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NGC 3077: H_α Features and the Young Population

H. Abdel-Hamid[1] and P. Notni
Astrophysikalisches Institut Potsdam, D-14482 Potsdam, Germany

1. Introduction

NGC 3077, an Irr II galaxy in the M81/M82 group of galaxies at 3.63 Mpc, suffered a tidal encounter with M81 about 400 Myr ago. Tidal structures of HI in this group of galaxies can best be seen in a VLA image by Yun et al. (1994).

This close encounter, perhaps, led to an accumulation of gas in the centre of NGC 3077 and triggered star formation there.

2. The young stellar population

The optical image of NGC 3077 is governed by a central irregularly distributed blue population and dust superposed on a regular old red stellar background of a dwarf Elliptical. Several nearly starlike blue knots have been selected from the clumpy light distribution. Some of them may be young star clusters (as shown by a comparison with an HST image), others may be the brightest young stars. The youngest of the knots have ages between 1 - 5 Myr derived from their colours and magnitudes, only slightly depending on the interpretation (stars or clusters).

A population analysis method using only broad-band colours (U,B,V,R) was applied to study the stellar population in NGC 3077, see Abdel-Hamid 1998. The method enables us to decompose the observed light at each point in the galaxy into two populations. We derive the intensity distribution of both populations I and II together with their age and extinction distributions. The surface brightness distributions of the two populations, taken from isophotal ellipse fits, are fitted well by exponential laws. The age and the extinction distributions show a grand design circular structure centred approximately on the optical centre. The same structure is seen in polarisation measurements published by Scarrott et al. (1990) and in excess H_α radiation.

3. The H_α morphology

Large scale structures: Near the centre, H_α mimics the centrally symmetric distribution of the blue stellar population. A network of arcs, loops, filaments and knots is seen superposed onto this huge central HII-region, the contrast growing with distance. There is generally *no* obvious relation between the H_α features and distinct star forming regions. In the outskirts, large partial shells

[1]Present address: National Research Institute of Astronomy and Geophysics, Helwan, Egypt

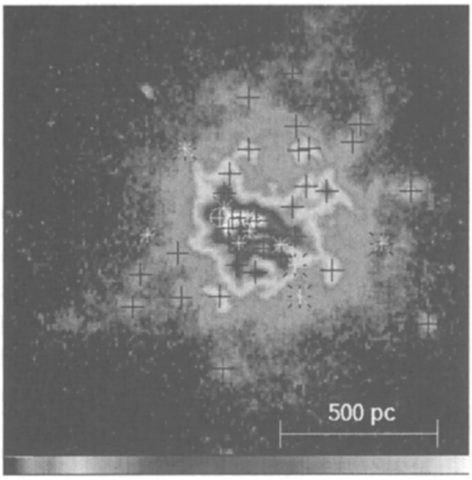

Figure 1. Ionized gas structure (H_α) in NGC 3077. Position of blue knots (*), HII regions (+) and the physical centre ($\oplus$)

are distributed at both sides of the central region along an inclined axis (N–S) up to a distance of about 1.5 kpc . None of these structures has an obvious continuum source inside. A faint glow of diffuse emission extends to the NW side.

HII regions: We selected 36 comparatively compact condensations ("HII regions"). Most of them are *not* geometrically correlated with a blue knot (Figure 1); the distribution of H_α seems to be largely matter-dominated, knots and shells signify turbulence and local motions. The luminosity function of the knots is fitted by a power law with power index α = -1.3±0.2. Surprisingly, this agrees well with that of dwarfs (Miller & Hodge 1994, Hodge et al. 1989) despite the fact, that we are discussing mostly knots in shell structures, whereas normally HII regions are associated directly with young star forming regions.

H_α-ring: Comparison of H_α, extinction and continuum polarisation (Scarrott et al.) shows that *enhanced* H_α often coincides with enhanced extinction and enhanced polarisation, all showing the nearly centrally symmetric grand design mentioned in Section 2. The polarisation pattern is roughly symmetric about the centre. This hints at an *illumination of the dust by a central light source* and *a scattered light origin also of part of H_α in these places.*

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