

TWO DIMENSIONAL DECOMPOSITION OF THE LUMINOSITY DISTRIBUTION OF THE SPIRAL GALAXIES : ESO598-G009, NGC1515 AND NGC7456

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1. Purpose of the two dimensional luminosity decomposition

Because it is inevitable to lose some information in the process of one dimensional luminosity profile extraction, we developed a two dimensional luminosity decomposition method in order to examine the structure of galaxy such as bulge, bar and spiral arms.

2. Numerical program

We assumed de Vaucouleurs' law and exponential law for the luminosity distribution of bulge and disk, respectively. The intensity profiles for bulge and disk can be described as;

$$I_B(r, \theta) = I_e 10^{\alpha(\theta)[(r/r_e)^{1/4} - 1]} \quad (1)$$

$$I_D(r, \theta) = I_0 \exp\left(-\frac{r}{h_R(\theta)}\right) \quad (2)$$

$$r = \sqrt{x^2 + \left(\frac{y}{\cos i}\right)^2}, \quad \theta = \tan^{-1}\left(\frac{y}{x}\right) \quad (3)$$

where r is distance from the center and θ is angle measured from the major axis. Using the numerical program we can determine five unknown param-

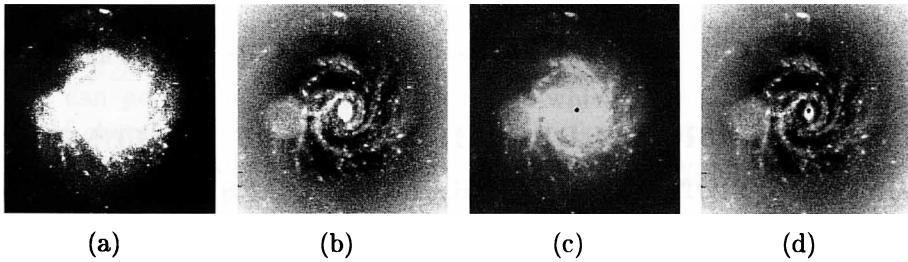


Figure 1. (a)observed image for NGC3344,(b)disk subtracted image,(c)bulge subtracted image, and (d)bulge and disk subtracted image. Because of very small bulge, (c) is not so different from (a). However, (b) and (d) show that NGC3344 has several large spiral arms, small elongated bulge component and inner ring-like structure.

eters in equations (1) to (3), denoted as I_e , $\alpha(\theta)$, r_e for bulge and I_0 , $h_R(\theta)$ for disk. We took the convergence criterion as 10^{-4} for each value.

3. Application to the observed galaxies

We applied our program to the galaxies, ESO598-G009, NGC1515 and NGC7456 observed with 1-m reflector at the MSSSO, Australia. However we found that the values of the photometric parameters diverged, mainly due to high inclination. Thus we applied it to the five spiral galaxies with lower inclination angles ($i < 40$ degrees) chosen from Frei *et al.*(1996). We could distinguish nonspherical bulges as well as spiral arms in NGC3147 and NGC3344(see Figure 1), and bar structure in NGC4394, NGC4548 and NGC5850.

4. Difficulties and solutions

Since galaxies have bulges with various shapes; oblate, prolate and triaxial ones, successful bulge fitting is quite difficult. This difficulty might be solved by considering projection effect of bulge shape. If we consider bar as a third component, the luminosity model for the bar is also required.

5. Acknowledgements

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References

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