation rates, SFR (Hα) and SFR (FUV), makes it possible to reveal starburst on ~10–100 Myr long time-scale.





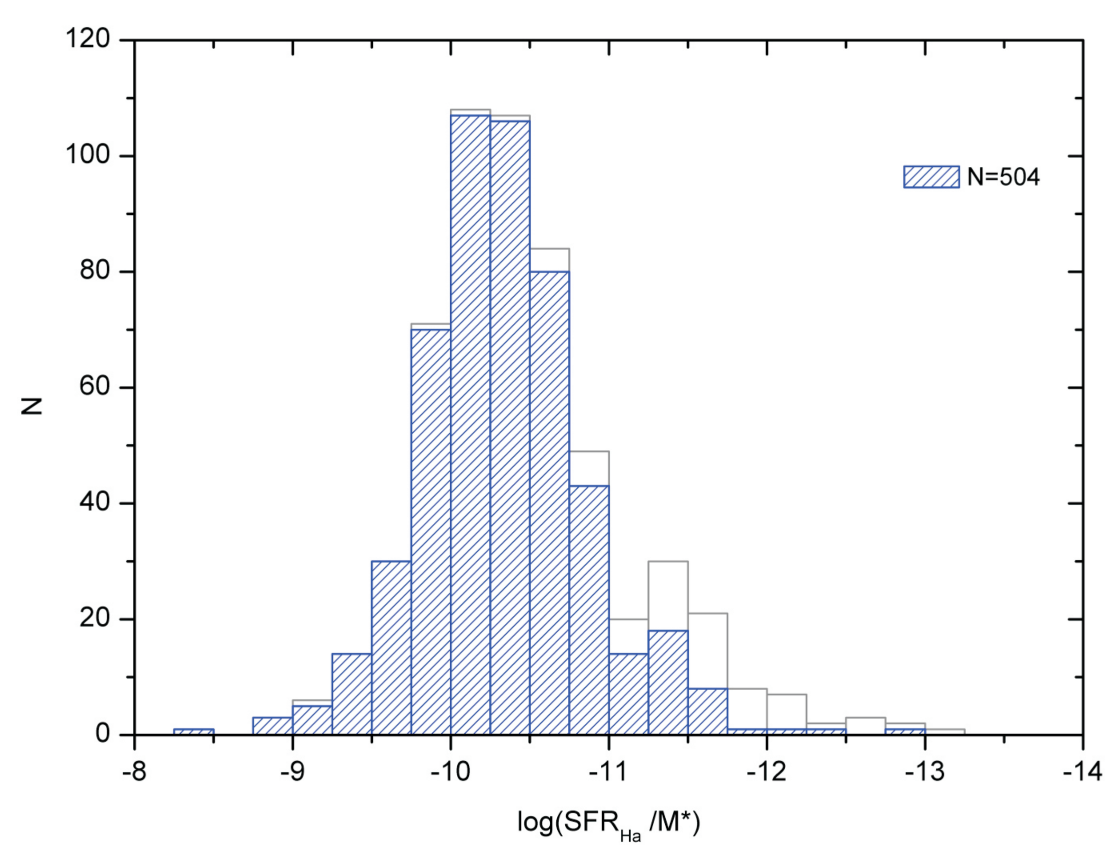


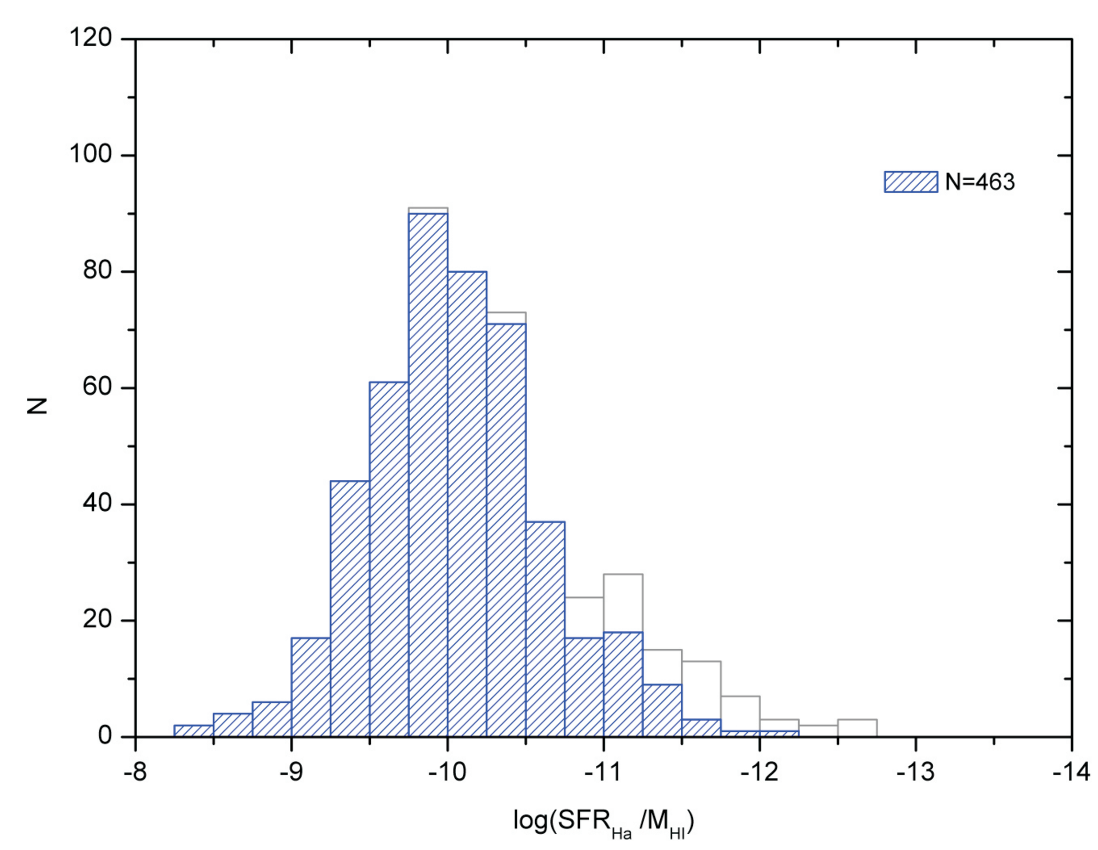
Ratio of Hα-to-FUV star formation rates vs. total stellar mass. Galaxies with measured FUV fluxes , but with the upper limit of the flux in Halpha, are marked by open circles.

