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The global modal analysis is applied to a family of models which are consistent with recent dynamical data of NGC 3115. A halo component at least as massive as the disk component is required to explain the apparent lack of spiral structures in NGC 3115.

NGC 3115 is an isolated edge-on galaxy of type SO (Figure 1). The luminosity profile along the major axis is highly symmetric and smooth. Figure 2 shows the rotation velocity profile  $V(r)$  and the velocity dispersion profile  $\sigma(r)$  along the major axis of NGC 3115.

We construct a family of gas dynamic models which are reproducing the observed  $V(r)$  and  $\sigma(r)$ . Each model consists of a disk component and a halo component and is characterized by a halo-mass fraction  $s$  and by a dimensionless halo radius  $r_h$ .

We suppose that the apparent lack of prominent spiral structures in NGC 3115 means that this galaxy is dynamically stable and has no growing spiral modes of oscillation. The global modal analysis (Aoki, Noguchi, and Iye 1979) is applied to these models of NGC 3115 to check this hypothesis. The use of gas dynamic models is justifiable for studying global modes of long waves. Figure 3 shows the growth rate of the most unstable mode for a series of models with  $r_h = 1$ .

It is concluded that a halo component at least as massive as the disk component ( $s > 0.5$ ) is required to interpret the apparent lack of unstable modes in NGC 3115 in terms of the modal analysis. This lower limit of the halo mass is obtained based not only on the equilibrium condition but also on the stability analysis of the observed galaxy.

#### REFERENCES

- Aoki, S., Noguchi, M., and Iye, M.: 1979, *Publ. Astron. Soc. Japan* 31, pp.737-774.  
 Illingworth, G. and Schechter, P. L.: 1982, *Astrophys. J.* 256, pp.481-496.  
 Rubin, V. C., Peterson, C. J., and Ford, W. K., Jr.: 1980, *Astrophys. J.* 239, pp.50-53.

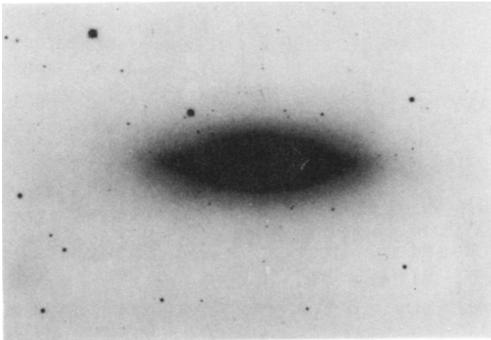


Figure 1. NGC 3115 taken at the Las Campanas 254-cm telescope (by courtesy of Dr. K. Wakamatsu).

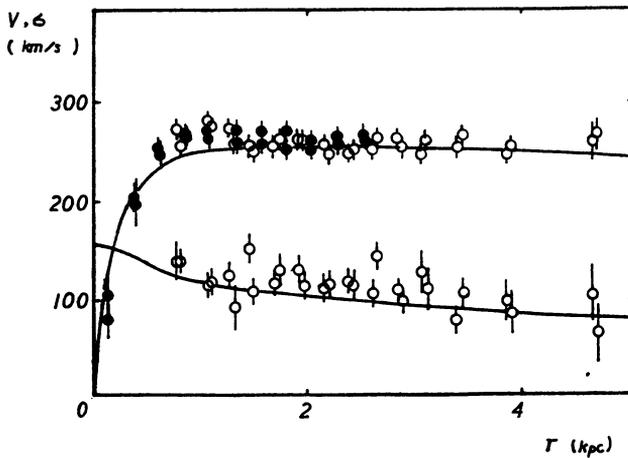


Figure 2. Rotation velocity profile  $V(r)$  and the velocity dispersion profile  $\sigma(r)$  of NGC 3115. Open dots (Illingworth and Schechter 1982) and filled dots (Rubin *et al.* 1980) are observed values. Solid lines are model profiles corrected for the line-of-sight effect and are common to every model analyzed in the present paper.

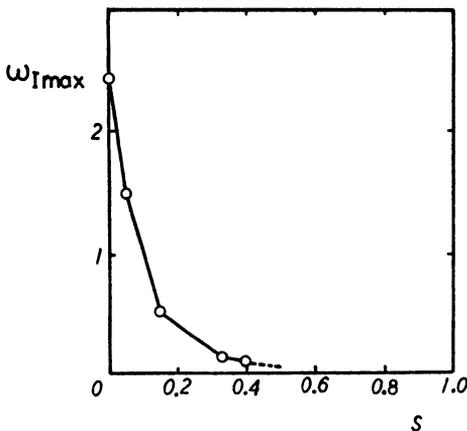


Figure 3. The growth rate  $\omega_z$  of the most unstable growing mode for a series of models of NGC 3115 with various halo-mass fractions  $s$ . The halo radius of this series of models is fixed ( $r_h = 1$ ) and it is equal to the disk radius.