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A Counterrotating Core in NGC 7097?

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Abstract. Observations of NGC 7097 show that there is counterrotation in the inner 1.8 kpc (-20 km s^{-1} at 0.88 kpc). This is already known for some time. A 3-integral constant M/L model clearly indicates that the observed counterrotation can be caused by counterrotating stars that are distributed over a large part of the galaxy. The dynamical model implies that for NGC 7097 apparent core counterrotation is not necessarily related to a compact group of stars located in the center of the galaxy.

1. Observations and Modelling

NGC 7097 is a flat galaxy of average luminosity (B_T = 12.6), showing some disky isophotes, E4 in RSA, E5 in RC3 and having a gaseous disk (Caldwell, Kirshner & Richstone 1986; Zeilinger et al. 1996). The kinematics for the major axis of NGC 7097 extend out to $30'' = 1.6r_e$, the rotational velocity reaches -20 km s^{-1} at $3''\!.5 = 0.88$ kpc, 0 at $7'' = 1.76$ kpc, changes sign and reaches about 40 km s^{-1} at the last measured point. For the dynamical modeling, we retrieved additional kinematic information from Caldwell et al. (1986). We used their velocity dispersion and mean velocity data along the minor axis and two axes through the center, tilted at 20° and 45°.

The 3-integral dynamical modeling is based on a Stäckel approximation for the galactic potential and uses a quadratic programming algorithm to create a distribution function with Fricke type components. For more details we refer to De Bruyne et al. (2001)

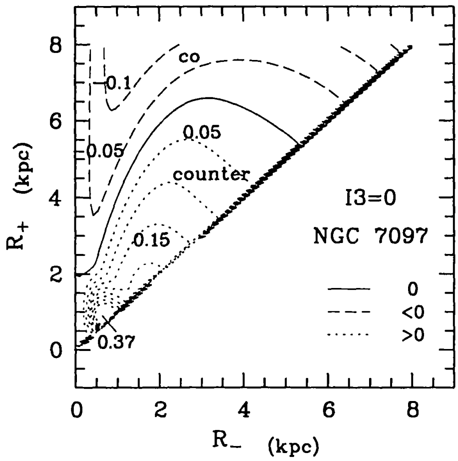

Figure 1. Normalized DF of NGC 7097 in turning point space.

2. Counterrotation in NGC 7097

Three-integral dynamical models are a mixture of photometric and kinematic information. However, it can be useful to separate the effects of photometry and kinematic data. This can be done by dividing the 3-integral distribution function (DF) obtained through a fit to the photometry and the full kinematic data set by the even 2-integral DF that is determined completely by fitting the photometry only (De Bruyne et al. 2001). The result is what we call a normalised DF.

A representation of the normalised DF in turning point space where the number of corotating orbits is subtracted from the number of counterrotating orbits is shown in Fig. 1. Positive contours are for regions with orbits that are producing counterrotation. The figure shows an extended region populated preferentially by orbits with positive L_z. For these orbits is $0 < R_-, R_+ < 5.5$ kpc; they are present in the galaxy at large distances from the center ($1\ r_e \simeq 5$ kpc).

The highest values for the contours are found in the region close to the center, approximately where the smallest $\langle v \rangle$ is measured.

3. Conclusions

In the case of NGC 7097, the signal in $\langle v \rangle$ (-20 km s$^{-1} < \langle v \rangle < 20$ km s^{-1} >) is not sufficient to trace back the counterrotation to a group of orbits in a limited area of space. Hence the origin of the counterrotation should not be found in a recent merger in the first place.

References

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