

FIG. 4.—Fit of exponential disk with maximum mass and halo to observed rotation curve (dots with error bars). The scale length of the disk has been taken equal to that of the light distribution ( $60''$ , corresponding to 2.68 kpc). The halo curve is based on eq. (1),  $a = 8.5$  kpc,  $\gamma = 2.1$ ,  $\rho(R_0) = 0.0040 M_{\odot} \text{pc}^{-3}$ .

dark matter to visible matter inside the last point of the rotation curve (at 30 kpc) is 3.9. The enclosed halo mass is 0.8 times the disk mass at  $R_{25}$ ; the enclosed halo mass is 1.5 times the disk mass at the Holmberg radius. The total mass inside 30 kpc is  $15 \times 10^{10} M_{\odot}$ . Another property of interest is the mass-to-light ratio of the disk; we find  $M/L_B(\text{disk}) \leq 3.6 M_{\odot}/L_{B_{\odot}}$  and  $M/L_V(\text{disk}) \leq 4.4 M_{\odot}/L_{V_{\odot}}$ .

The disk-halo model shown in Figure 4 has the characteristic flat rotation curve over a large part of the galaxy. Beyond 30 kpc it is a mere extrapolation, but the observations inside 30

kpc do not show any sign of a decline, and the extrapolated curve may well be close to the true one. To obtain an estimate of the minimum amount of dark matter at large distances from the center we have also made a fit, shown in Figure 6, with a halo density law whose slope changes from  $-2$  in the inner region to  $-4$  in the outer region:

$$\rho_{\text{halo}}(R) \propto \left[ \left( \frac{a}{R_0} \right)^2 + \left( \frac{R}{R_0} \right)^2 + 0.08 \left( \frac{R}{R_0} \right)^4 \right]^{-1}, \quad (2)$$

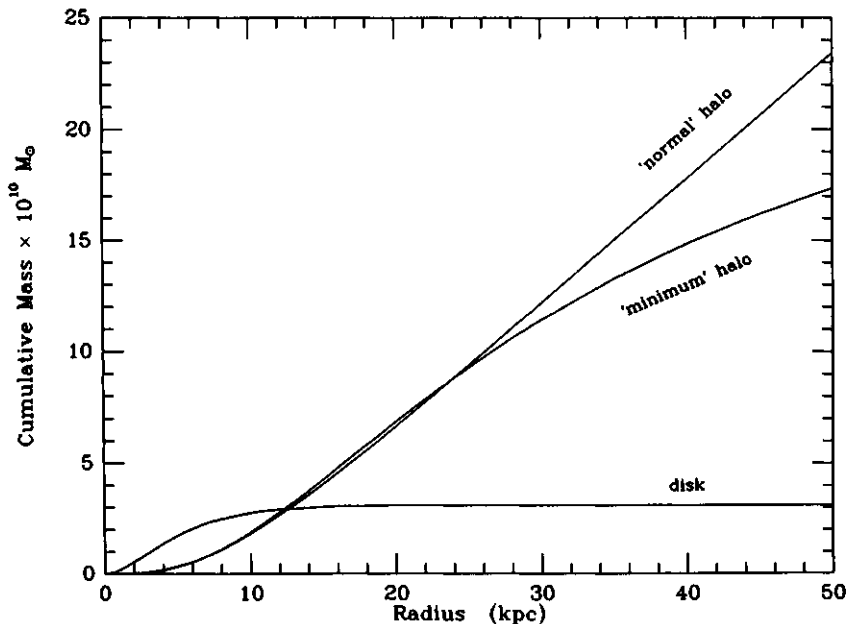


FIG. 5.—Cumulative distribution of mass with radius for disk and halo for the maximum disk mass case. Two halo fits are shown. The curve labeled “normal” halo is based on eq. (1); the parameters of the fit are the same as those in Fig. 4. The curve labeled “minimum” halo is based on eq. (2); it corresponds to a density distribution whose slope changes from  $-2$  in the inner regions to  $-3.5$  in the outer regions. This curve represents an estimate of the minimum amount of dark matter in NGC 3198 inside 50 kpc.