Search for evidences of gas accretion onto late-type disc galaxies in void environment: first results

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Abstract

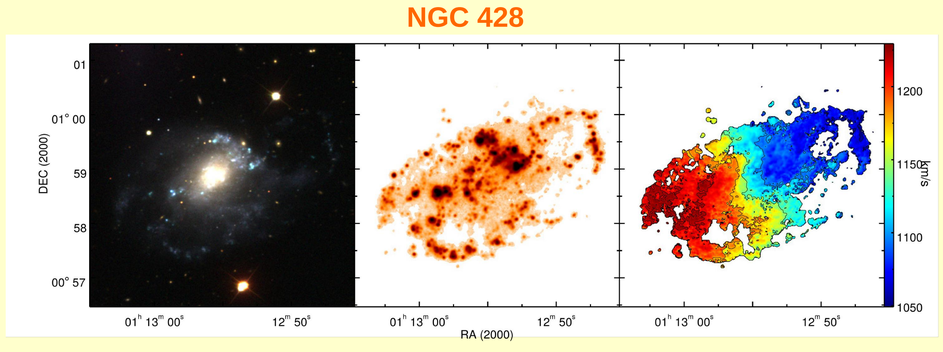
The previously performed study of galaxies residing in low density environment revealed a number of objects which deviate significantly from the “standard” “metallicity-luminosity” relation. These objects, with significantly reduced metallicity for their luminosity, are represented mainly by faint dwarf galaxies. But among such objects there are also a few galaxies of the intermediate luminosity. They appeared to be the late-type galaxies with regions of intense star formation on their periphery. We compiled a sample of such unusual objects for their further investigation. Our hypothesis is that their reduced metallicity along with apparent peculiar morphology might be caused by the accretion of the external gas onto these galaxies. To examine this hypothesis we use Fabry-Perot interferometer data in H-alpha line. Here we present first results of our study.

According to recent studies, the current galaxy evolution is ruled mainly by two processes — the star formation and the accretion of external cold gas onto galaxies. It seems that these two processes are very good fitted to each other. One of the evidences for this is equal and quite small time of gas depletion due to star formation in disk galaxies of different masses. But neither the mechanism of such fine-tuning nor the source of gas accretion is not well understood yet.

The accretion mode should depend on its source. We could suspect that it differs from galaxy to galaxy and depends on the environment and the properties of individual object. So any reliable case of accretion of the external gas onto the galaxy disk would be of great interest.