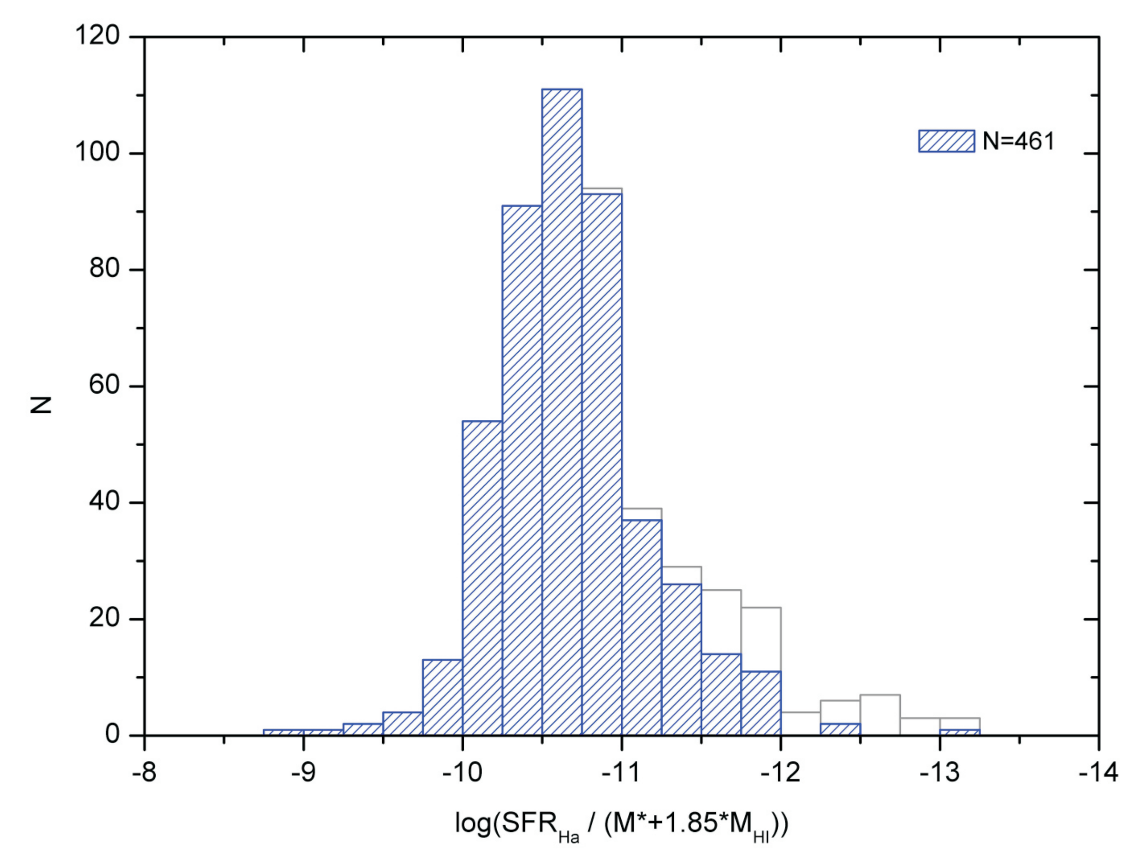


Ratio of Hα-to-FUV star formation rates vs. total hydrogen mass.

As is well known, the integral star-formation rate closely correlates with the luminosity or mass of a galaxy. Therefore, to characterize the process of star formation, the so-called specific star formation rate is usually used, sSFR = SFR/M* per unit of stellar mass. Along with this, the parameter SFE = SFR/MHI showing how quickly the available gas reserves in a galaxy will be used, since both the stellar and gas masses of a galaxy are changing during the evolution. In the evolutionary picture without any external influence, in the so-called "closed box", it is reasonable to introduce a new characteristic: the specific rate of star formation per unit of the baryon mass of the galaxy, bSFR = SFR/(M* + 1.85*MHI). Here, the factor 1.85 takes into account the contribution of helium and molecular hydrogen to the total mass of gas. Distribution of a number of Local Volume galaxies in terms of the parameters: sSFR, SFE, and bSFR is presented in the panels. In each case, SFR was determined from the measured Halpha flux. Galaxies with an upper limit of the H αflow are shown without shading.

