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CENTRAL DARK AND BARYONIC MASS DISTRIBUTION IN THE ISOLATED BARRED GALAXY NGC 3367

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RESUMEN

Hemos iniciado un proyecto que pretende revisar la robustez de las sugerencias que existen sobre la ausencia de materia oscura en las regiones centrales de las galaxias barradas mediante un estudio detallado de la galaxia NGC 3367. La cinemática interna de esta galaxia ha sido medida en el gas ionizado y molecular, así como en la componente estelar, haciéndola un buen candidato para estudiar sus propiedades dinámicas debido a que nos permite estudiar los sesgos asociados a cada trazador. A partir de nuestras observaciones mediremos directamente la frecuencia de rotación de la barra, una propiedad que ha sido considerada como un parámetro libre en todos los estudios anteriores.

ABSTRACT

We have initiated a project that aims to revise the robustness of the suggestions of the dearth of dark matter in the central regions of barred galaxies through a detailed study of the galaxy NGC 3367. The internal kinematics of this galaxy has been measured in ionized and molecular gas and in the stellar component, making it a good benchmark for dynamical studies because it allows us to analyze the biases associated with each tracer. From our observations we will directly measure the bar pattern speed, a property that has been considered as a free parameter in all previous studies.

Key Words: dark matter — galaxies: bulges — galaxies: individual (NGC 3367)

1. INTRODUCTION

Recent studies suggest that the presence of dark matter in the central regions of barred spiral galaxies (including the Milky Way, see Bissantz, Englmaier, & Gerhard 2003) is almost null or less than 20% inside an effective radius even for extreme models (Pérez et al. 2005; Pérez & Freeman 2006; Weiner et al. 2001; Zánmar-Sánchez et al. 2008). On the other hand, the adiabatic contraction models predict a comparable contribution for both dark and luminous components inside an effective radius with weak sensitivity to the initial configuration (Blumenthal et al. 1986; Klypin et al. 2002). We initiated a project that aims to revise the robustness of the estimation of the central dark matter content inside barred galaxies, through a detailed study of the central structure of the galaxy NGC 3367 (Figure 1). This barred spiral has been observed in molecular and ionized gas (García-Barreto & Rosado 2001) making it a good benchmark for dynamical studies because it allows us to analyze the biases associated with each tracer. We present preliminary results from this master thesis project and comment on the expected results.

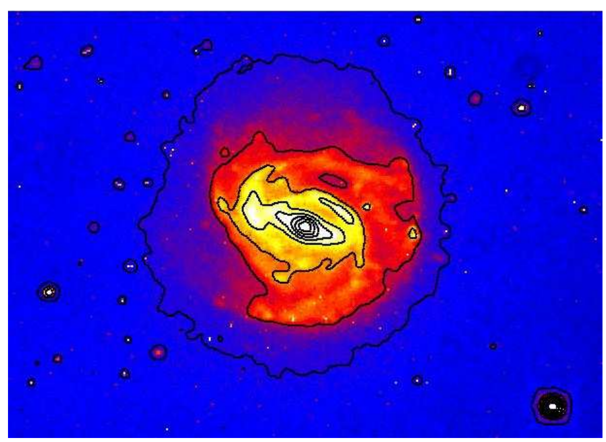

Fig. 1. R band image of NGC 3367 from Observatorio Astronómico Nacional, San Pedro Mártir (OAN-SPM). The contour in black traces 24 mag arcsec^{-2} isophotal level.

2. PRELIMINARY RESULTS

We have initially focused on the characterization of the disk structure by performing the surface photometry of the optical and NIR images (surface brightness, ellipticity, position angle, m=1, m=2 Fourier amplitudes profiles and bulge/disk decomposition). We have also made color maps in order to

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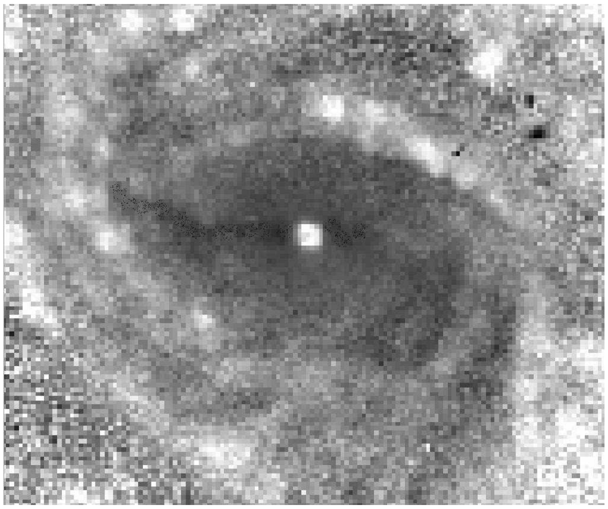

Fig. 2. B-I colour index map of the central region of NGC 3367, where the dust lanes are clearly shown. The geometry of the dust lanes suggests that the bar is fast,strong or both or it does not have an inner Lindblad resonance (Athanassoula 1992).

determine the geometry of the shocks triggered by the bar (dust lanes, see Figure 2). This will be an important constraint for the bar strength and angular speed. The dust lanes are not parallel to the bar PA. This is a constraint to the bar strength, speed and mass (see Athanassoula 1992). In order to break the degeneracy we have also measured the bar strength based on the photometry (Buta & Block 2001).

3. FUTURE WORK

We are currently starting a new analysis of the ionized gas kinematics (velocity field). We recently obtained stellar spectroscopy required to measure the bar angular frequency using the Tremaine-Weinberg method (Tremaine & Weinberg 1984). This quantity, combined with the bar strength, is a key parameter in order to set strong constraints on the stellar M/L ratio. Finally, we will perform the comparison of observations with self consistent galaxy simulations including gas in order to give a precise result of the distribution of dark and baryonic mass in the central region of NGC 3367 (inside an effective radius).

4. CONCLUSIONS

The availability of more and tighter observational constraints will enable us to consider more realistic mass models and to either verify or update the suggestions about the dearth of dark matter in the central regions of barred galaxies, and set constraints on the dark matter-baryons dynamical interaction.

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