

Edge-on thick discs

A. Kasparova¹, I. Katkov¹, I. Chilingarian^{2,1},
O. Silchenko¹, A. Moiseev^{3,1} and S. Borisov^{1,4}

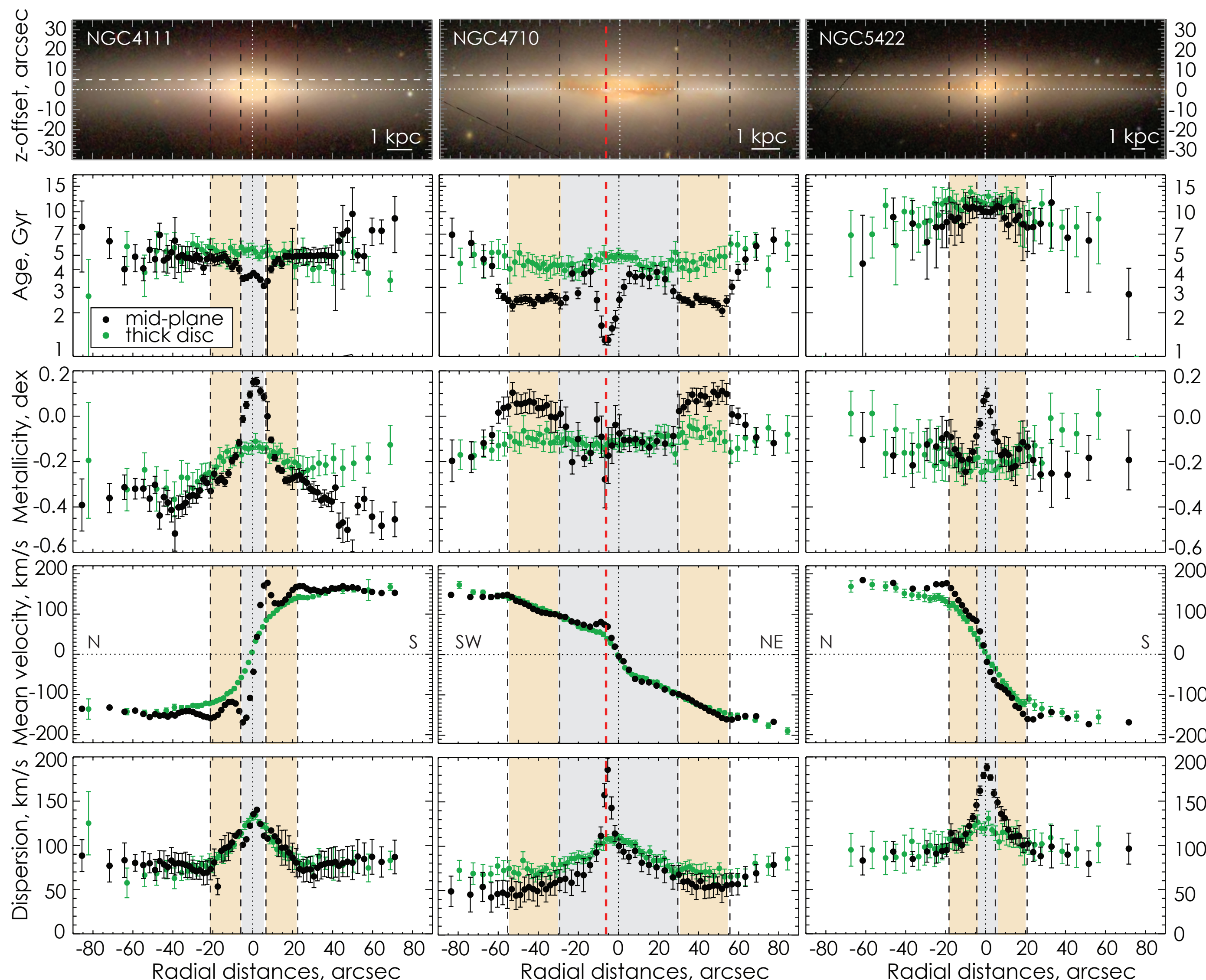
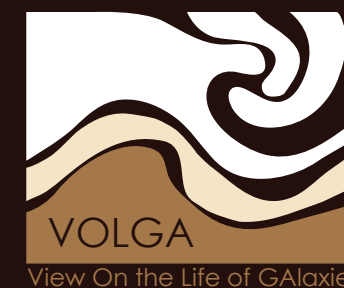
¹Sternberg Astronomical Institute, Moscow M.V. Lomonosov State University

²Smithsonian Astrophysical Observatory, Harvard-Smithsonian Center for Astrophysics

³Special Astrophysical Observatory, Russian Academy of Sciences

⁴Department of Physics, Moscow M.V. Lomonosov State University

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Stellar populations and internal kinematics of three edge-on galaxies. Panels (top to bottom): the slit positions overplotted on SDSS color images, SSP equivalent ages, metallicities, radial velocities and line-of-sight velocity dispersions. Black and green symbols denote mid-planes and thick discs correspondingly.