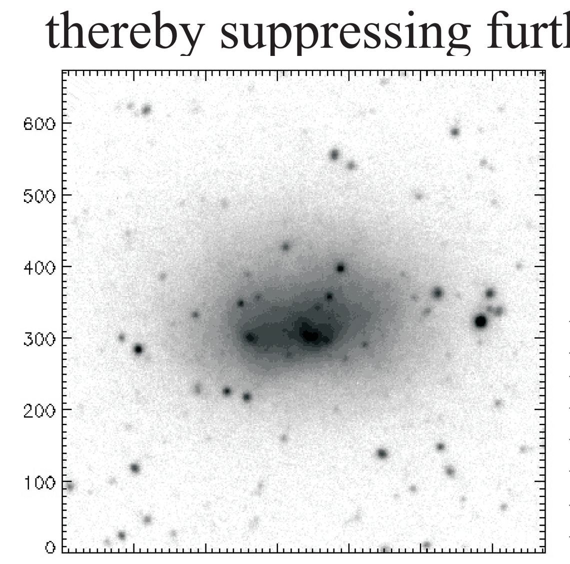


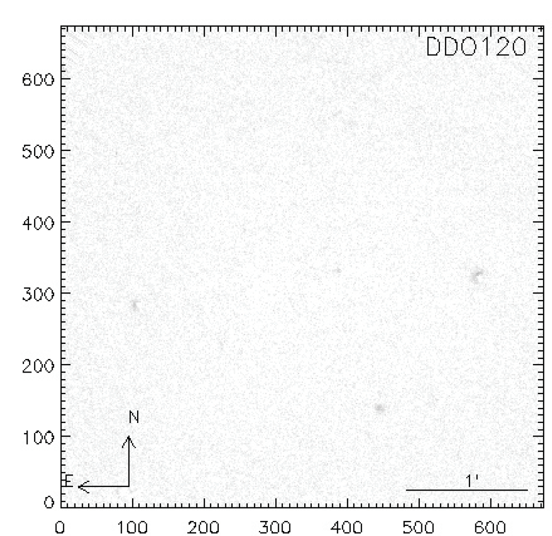


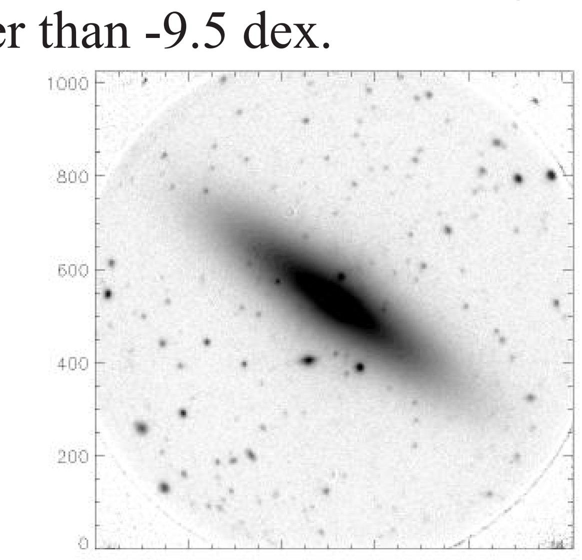


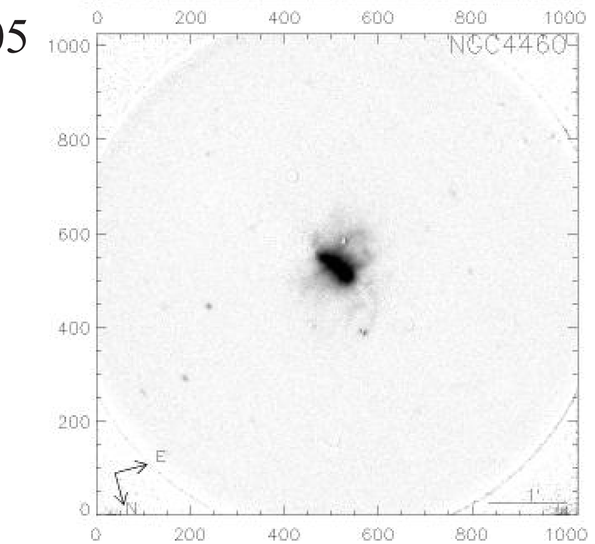
The presented data lead us to conclude that star-formation processes in irregular dwarf galaxies and disks of late-type spiral galaxies have much in common. Most of the Scd-Sc-Sdm galaxies without apparent manifestations of a bulge must have never undergone merging acts over about the last ~10Gyr . Such "virgin" galaxies are characterized by regular, sluggish SFR. Dwarf irregular galaxies have about the same average sSFR, but SFR variations among them are the higher the smaller is the baryonic mass of the dwarf. The SFR and its variations in late-type galaxies are mostly determined by individual parameters of these galaxies and depend little on external influences. However, in the process of the H αsurvey we found a number of interesting objects where star formation appears to be caused by external factors, namely, by the inflow of intergalactic gas (NGC4460).

The distribution of specific star-formation rate per unit baryonic mass, bSFR, for late-type galaxies has a rather well-defined upper limit similar to the Eddington limit for stellar luminosity, which are determined by the presence of hard feedback: a strong burst of star formation in a galaxy exhausts local reserves of neutral gas thereby suppressing further process of the birth of stars. Our sample of 460 galaxies contains only a few galaxies whose bSFR Hα are greater than -9.5 dex.