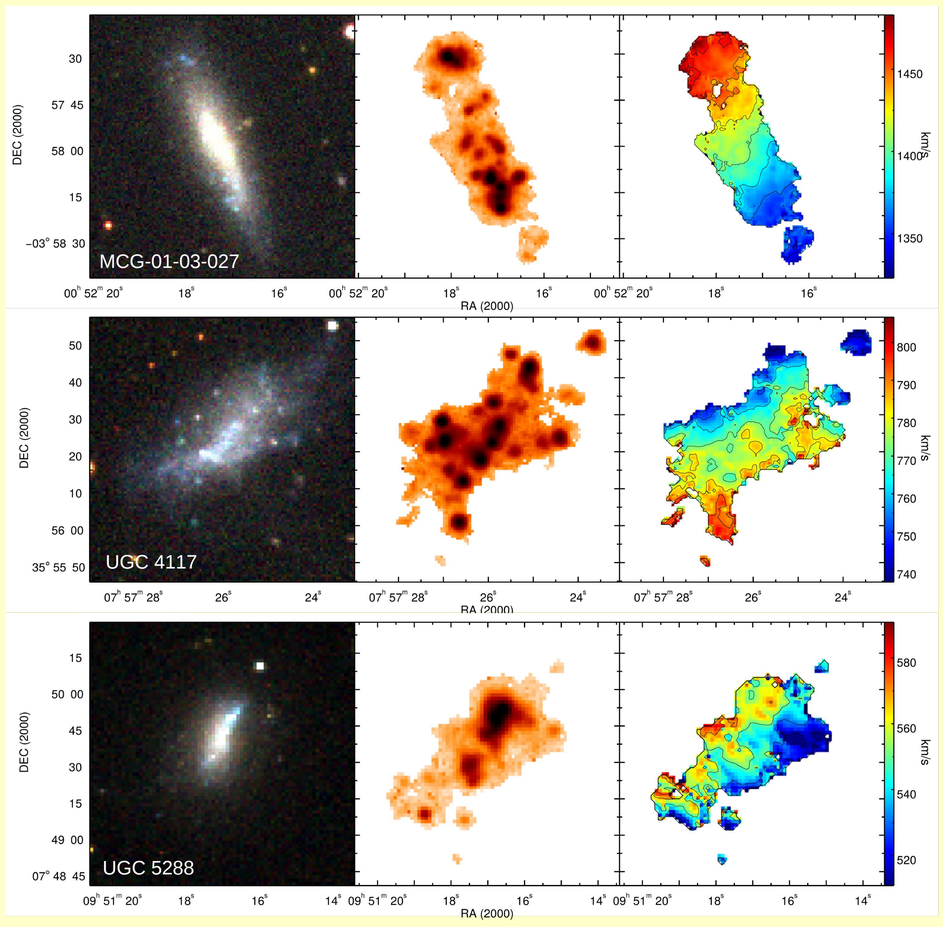
Name	RA	Dec	Vel, km/s	M_B	12+log(O/H)
MCG -01-03-027	$00^h52^m17.2^s$	$-03^o58^m00^s$	1412	-18.0	7.92
NGC 428	$01^h12^m55.7^s$	$+00^o58^m54^s$	1152	-19.0	8.01
UGC 4117	$07^h57^m25.9^s$	$+35^o56^m21^s$	773	-15.5	7.82
NGC 2552	$08^h19^m20.1^s$	$+50^o00^m25^s$	524	-17.5	8.28
UGC 5272	$09^h50^m22.4^s$	$+31^o29^m16^s$	520	-15.7	7.84
UGC 5288	$09^h51^m17.0^s$	$+07^o49^m39^s$	556	-15.6	7.81

NGC 428



The dominant member of loose group. The nearest companion is situated ∼3' north. Velocity field in H-alpha reveals several regions with non-circular motion, which could be caused either by accretion or by SF feedback.

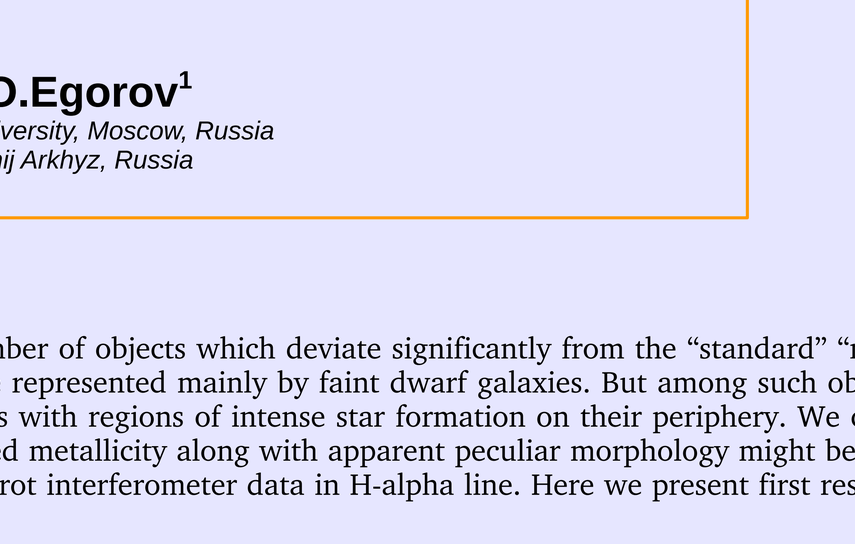
The extremely isolated galaxies MCG-01-03-027, UGC 4117 and UGC 5288



MCG-01-03-027, UGC 4117 and UGC5288 are the good examples of truly isolated galaxies. There are no known companions for these galaxies at this moment.
Velocity field in H-alpha for MCG-01-03-027 does not reveal any significant pecularities, while in UGC 4117 and UGC 5288 we observe misalignments between optical major axis and rotational axis of the ionized gas. These axes are nearly perpendicular to each other for both UGC 4117 and UGC 5288. Such misalignment could be caused by accretion of external gas onto galactic discs.

