MASS-TO-LIGHT RATIOS OF SPIRAL BULGES IN NEAR-INFRARED

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1. Introduction

Sofue (1996, 1997) presented accurate rotation curves of nearby galaxies, which are almost completely sampled from the inner to outer regions. The conspicuous common feature of the rotation curves is a steep rise at the inner bulge. The rise suggests a compact massive concentration near the nucleus (Sofue 1996). The study of the light distribution at the inner bulge demands accurate surface photometry at near-infrared wavelengths, where dust extinction is much less effective than in the optical. Most of Sofue's samples are nearby large galaxies, so that observations with a wide field view is clue to constructing reliable light distribution models.

2. Observations and Reduction

We selected 9 spirals from Sofue's samples (M 81, IC 342, NGC 2841, 2903, 3198, 4303, 4258, 4736, 5907). The morphological type ranges in Sab -

Y. Sofue (ed.), The Central Regions of the Galaxy and Galaxies, 53-54.

Sc. The observations were made in J and H bands with a near-infrared camera attached to the 105 cm Schmidt telescope at the Kiso Observatory. The array is 1040×1040 PtSi CSD supplied by Mitsubishi Co. The field of view is $18.4' \times 18.4'$ with a resolution of $1.1''$ per pixel. Most of our samples (except M 81 and IC 342) are covered by one frame.

A two-dimensional decomposition scheme was applied to the sample galaxies to decompose the galaxy into a disk and a bulge. We basically assume a 1/4-law bulge and a exponential disk. The contribution to the circular velocity from the bulge and disk potentials can be obtained on the assumption of a constant mass-to-light ratio for each component. We fit the model rotation curve to the observation by changing disk and bulge M/L's. Here we ignore a halo component because the contribution near the bulge region is negligible.

3. Results

The inner rise of the rotation curves except for M81 and NGC 4258 is well reproduced by the observed bulge light with a constant M/L. No additional massive components are indicated in the bulge. Although the small deviation from the observation can be seen, it may be due to inner fine structures like bar or ring.

The mass-to-light ratios of the bulges range from 0.12 to 3.0 and from 0.6 to 3.2 in J and H bands, respectively. There is no clear morphological dependence. Jablonka and Arimoto (1992) calculated the mass-to-light ratio of spiral galaxies in the present epoch in the blue and H bands using a chemical and photometric evolution model with a two-component bulge-disk system. Bulge stars are formed from primordial gas in their model. Therefore, M/L of the bulge is expected to be in very narrow range from 1.7 (Sa) to 2.3 (Sd) in H band. However, out result is wide-ranging. The origin of the variety is still unknown. Dust extinction may prevent accurate modeling of the light distribution even in near-infrared light or the assumption of the pure circular rotation may be doubted by asymmetric fine structures or non-circular motion of gas at the inner galaxies.

References

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