SPIRAL GALAXIES

Giant Interacting Galaxies NGC 6872 / IC 4970
(VLT ANTU + FORS1)

ESO PR Photo 20b/99 (30 April 1999)

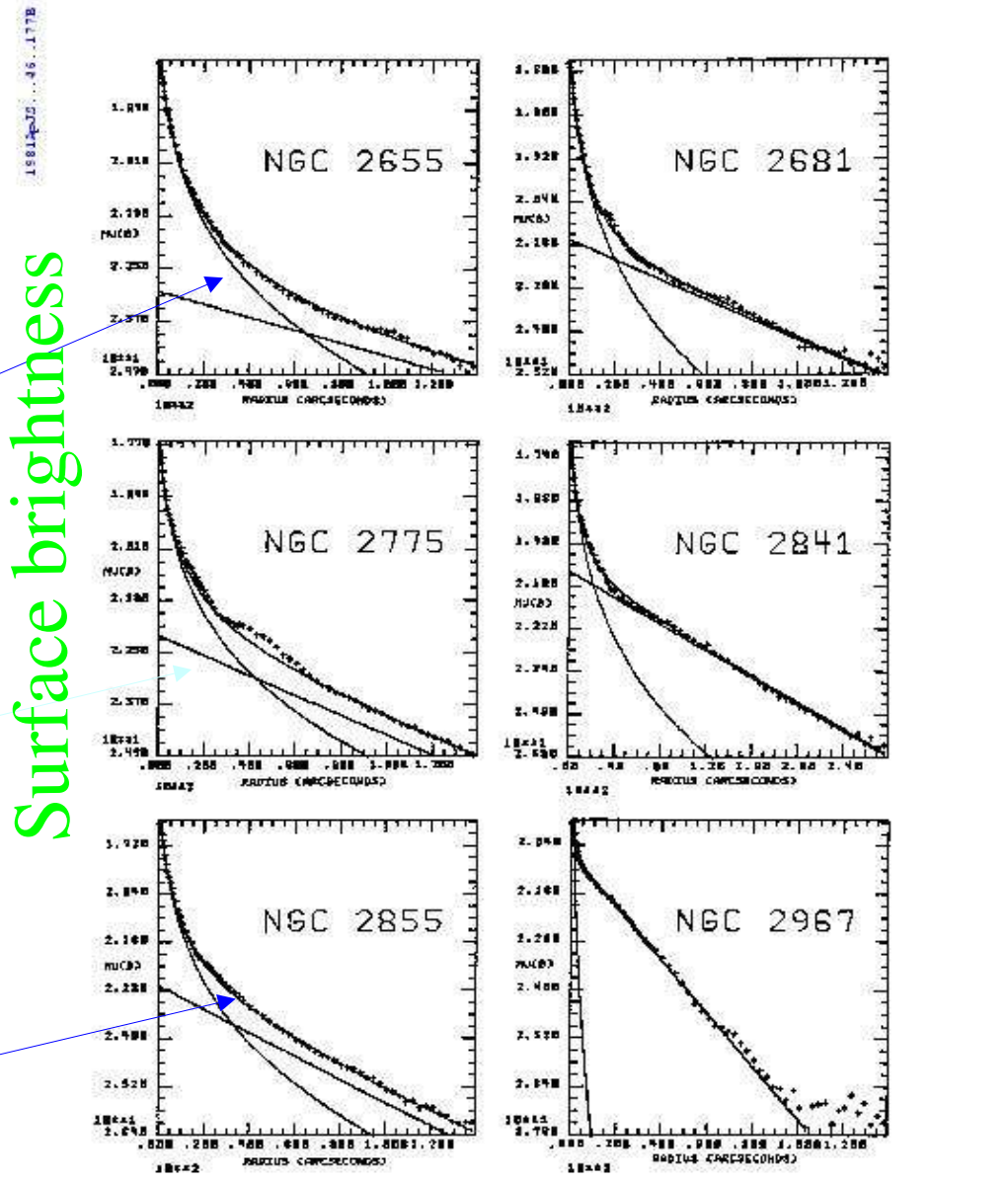
THE BULGE-DISK DECOMPOSITION

Bulge: r^1/4 law

Exponential disk

Total profile

(Boroson 1981)



