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SPATIAL POPULATION SYNTHESIS AND EMISSION LINE ANALYSIS OF NGC5253

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RESUMEN.Se presenta espectrofotometría en el intervalo de 3700- 7200 A para el nucleo y seis posiciones diferentes de NGC5253. Mediante modelos de síntesis de población estelar se demuestra que NGC5253 está altamente compuesta en edad y caracterizada por un fuerte gradiente en el sentido que la componente azul es más importante y más joven hacia el centro. El substracto estelar más viejo es deficiente en metales $[Z/Z_0] < -0.5$. Similar abundancia metálica es encontrada para el gas sin variaciones espaciales.

ABSTRACT: Detailed slit spectrophotometry in the range 3700-7200 A is presented for the nucleus and seven different positions in NGC5253. Population synthesis models show that NGC5253 is highly composed in age and characterized by a strong gradient in the sense that the blue components become not only stronger but younger towards the center. The old population substratum is metal deficient $[Z/Z_0]<-0.5$. A similar abundance is derived for the gas with no spatial variations.

Key words: GALAXIES-SPIRAL — GALAXIES-STELLAR-CONTENT

INTRODUCTION

Optical, UV and IR observations of the dwarf galaxy NGC5253 show ıe presence of intense star formation processes in the central region of this ılaxy (Walsh and Roy 1989; Moorwood et al. 1982; Sersic et al. 1972). The ıst absorption feature in near-infrared suggests that the nuclear region is ıbedded in dust clouds (Aitken et al. 1982).

The intense star-forming processes throughout the galaxy have been ːurring in the last Gyrs, as is deduced from the presence of more than 100 ːar clusters (Caldwell et al. 1989). A possible interaction with M83 in the ıst was suggested by Van den Bergh (1980) as the triggering mechanism of the ıgh rate of the star formation.

The purpose of this paper is to study the stellar population content ı several regions of this galaxy in order to determine ages and ːtallicities. Analysis of the emission spectra free of the stellar absortion ıllows one to derive physical parameters of the ionized gas and the chemical ɔundances.

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II. OBSERVATIONS

The spectra were obtained with the two-dimensional photon-counting detector 2D-FRUTTI attached to the Cassegrain spectrograph of the 1.0-m telescope of CTIO on February 1987. Spectra of different regions of the galaxy in the range 3700-7200 A with a FWHM resolution of 5 A were taken at the nucleus, 7", 14" and 24" in the south direction, and 24" North. The slit width was 5" in all cases. Figure 1 shows a B isophote map where the observed regions are drawn in scale. The spectra were reduced using IRAF package and flux calibrated with standard stars from Stone and Baldwin (1983).

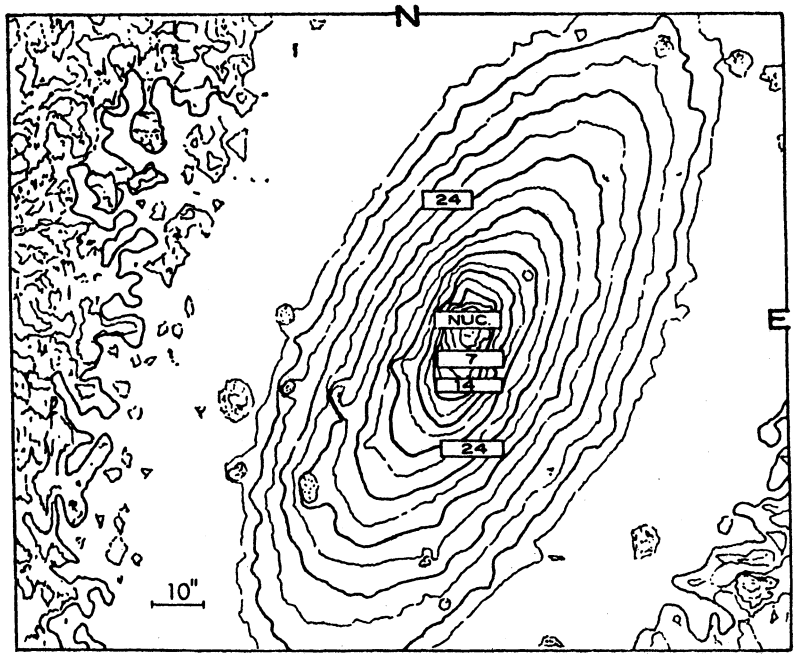

Figure 1.- B-isophote map of NGC5253. The slit positions are drawn to scale: the nucleus, 7", 14" and 24" S and 24"N.