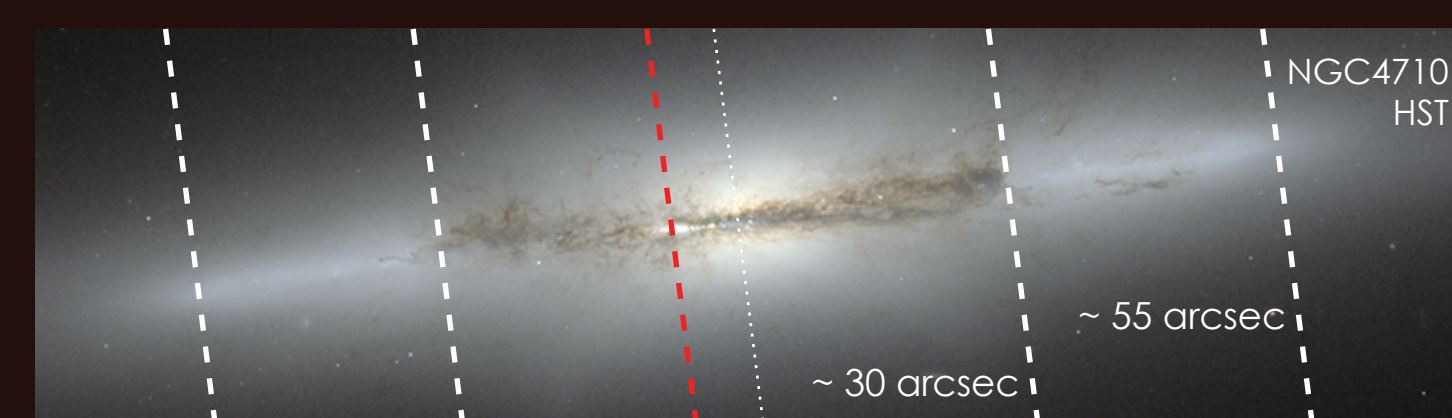
Although thick stellar discs are detected in nearly all edge-on disc galaxies, their formation scenarios still remain a matter of debate. Due to observational difficulties, there is a lack of information about their stellar populations. Using the Russian 6-m telescope BTA we collected deep spectra of thick discs in three edge-on early-type disc galaxies located in different environments: NGC4111 in a dense group, NGC4710 in the Virgo cluster, and NGC5422 in a sparse group. We see intermediate age (4 – 5 Gyr) metal rich ($[\text{Fe}/\text{H}] \sim -0.2 - 0.0$ dex) stellar populations in NGC4111 and NGC4710. On the other hand, NGC5422 does not harbour young stars, its only disc is thick and old (10 Gyr) and its α -element abundance suggests a 1.5 – 2 Gyr long formation epoch implying its formation at high redshift. Our results prove the diversity of thick disc formation scenarios.

Long-slit spectroscopy of the sample galaxies.

NGC	Date	z-offset arcsec/pc	PA deg	Sp. range Å	T _{exp} sec	Seeing arcsec
4111	21/05/09	0/0	150	4825–5500	8400	1.3
4111	24/04/15	5/364	150	3600–7070	5600	1.0
4710	24/04/15	0/0	27.5	3600–7070	3600	1.2
4710	24/04/15	7/560	27.5	3600–7070	7200	1.1
5422	24/04/12	0/0	151.4	3600–7070	3600	2.5
5422	25/04/15	7/1049	151.4	3600–7070	8400	1.5

We present the first results of our observational program on three S0-a galaxies. We are convinced that with the sample expansion, the quality of this data will allow us to draw the general conclusions about the origin of these structures in the different types of galaxies.

Several processes may act simultaneously during the formation of structures that we observe as thick discs. Presently, we see hints about key processes in these galaxies. So, only NGC5422 is consistent with model of the rapid turbulent thick disc formation by Bournaud et al. (2009). But we cannot clearly assess the importance of other thick disc formation mechanisms, such as minor mergers or accretion events, for all three galaxies. As for the models of the stellar radial migration, it is difficult to test the relevance of the radial migration scenario from observations. One of the reasons is that depending on the initial distribution of the radial metallicity, very different radial profiles of stellar population parameters can emerge. Nevertheless, we do not see notable negative age gradients in thick discs predicted by Minchev et al. (2015).



A slight asymmetry within the central region (see red line) corresponds to the bright spot distinctly seen on optical images of NGC 4710 south-west of its centre. It is probably a giant star formation region that shines through unevenly distributed dust.