THE B/T-MORPHOLOGY CORRELATION

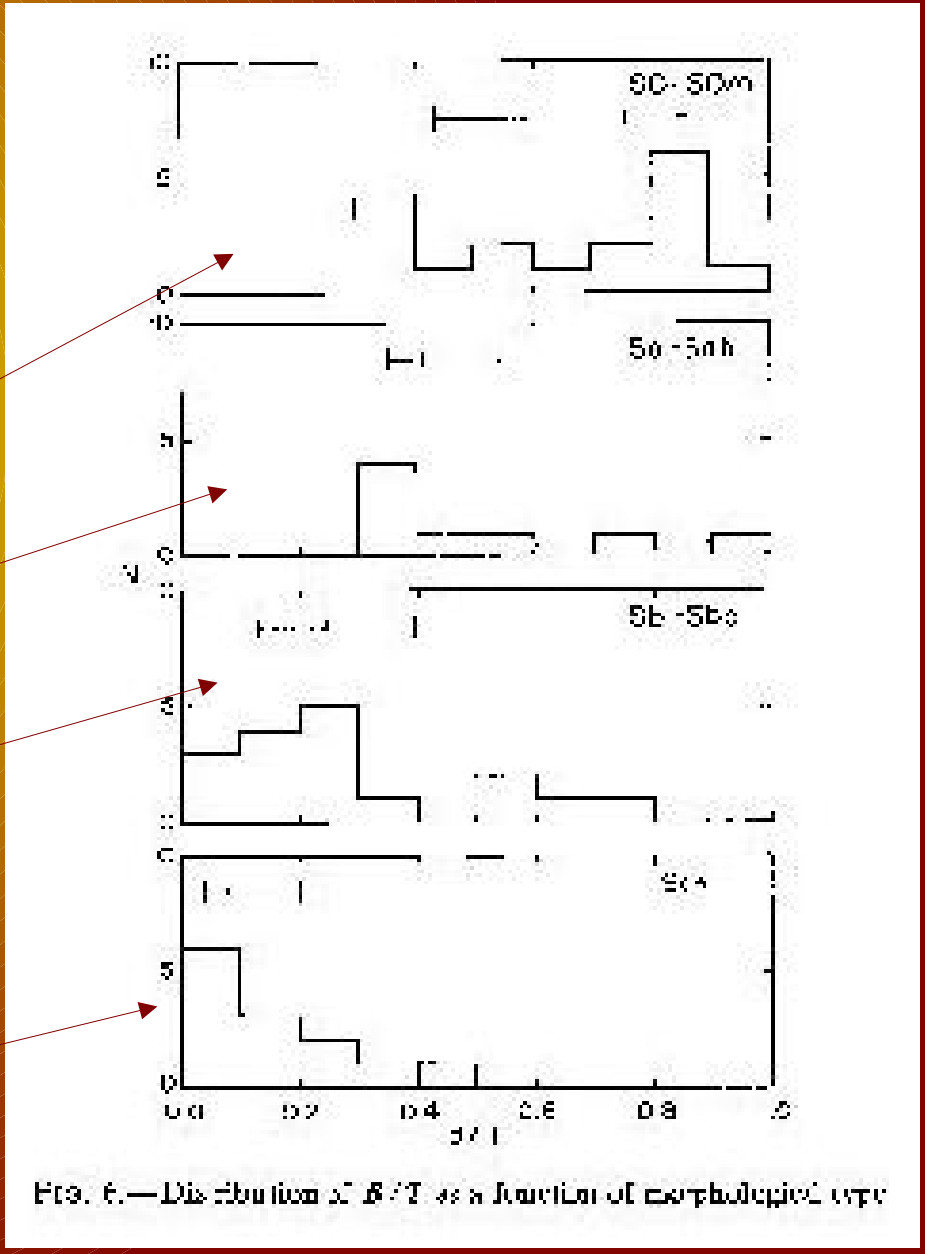
B/T=Bulge/Total luminosity=
= Bulge/(Bulge+Disk)