III. STELLAR POPULATION SYNTHESIS

Taking star clusters spectra of ages 10, 100, 500 Myr (Y1, Y3, Y4 heretofore) and the continuum of NGC1714, an excited LMC HII region (RHII) as well as an old metal poor galaxy substratum (E4) with metallicity $[Z/Z_0]=-0.5$, we have fitted simple population models in order to reproduce the stellar components of different regions. The population templates and the methods of population synthesis were given in Bica (1988) and references therein. Details of the present synthesis will be given in a forthcoming paper. The results for the central region are illustrated in figure 2: in addition to the emission component associated to the HII region continuum,there is a strong contribution of Y3 (100Myr) evidencing an accumulation of several generation of stars in the nuclear region. The contribution of the stellar population to the observed spectra increases from the nucleus to the outskirts of the galaxy, as can be seen in table 1 where are listed the fraction of each template. As an example of an extreme case of this sequence, we present the synthesis results of region 24" S in Figure 3. This figure also shows the increasing perturbation of the emission lines (particularly Hβ) by the underlying stellar absorptions, which have important influence on reddening and metallicity.

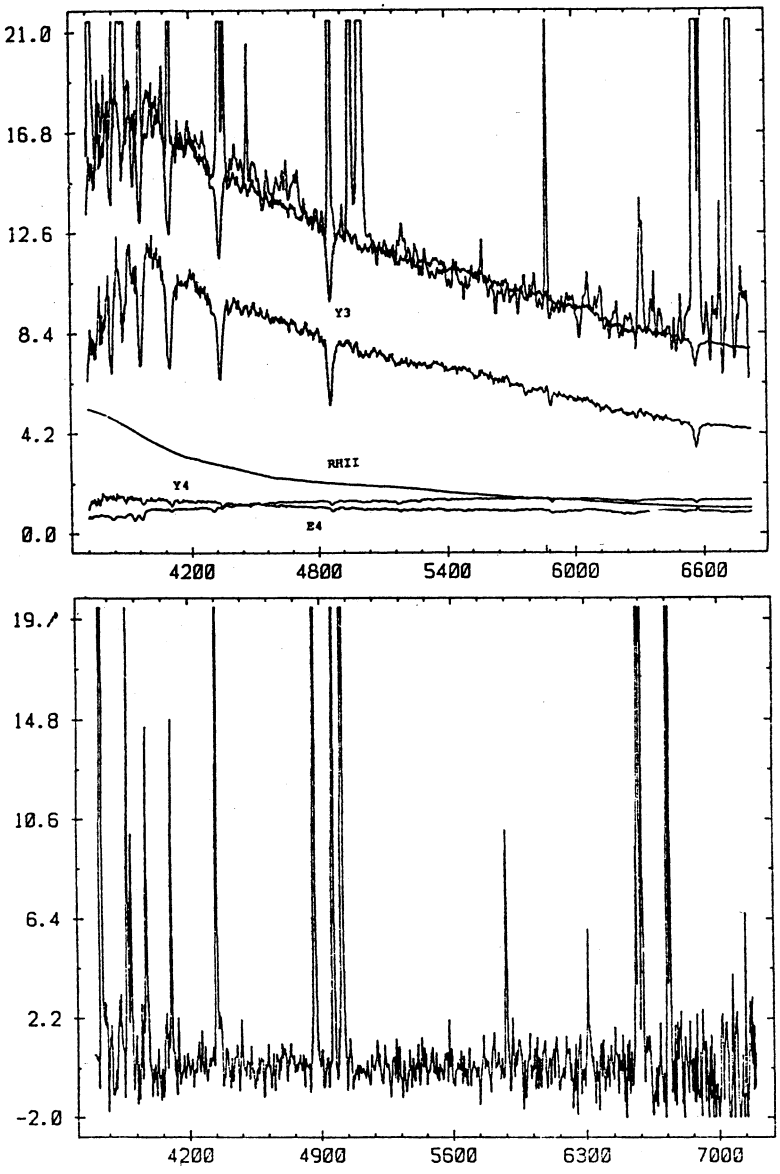

Figure 2.- In the nuclear region the contribution of the underlying old stellar population (E4) is very small. The dominant population ranges from 100 Myr (Y3) to a few Myr (Highly excited HII region). The emission spectrum after subraction is also presented.

Table 1. Contribution in each region of NGC5253

NGC5253 REGIONS	SYNTHESIS ELEMENTS E4	Y1	Y3	Y4	RHII
Nucleus	15%	10%	60%	-	15%
7 " S	15%	-	70%	-	15%
14 " S	30%	-	70%	-	-
24 " S	38%	-	24%	38%	-
24 " N	50%	-	-	50%	-