Publication

Kaisin S.S., Karachentsev I.D., Star Formation in Nearby Dwarf Galaxies, 2019, AstBu, 74, 1
Karachentsev I.D., Kaisin S.S., Kaisina E.I., Extending the Hα Survey for the Local Volume Galaxies, 2015, Ap, 58, 453
Kaisin S.S., Karachentsev I.D., New H αflux measurements in nearby dwarf galaxies, 2014, AstBu, 69, 390
Kaisin S.S., Karachentsev I.D., Star forming regions in dwarf galaxies of the Local Volume, 2013, AstBu, 68, 381
Kaisin S.S., Karachentsev I.D., H αSurvey of low mass satellites of the neighboring galaxies M31 and M81, 2013, Ap, 56, 305
Kaisin S.S., Karachentsev I.D., Ravindranath S., H αsurvey of nearby dwarf galaxies, 2012, MNRAS, 425, 2083
Kaisin S.S., Karachentsev I.D., Kaisina E.I., Survey of H αemission from thirty nearby dwarf galaxies, 2011, Ap, 54, 315
Karachentsev I., Kaisina E., Kaisin S., Makarova L., Emission sparks around M81 and in some dwarf spheroidal galaxies , 2011, MNRAS, 415L, 31
Moiseev A.V., Karachentsev I.D., Kaisin S.S., Ionized gas outflow in the isolated S0 galaxy NGC 4460, 2010, MNRAS, 403, 1849
Karachentsev I.D., Kaisin S.S., More Galaxies in the Local Volume Imaged in H α, 2010, AJ, 140, 1241