S0

Sa

Sb

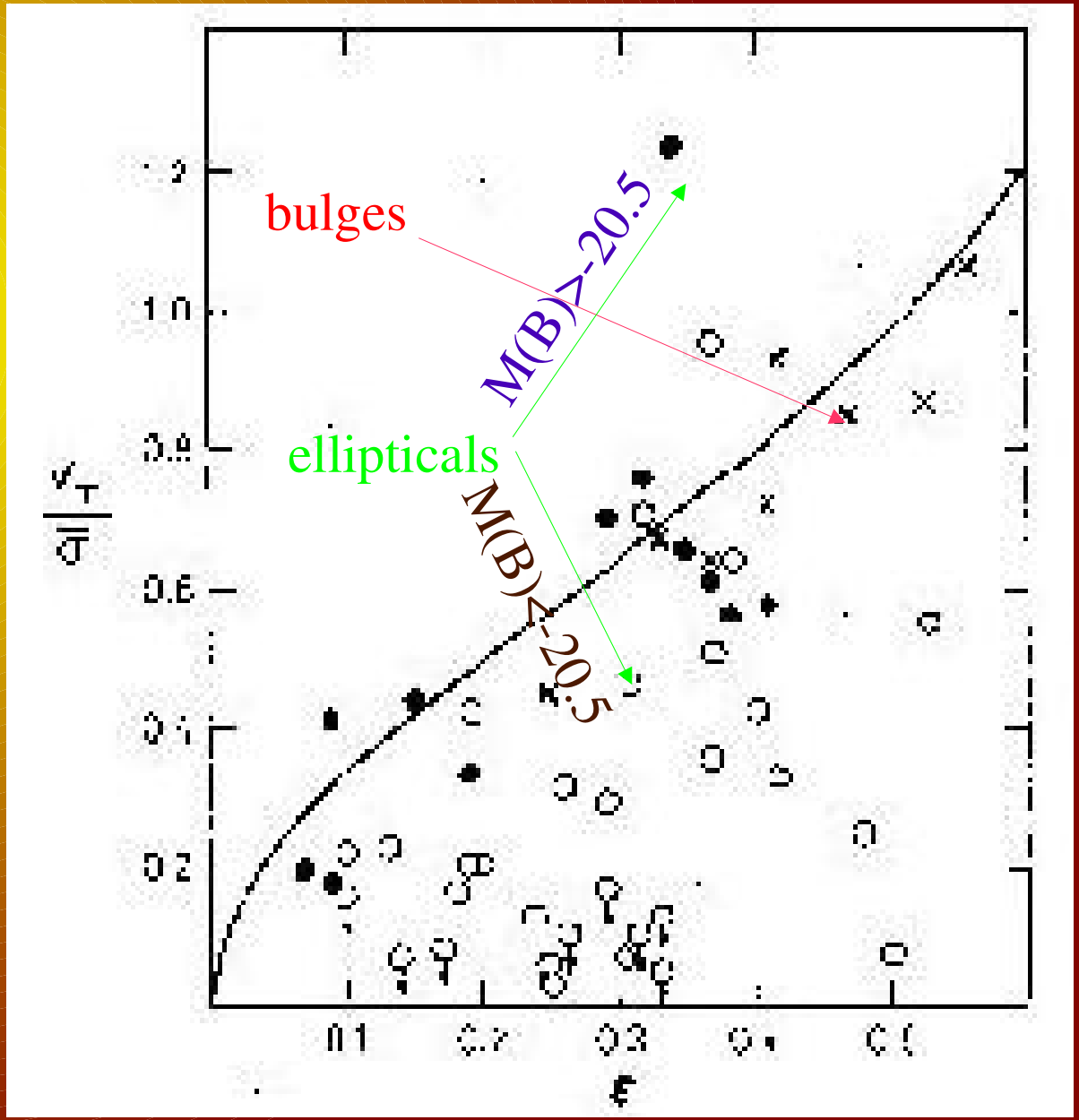
Sc



faint bulges B/T bright bulges

(Kent 1985)