uncertainties ≈ 10%

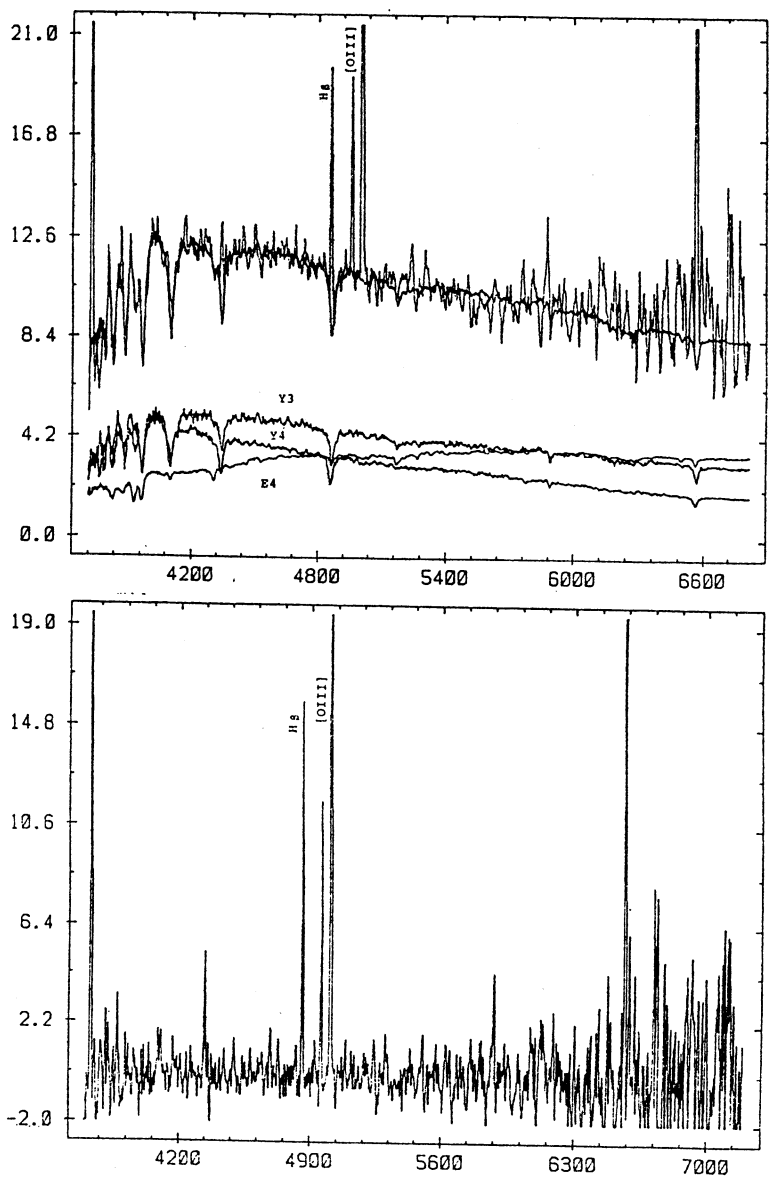

Figure 3.- The 24"S region is similar to the 24"N one. The flux fraction from the old component is considerably larger than in the nuclear region. Notice that after subtraction, Balmer emission lines are enhanced.

IV. EMISSION-LINE ANALYSIS

The fluxes of the main emission lines after the population subtraction were corrected by using Balmer decrement to estimate the local reddening. The visual absorption of the nuclear emission ranges from 1.2 to 2.6 mag and for the remaining regions, it ranges from 0.6 to 1.7 mag. Densities and electron temperatures were obtained from the [SII], [OIII] and [NII] lines which allow to determine the abundances listed in table 2 using the relations and atomic parameters given by Mc Call (1984). These values are in good agreement with those found in NGC5253 by Walsh and Ray (1989) in several regions of the bulge.

TABLE 2. Chemical abundances in the observed regions of NGC5253.

REGION	X	Te	{[O/H]}	{[S/H]}	{[N/H]}	{[Ne/H]}	{[Ar/H]}
Nucleus	0.06	13375	8.5	5.5	5.2	5.7	6.6
7 " S	0.01	11520	8.5	6.1	5.7	6.1	6.9
14 " S	0.02	14457	8.2	6.1	5.7	5.9	6.8
24 " S	0.05	12061*	8.4	6.7	6.8	7.3	7.7
24 " N	0.05	12061*	8.6	6.1*	5.7	6.2*	8.1*

(*) - Upper limit adopted {[X/H]}=12+log(X/H)

'. CONCLUSIONS

The series of synthesis computed in this paper shows that NGC5253 is ighly composed in age characterized by strong population gradient in the ense that blue components became not only strong but younger towards the enter. The NGC5253 old population substratum is metal deficient like a ypical nucleus of a low luminosity E/SO galaxies with maximum $[Z/Z_0] = -0.5$.

he calculated abundances for the gas (12+log (O/H)) values for the regions: entral, 7", 14", 24" and 24" N do not show evidence of metal abundance radient and these values are comparable with giant HII region like 30 Doradus n the LMC and NGC604 in M33. Also for the other elements S, N, Ne, and Ar no bundance gradient was detected. This probably results from the fact that the as component has convective motions and the elements produced by ucleosynthesis processes have been mixed.

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