STELLAR POPULATION IN THE NUCLEI OF EARLY-TYPE GALAXIES

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Abstract. The results of nuclear stellar population investigation are presented for 100 "normal" galaxies. The significant fraction of intermediate-age stars (T being about 1 billion years) is found in the nuclei of 50% of early-type disk galaxies.

Key words: Galaxies - Spectra of galaxies - Age of population

In 1986–1989 we have undertaken a spectral investigation of normal galaxies' nuclei at the 6-m telescope of Special Astrophysical Observatory of RAS to study their stellar populations. Using the 1000-channel skaner, we have obtained more than 120 spectra for the central parts of 100 nearby galaxies of different morphological types. The sample includes 29 E-galaxies, 21 S0's, 30 Sa-Sb's, and 20 Sc's; all the galaxies possess bright star-like nuclei. The spectral dispersion is 1.8 A/px (the spectral resolution 6–8 A), the spectral range is 3700–5500 AA. We have used two sets of aperture: rectangular one, with the height of 4" and the width from 0.6" to 2", and the round one, with the diameter from 1.5" to 2.5". The equivalent widths of 12 strong absorption lines have been measured (for the numerical data – see [2] and [3]). The intrinsic accuracy of equivalent width for lines of the moderate strength ($EW = 1 - 5$A) is estimated as 0.8 A. For the strong lines $CaIIH$ and K the accuracy is somewhat worse: 1.5–2.0 A.

All the absorption spectra have been divided by us into two groups:

– the "E"-type ones, having strong metallic lines (Mg,Ca,Fe) and some molecular bands, but only one Balmer line H_β,

– and the "H"-type ones, having, except the metallic lines, also the strong Balmer lines H_γ and H_δ in absorption.

Almost all elliptical galaxies have the "E"-type nuclear spectra; this spectral type can result from an old stellar population with nearly solar metallicity. Among the early-type disk galaxies (S0, Sa-Sb), 50% of nuclei have the "H"-type spectra which indicate the presence of A-stars (Fig.1). This fact may be the evidence of either the intermediate age of stellar population (T=1–2 billion years) or the low abundance in the nuclei of 50% early-type disk galaxies.

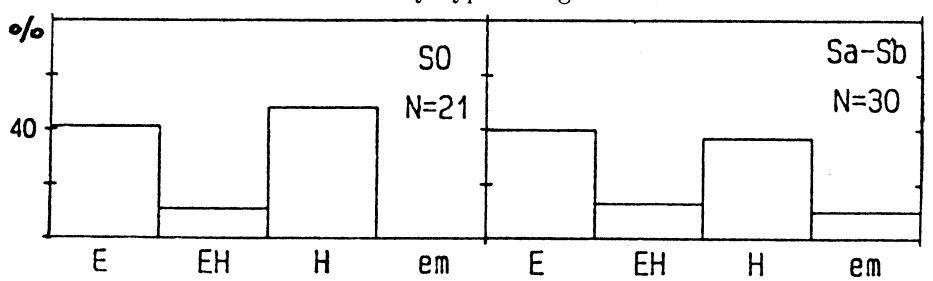

Fig. 1. The distribution of the investigated early-type disk galaxies over the spectral types: "E" and "H" – see the text,"EH" – the type is unclear, "em" – the HII-type emission.

H. Dejonghe and H. J. Habing (eds.), Galactic Bulges, 429–430.

To test these hypotheses we have calculated some evolutionary models with solar metallicity and varying star formation rate [1] and have compared the equivalent widths of absorption lines for the observational spectra and synthetic ones (Fig.2). It is quite visible that on the diagram ($< H >$, $CaIIK$) the "E"–nuclei follow the sequence of globular clusters so they may be old stellar systems with metallicities about from 0.1 $Z_\odot$ to $Z_\odot$. And the "H"–nuclei mostly follow the model sequence "SFR" (which is calculated with the exponentially decreasing star formation rate, characteristic decay time being from infinitely large to 1 billion years); so they must have nearly solar metallicity and star formation rate rather intense in some cases (among those there are S0–galaxies such as NGC 3412, 3489, 4150, 4262, and S0/a galaxies NGC 2681, 3166, etc.)

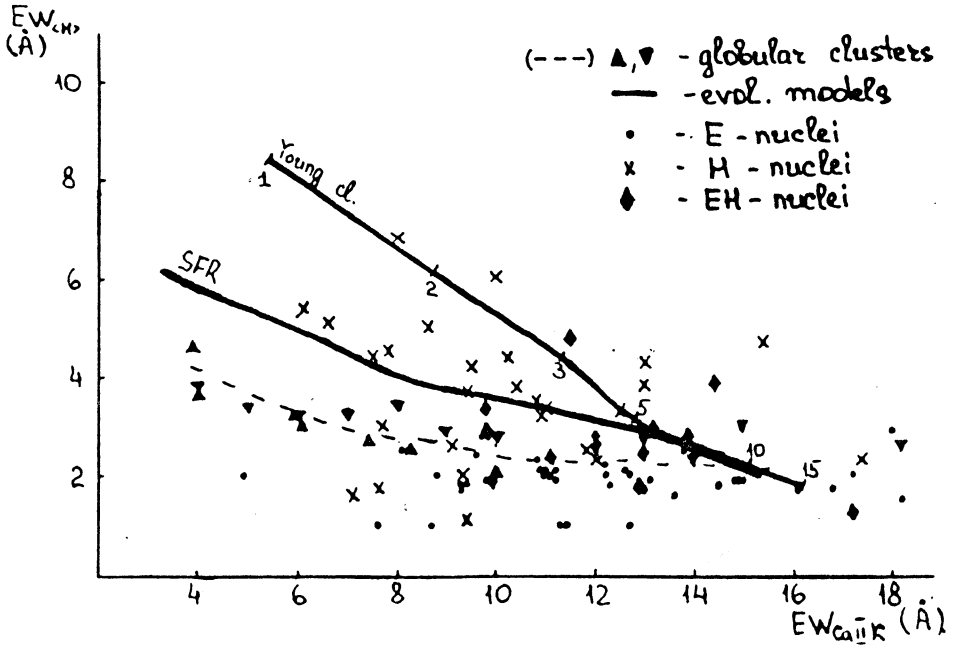

Fig. 2. The diagram ($< H >$,$CaIIK$) for the observed early–type disk galaxies compared with Galactic globular clusters and with model sequences calculated for the solar metallicity and different star formation histories. Numbers are the ages of model star clusters in billion years.

References

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[2] Sil'chenko, O.K., & Shapovalova, A.I., 1989. *Preprint SAO RAS* No.37.
[3] Sil'chenko, O.K., 1990. *Preprint SAO RAS* No.42.