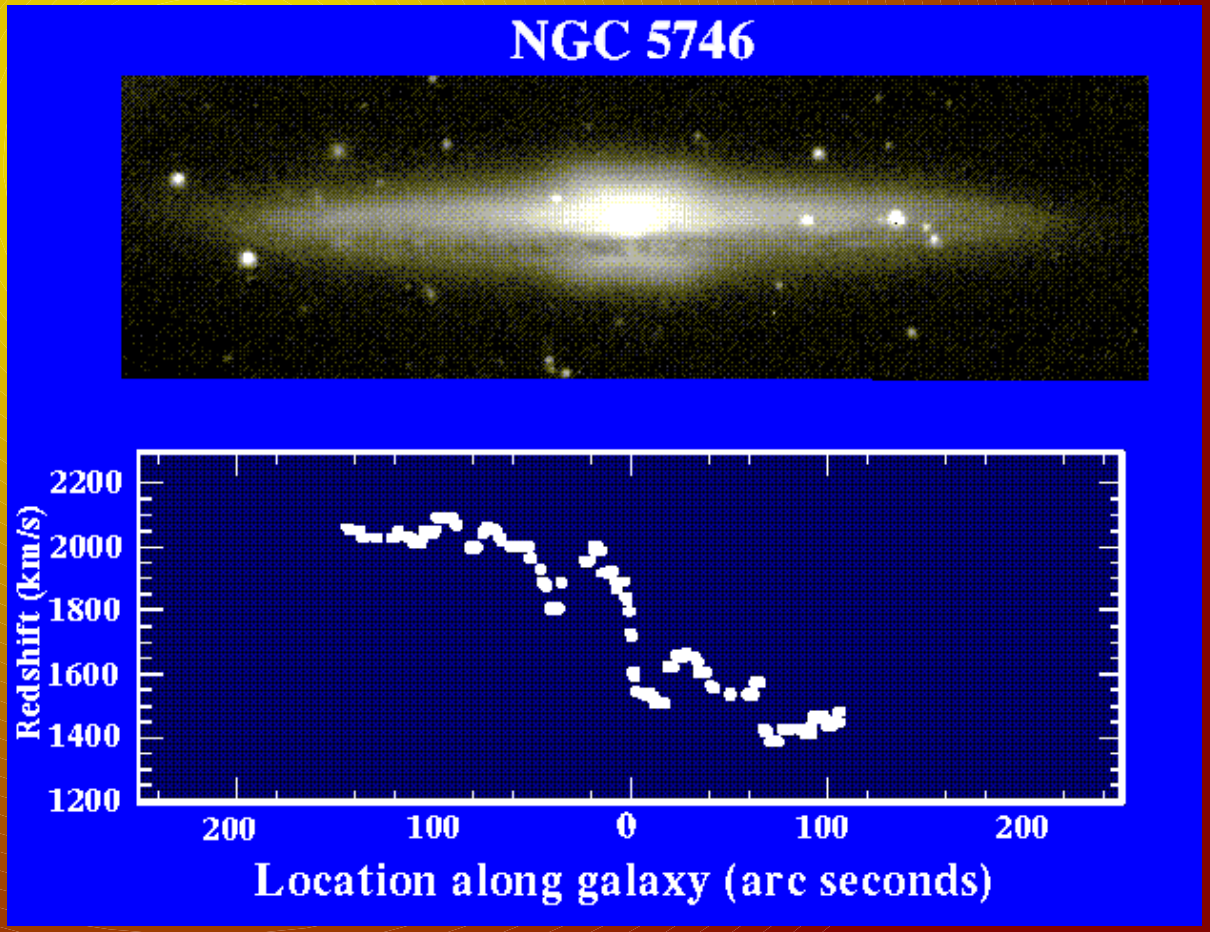
Are bulges supported by rotation?