The sample and observations

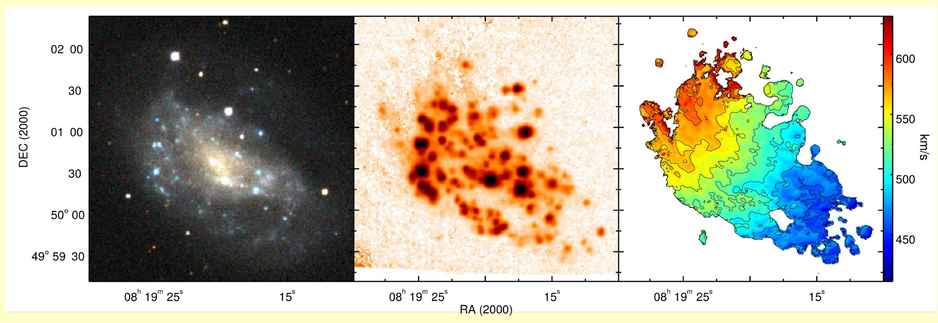
We selected several objects of intermediate luminosity in the Eridanus and Lynx-Cancer voids [1] that show some deviation from the standard «metallicity-luminosity» relation for denser environment [2], and have relatively low metallicity (see Table and Figure below). Some of the objects that don't show significant deviation from the relation were chosen due to their unusual and perturbed appearance. Sample objects are appeared to be late-type galaxies. The anomalously low metallicity in some of them could point to the recent gas accretion. It could be the accretion of unevolved gas from the cosmological filament with near-primordial chemical abundances, or it could be merging with the dwarf satellites. In these cases we may expect that gas kinematics will differ from the regular circular rotation in the main symmetry plane of the disc.



The «luminosity-metallicity» relation for galaxies in the Lynx-Cancer and Eridanus voids. Our sample objects are marked by red circles and triangles.

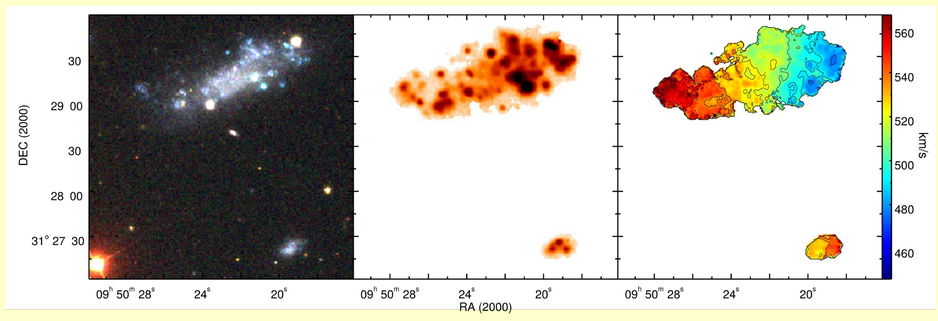
We performed observations of selected objects in 2015-2016 with scanning Fabry-Perot interferometer at the SAO RAS 6m telescope BTA (Russia). The IFP751 interferometer with spectral resolution 0.4A was installed inside the focal reducer SCORPIO-2 [3]. The purpose of our observations was the search for evidences of recent gas accretion onto selected objects — noncoincidence between the rotational axis and the symmetry axis of the stellar disc, noncircular motions and high turbulence.

NGC 2552



NGC 2552 may be a member of loose group. Velocity field in H-alpha reveals some disturbance in north-east part of the galaxy.

UGC 5272 (DDO64)



Tight isolated pair of dwarfs: UGC 5272 and KK 78 [4]. According to [5] these galaxies are connected by an HI bridge. Velocity field in H-alpha is disturbed and reveals clear signs of non-circular motions.

Conclusions

Here we present the first results of our study of the gas accretion onto late-type galaxies in void environment. In most of the sample objects including two galaxies without any known companions we observe non-circular motions that might be caused by accretion of external gas or by tidal disturbance. We will perform further detailed analysis of the velocity fields for these objects. We plan to extend our sample and to complement our data by long-slit observations.

References:

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