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Structural Components of NGC 5850

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Abstract. Here we present a study of the structural components of the barred galaxy NGC 5850 using U, B and I photometry. After subtracting a bulge+disk model from the observed image, we obtain the bar and other non-axisymmetric structures. We determine the position of the ILR from the ellipticity and position angle profiles of the isophotes.

1. Introduction

We are analyzing the structure of a sample of isolated barred galaxies with moderate circumnuclear starbursts to study the effects of departures from axial symmetry, like triaxial bulges, bars and other oval distortions on the dynamical behavior of galaxies. These structures are related to spiral arms and rings and other dynamical phenomena. Here we present some preliminary results of this study for NGC 5850. This is an SBbc(s)I-II galaxy, and has a radial velocity of 2372 km s^{-1}. For H=50 km s^{-1} Mpc^{-1} the distance to the galaxy is 47 Mpc and the scale is 4.4 kpc $arcmin^{-1}$.

2. Observations and Data Reduction

The observations were obtained at the Cassegrain focus of the 2.5m Isaac Newton Telescope on La Palma using a CCD detector. The limiting theoretical angular resolution was determined by the CCD pixel size (0.54 arcseconds). The seeing oscillated between 1.6 and 1.8 arcsec.

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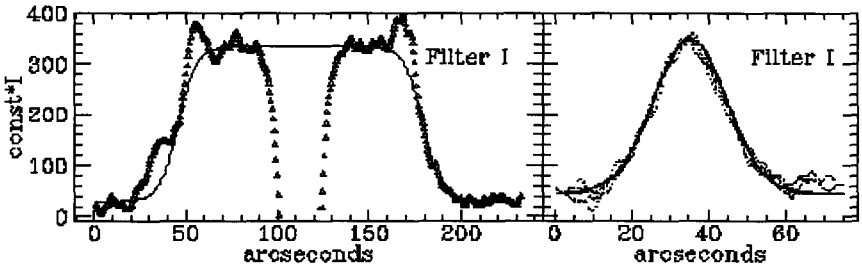

Figure 1. Profiles along (left) and across (right) the bar in the I band and fitted analytical functions

3. Bulge and Disk

The Intermediate Zone (IZ) in NGC 5850 is very strong and wide and our mean radial profiles extend to only about 100″ from the center (39% of the $R_{25}(B)$). Therefore we do not have enough information about the disk for a reliable bulge and disk component modeling. To model these we need to extend the optical profiles further from the center or obtain near-IR data where the effects of star formation are not prominent.

However, analysis of the minor axis profile, which extends beyond 100″, allows us to model reliably the bulge and the disk components in the region $9'' < r < 90''$. In this zone the individual profiles have the same shape. Hence we have used the north minor axis profiles to decompose a $R^{1/4}$ bulge and an exponential disk.

We have created a two-dimensional luminosity bulge+disk model in every observed wavelength band. These components have been smoothed by convolving them with a Gaussian, corresponding to the seeing in the images.

4. The Bar and the Ring

After subtracting the bulge and the disk models from the observed images, we are left with the bar, the ring and other structures, such as spiral arms. Only the components within $9'' < r < 90''$ (the bar, except its central parts, and the ring) are definitely seen.

In Figure 1, we show one profile along the bar and several profiles across the bar at different positions with fits of analytical functions. In the I band the length of the bar is 66.″4 and the width 9.″3. The bar is resolved into several clumps.

A ring-like structure is seen at the end of the bar. The luminosity distribution of all perpendicular profiles are Gaussian.

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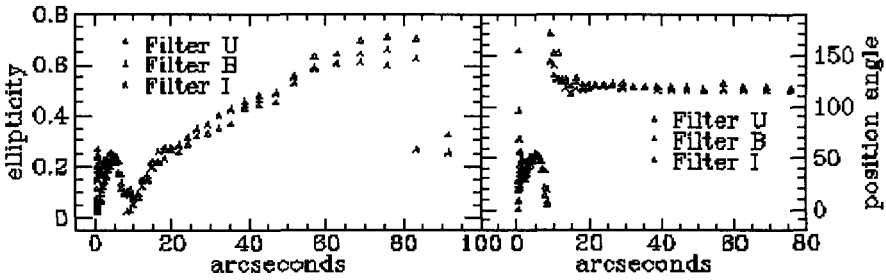

Figure 2. Ellipticity and position angle profiles

5. The Inner Lindblad Resonance

From Figure 2, it can be seen that there is a minimum at 9.″3 in the position angle and ellipticity of the isophotes. This radius agrees with the width of the bar, and from our $B - I$ image we have found a blue ring at this distance, surrounded by a red one. At larger radii the isophotes of the bar rotate by about 70° with respect to the inner parts. We interpret this in terms of a change in the orientation of the principle stellar orbits that compose the bar. Orbits between the ILR and corotation are oriented along the bar, and inside the ILR the orbits are perpendicular to the bar. Thus we identify the minimum in the position angle and the abrupt change in the ellipticity of the isophotes at a radial distance of 9.″3 with the ILR.

6. Conclusion

In this study of NGC 5850, we have:

1. Determined the bulge and disk components in the region $9'' < r < 90''$;
2. Subtracted a two-dimensional luminosity model of the bulge and the disk from the observed images and obtained the non-axisymmetric structures;
3. Found the luminosity of the bar to be clumpy, but constant along its principal axis. Orthogonal to this axis, the luminosity is Gaussian in shape. In addition, the bar appears most distinct in the I band;
4. Detected a ring-like structure at the end of the bar;
5. Found the ILR at a radius of 9.″3.

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