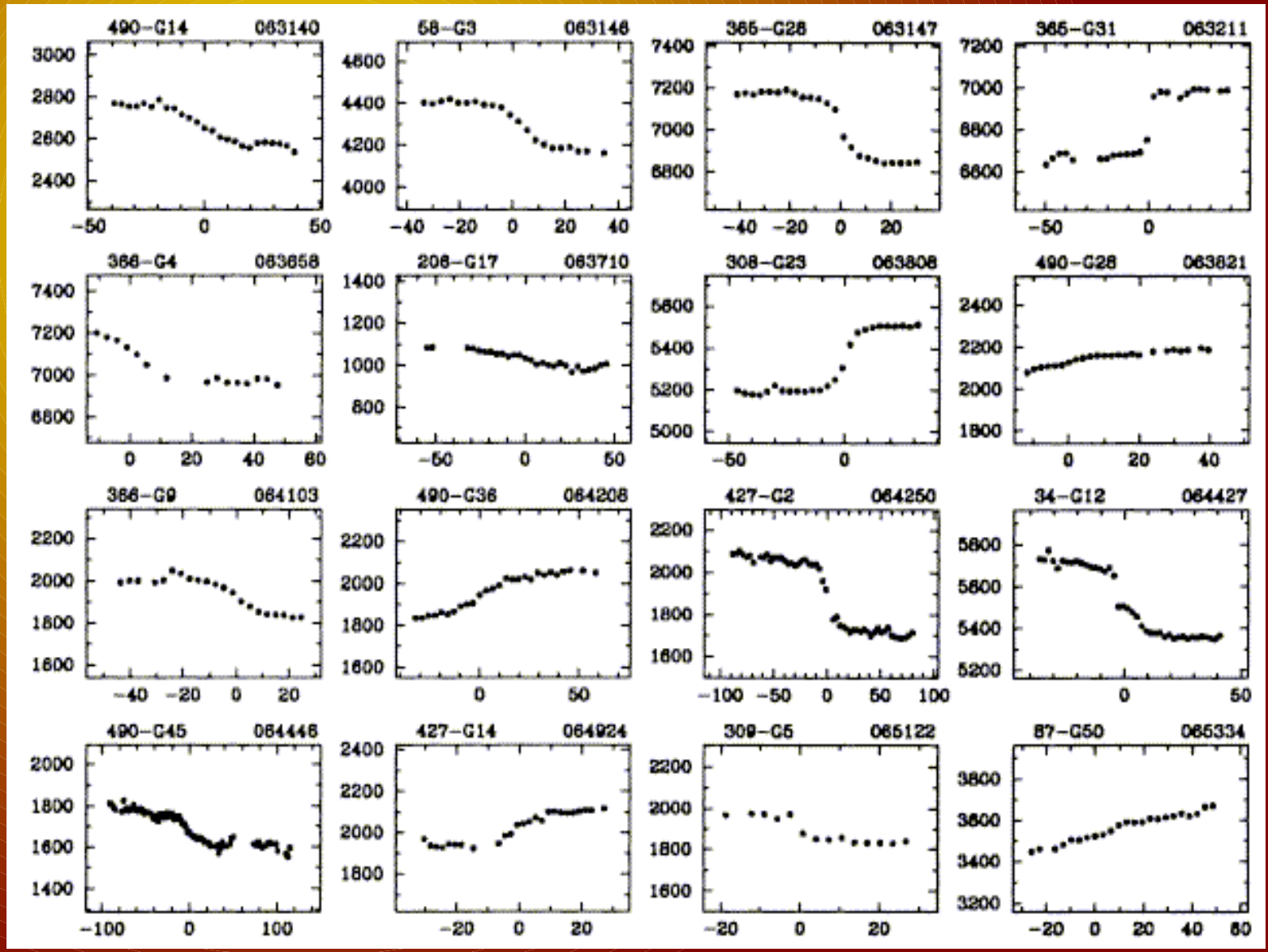
(Solid line is for oblate galaxies with isotropic vel disp)

(Davis et al. 1983)

ROTATION CURVES



ROTATION CURVES ARE NOT ALWAYS FLAT!



