ON THE APPEARANCE OF THE HOST GALAXIES OF QUASARS

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ABSTRACT. It is believed that the QSO phenomenon is a form of violent activity in the nuclei of galaxies. This view has found support after the recent detection of nebulosity around a large number of quasars. The nature of the fuzz is not yet clear, but there is some evidence that it is normallly a spiral galaxy hosting a quasar (e.g. Hutchings et al. 1984). However, the experience with radio galaxies suggests that the host of a radio loud quasar ought to be an elliptical galaxy. We have considered the appearance of elliptical galaxies of various redshifts with a view towards determining the nature of ellipticals which could act as hosts for radio quasars at large redshifts. For spirals we have considered the data given by Boroson (1981) and calculated the appearance of different morphological types at large redshifts.

RESULTS

Elliptical galaxies which follow de Vaucouleur's law and Kormendy's relation cannot be visible beyond $z = 0.47$ in the V band (H_o=50 km/sec/Mpc). Therefore, if ellipticals are observed around quasars at higher z_s they have to have special properties.

Our calculations for ellipticals show that at a given redshift, we can observe only a part of the luminosity function. Lower cut-off of the observed luminosity increases with redshift.

If we consider nearby ellipticals (upto $\sim$100 Mpc), then the calculations show that the surface brightness of ellipticals decreases for $M < -21$. This is consistent with observations.

Visibility studies for various morphological types of spiral galaxies show that Sbc - Sc galaxies are most likely candidates for host spiral galaxies of quasars.

CALCULATIONS

We have calculated the surface brightness $\mu(r)$ of different types of galaxies as a function of redshift. We assume that a galaxy can be distinguished as such if the 25 mag/(arc sec)^2 isophote has an angular size = 1".

G. Swarup and V. K. Kapahi (eds.), Quasars, 121–122.

Ellipticals

We assume that the surface-brightness profile of ellipticals follows de Vaucouleur's law. To this we add Kormendy's (1980) relation for ellipticals:

$$\mu(r_e) = 3.28 \log r_e + 19.45 \quad \text{B mag/(arc sec)}^2.$$

Using these two relations, the number of parameters defining $\mu(r)$ is reduced to just one: Then, for a given Z, $\mu(r)$ has a minimum and appears brightest for $r_e = 4.54r$. Choosing this optimal value of r_e, and introducing observational constraint as stated above, and solving the $\mu(\theta = 1'')$ equation for Z, we get the limiting value of Z upto which ellipticals can be seen. Even giant ellipticals like NGC 4073 and CDs like A2029 disappear before Z = 0.41. For any $Z < Z_{lim}$, we get two limiting values of r_e. The effective radius of an elliptical must be contained in these limits for it to be visible. The limits on r_e translate to limits on the absolute magnitude. These limits are shown in Fig.1. For nearby ellipticals (dist ~100 Mpc) we have r_e (optimum) = 1.9 kpc which corresponds to $M_B = -21$. A galaxy brighter than this would have a lower surface brightness.

Spirals

The parameters describing $\mu(r)$ of spirals are many and we have not been able to reduce their number as in ellipticals. Preliminary investigations, using various values for disc and bulge parameters as given by Boroson have shown that Sb - Sc galaxies are the best candidates for detection at the redshifts reached by Hutchings et al (Z = 0.6).

References

Hutchings et al. (1984) Ap. J., **280**, 41
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Kormendy, J. (1984), Morphology and Dynamics of Galaxies, 162.

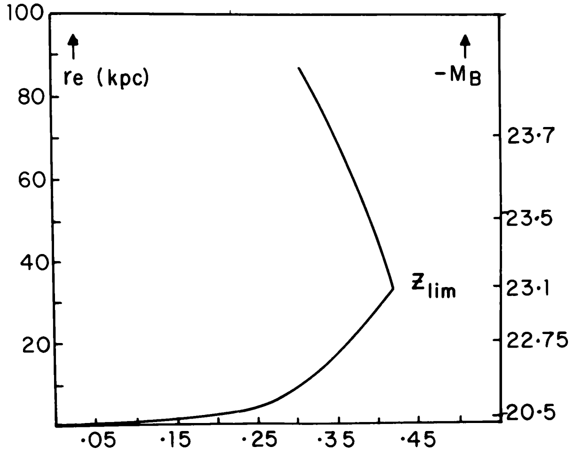

Fig. 1. The bounds on the effective radius are shown as a function of redshift. Values of the corresponding absolute blue magnitude are shown on right.

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