

# THE CENTRAL REGION OF NGC 5915: A STARBURST GALAXY

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## RESUMEN

NGC 5915 es miembro de un sistema triple de galaxias. Los otros dos objetos del sistema son NGC 5916 (probablemente una galaxia espiral) y NGC 5916A (sin estructura definida). Se considera que este grupo de galaxias (sus corrimientos al rojo son muy similares:  $\approx 2260 \text{ km s}^{-1}$ ) constituye un sistema interactuante.

## ABSTRACT

NGC 5915 is a member of a triple system of galaxies. The other two objects are NGC 5916 (probably a spiral) and NGC 5916A (without a well defined structure). This group of three galaxies (their redshifts are very similar:  $\approx 2260 \text{ km s}^{-1}$ ) are considered to form an interacting system.

**Key words:** GALAXIES: INTERACTIONS — GALAXIES: STARBURST — GALAXIES: INDIVIDUAL: NGC 5916

## 1. INTRODUCTION

NGC 5915 is classified as an SBbc spiral. It is an IRAS object (15187-1254) and is a rather peculiar, with a fat bar and incipient thick short, arms. It is close to two other galaxies, both in projection and in space: NGC 5916 and 5916A. No morphological type has been assigned to NGC 5916A, but NGC 5916 is probably a spiral. NGC 5915 is the brightest of the three and has a fat bar studded with six “hot spots”. Earlier work on NGC 5915 deals mostly with the overall characteristics of interactive galaxy groups. Some relevant works including this galaxy are the following. Spinoglio & Malkan (1989) in their  $10 \mu\text{m}$  radiation IRAS galaxy sample consider this galaxy to be a normal one. Surace et al. (1993) discuss interacting groups from the IRAS bright galaxy sample which includes NGC 5915. Devereux (1987) obtains the distribution of  $10 \mu\text{m}$  radiation in NGC 5915 as in other spiral galaxies. A megamaser search is carried out by Morris et al. (1989) with no positive detection in NGC 5915. Lutz (1992) studies the infrared properties of interacting galaxies while Bottinelli et al. (1984) investigate H I and 21 cm continuum emission in galaxies including also NGC 5915. Puxley et al. (1988) have suggested intense star formation in central regions (1–3 kpc) in barred galaxies like NGC 5915. However, no study in the optical region is carried on NGC 5915 to date.

We included this galaxy in our list of mildly active galaxies (MAGN) but it proved to be a starburst object. In what follows we shall give evidence to support this conclusion. We have carried out CCD imaging in the spectral bands *BVRI*,  $\text{H}\alpha$  and  $[\text{O III}] \lambda 5007 \text{ \AA}$ , using the 2.1-m reflector at San Pedro Mártir Observatory (México); spectroscopic data were obtained at the INT 2.5 m reflector at La Palma using a long slit. The spectra were obtained in 4 position angles namely at  $13^\circ$ ,  $31^\circ$ ,  $72^\circ$ , and  $127^\circ$ , all passing through the center of the galaxy and through one or more hot spots whenever possible.

## 2. RESULTS AND CONCLUSIONS

The main conclusions from the study of the data are:

1. The rotation curves of each of the PA's are unsymmetrical; this is particularly marked in direction at PA  $13^\circ$  and  $31^\circ$  which are close to the minor axis of the object. The asymmetry in the direction east to west is the direction towards the galaxy NGC 5916A.
2. Strict correlation exists between the position of the hot spots and the flux enhancement of the  $\text{H}\alpha$  radiation.
3. No correlation is noted between the general rotation and the increase of the flux (with the hot spots).
4. The central region shows high FWHM which extends to about seven arcsec around the center. This means that the dispersion of gas velocities have a considerable dispersion.
5. The spectra in the  $\text{H}\alpha$   $[\text{S II}]$  (red region) of the hot spots is no different from giant H II regions.

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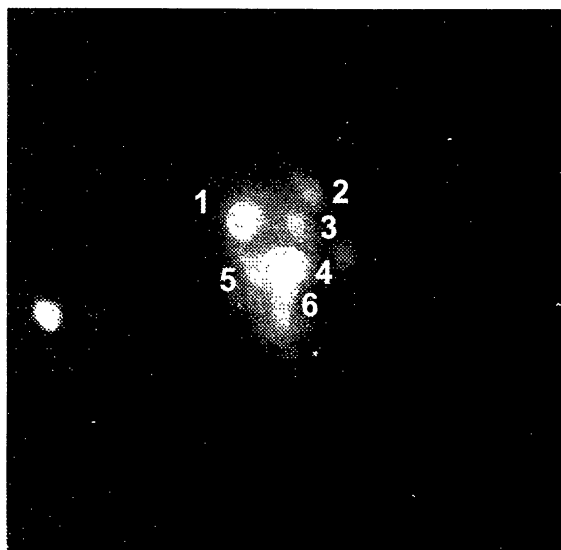


Fig. 1. *a)* CCD image of NGC 5915 taken in  $H\alpha$ . The six hot spots of the fat bar are marked from 1 to 6. *b)* A CCD image of the central part of NGC 5915 taken in the  $H\alpha$  line. Both images were taken with the 2.1-m telescope at San Pedro Mártir Observatory.

6. The hot spots are photoionized by massive hot A and early B stars or by clusters of them.
7. Those objects are of recent star formation such that **NGC 5915 qualifies as a starburst galaxy**.
8. Further investigation on the two member galaxies are being performed to see whether the properties of NGC 5915 are caused by an interaction with the members of the group or are they the product of an internal phenomenon occurring in the galaxy.
9. The hot spots do not show radial motion, they are neither approaching nor receding from the center but follow the general rotational structure.

### 3. SUMMARY

We report on a study of the peculiar barred galaxy NGC 5915, the fat bar of which contains seven prominent spots (clumps). Long slit spectra are obtained at position angles  $13^\circ$ ,  $31^\circ$ ,  $72^\circ$ , and  $127^\circ$  all passing through the center of the galaxy and through six of the “hot spots”. At the hot spots the flux is high in all five of the spectral lines in the red region we have observed ( $H\alpha$ , [N II] and [S II]). FWHM as well as the flux do not show a correlation with the velocity of the spots. Radial velocities obtained show that the rotation curves in all four directions are asymmetrical with respect to the center. It appears that this asymmetry is due to an interaction with the nearby galaxy NGC 5916A. The inclination and the axis of rotation is not reliably determined in this strange barred galaxy. Tentatively, the projected rotation axis is at PA  $36^\circ$ . The galaxy appears to rotate “end-over-end”. The galaxy is not an active one but is a starburst object. It is risky to decide whether the cause of the starburst is the neighbouring galaxy NGC 5916A or is intrinsic to NGC 5915. Further details on the subject will be given in a forthcoming publication in collaboration with A. Mampaso, M. Manteiga, E. Recillas, and G. Cruz-González.

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