km/s

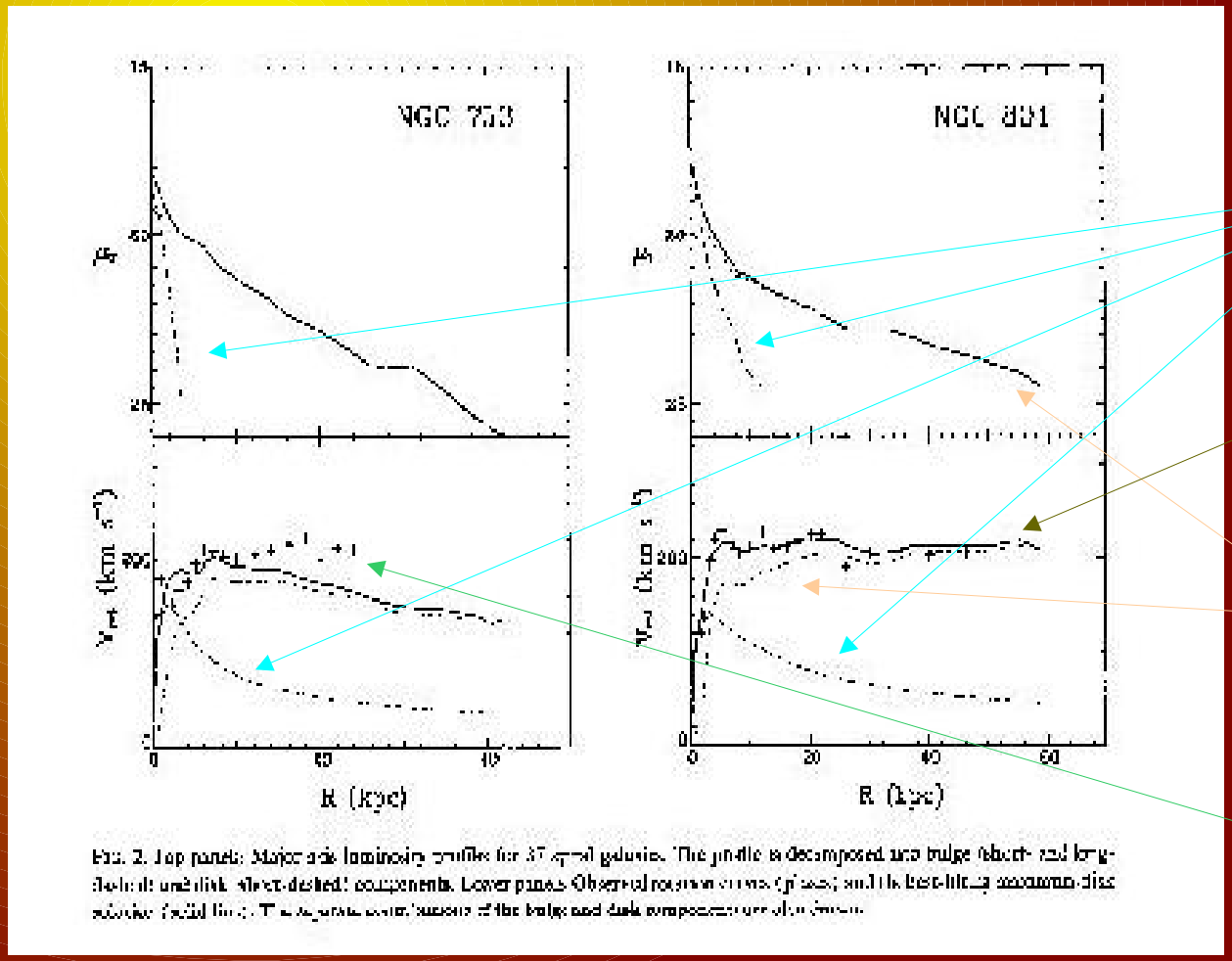
kpc

(Mathewson, Ford & Buchhorn 1992)

LUMINOUS OR DARK MATTER?

Bad fit

Good fit



SB

Rot. vel.

