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Intrinsic Shape of Elliptical Galaxy NGC 661

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Abstract. We investigated the intrinsic shape of the luminosity density of the triaxial galaxy NGC 661 by comparing its observed profiles of photometric parameters with the projected surface brightness of model galaxies. We examined NGC 661 which shows a small scale variation in the ellipticity profile at $\sim 0.3\ r_e$. We suggest complex form of density distributions which might explain it.

1. Introduction

Using the spherical γ - model, $\rho(r) = f(r)$ of Dehnen (1993), deZeeuw and Carollo (1996), studied the projected properties of its triaxial generalisation

$$\rho(r,\theta,\phi) \;\; = \;\; f(r) - g(r)Y_2^o(\theta) + h(r)Y_2^2(\theta,\phi) \qquad (1)$$

and, following the similar scheme, Chakraborty and Thakur (2000), studied the projections of the model of deZeeuw and Merritt, which forms a triaxial generalisation of the modified Hubble mass model. The triaxial models of type (1), exhibit ellipticity variations and isophote twists in their projections. An interesting correlation property of the models (1) was noted by Thakur and Chakraborty (2000). This can be used to set constraints on the intrinsic shape, from the observations of $\frac{b}{a}$, using the methods developed by Statler and Fry (1994).

2. Formulation

Many elliptical galaxies, devoid of any features, indicating the absence of shells or dust, are found to exhibit small scale variations in the radial profiles of the parameters of the elliptical isophotes. As these profiles in the projections of model (1), are mostly smooth functions of the radius, it indicates that the density function of these galaxies are more complex than model (1). With this aim in mind, we modified model (1) by adding functions

$$\begin{aligned} g_1(r) &= \frac{M}{4\pi b_o^3}\, 4a_1^4 \frac{r^8 + 12a_2^2r^6 - 9a_2^4r^4}{(a_2^2+r^2)^6} \\ h_1(r) &= \frac{M}{4\pi b_o^3}\, 4a_3^4 \frac{r^8 + 12a_4^2r^6 - 9a_4^4r^4}{(a_4^2+r^2)^6}. \end{aligned} \qquad (2)$$

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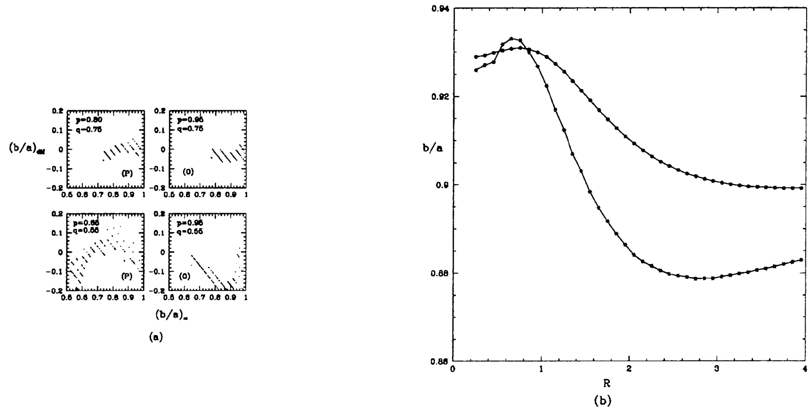

Figure 1. (a) Correlation between $(\frac{b}{a})_{dif}$ and $(\frac{b}{a})_{\infty}$ when the model of a chosen $(p,\ q)$ is projected in all possible viewing angles. (b) Plot with crosses (filled circles) show $\frac{b}{a}$ as a function of R with (without) g_1 and h_1 terms.

to g and h, respectively, confining ourselves to the case of triaxial modified Hubble mass model. The constant parameters in g_1 and h_1 are chosen such that their contributions are small compaired to those of g and h.

The projected surface density is calculated analytically and axis ratio $\frac{b}{a}$ and position angle are estimated. *Figure* 1(a) shows the correlation between $(\frac{b}{a})_{dif} = (\frac{b}{a})_o - (\frac{b}{a})_{\infty}$ and $(\frac{b}{a})_{\infty}$ when function g_1 and h_1 are added which are qualitatively similar to those obtained by Thakur & Chakraborty. Further, the profiles of $\frac{b}{a}$ show fine structures.

3. Results

We find that NGC 661 which is a featureless galaxy, shows a small scale structure in $\frac{b}{a}$ profile around $0.3r_e$. Using the observed values of the $\frac{b}{a}$ at small and large radii of NGC 661, we estimated the most probable values of p and q and the viewing angles by applying the graphical method of Statler and Fry (1994). *Figure* 1(b) shows the fine structure in the $\frac{b}{a}$ profile by using these parameters (p,q) and viewing angles with a suitable choice of the constants in g_1 and h_1.

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