Bulge

Total

Disk

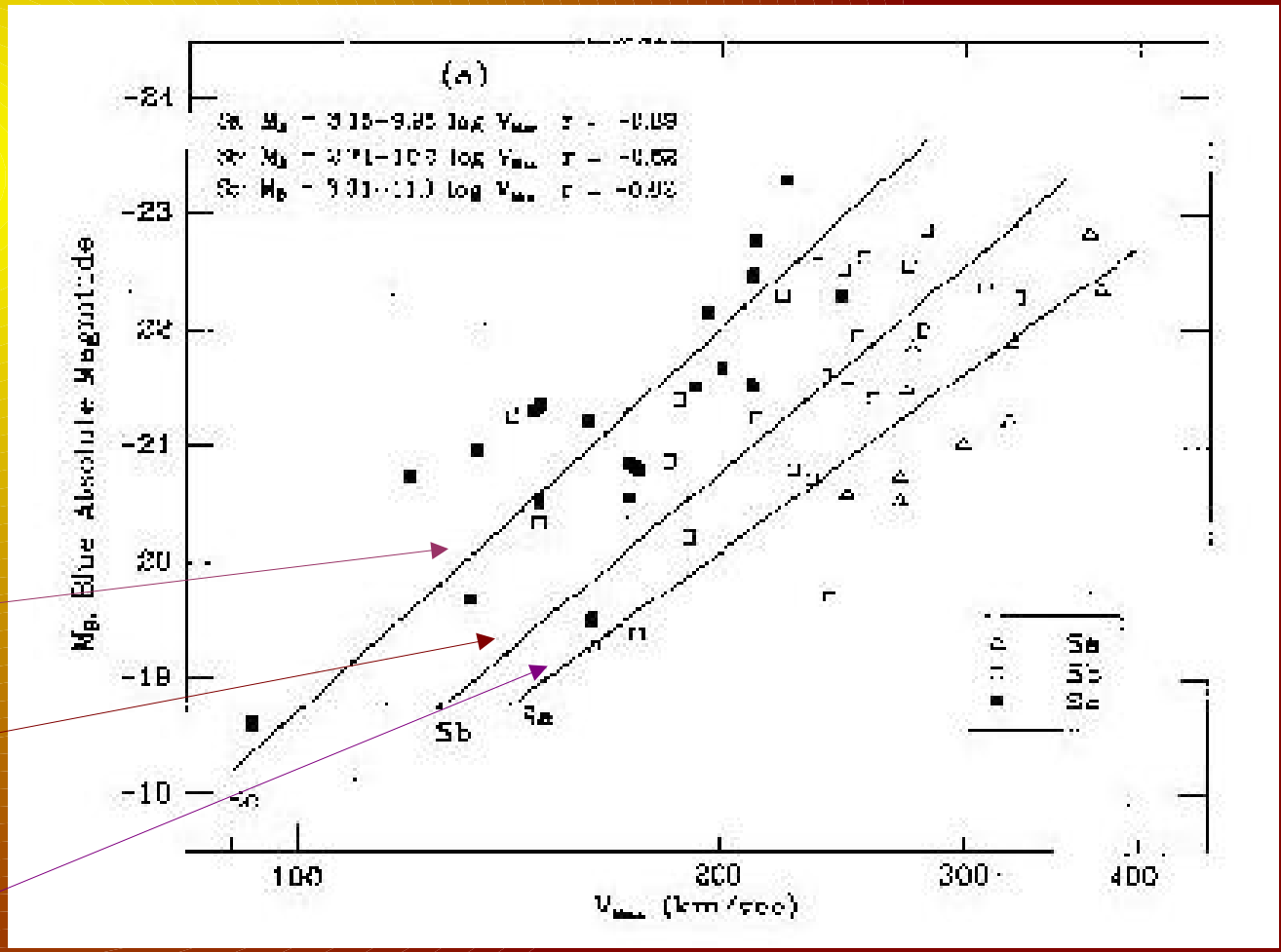
Data

(Kent 1986)

THE TULLY-FISHER RELATION

$M = a - b \log(V_{rot})$

M(B)



Sc

Sb

Sa

Max rot. vel. (km/s)

(Rubin et al 1985)

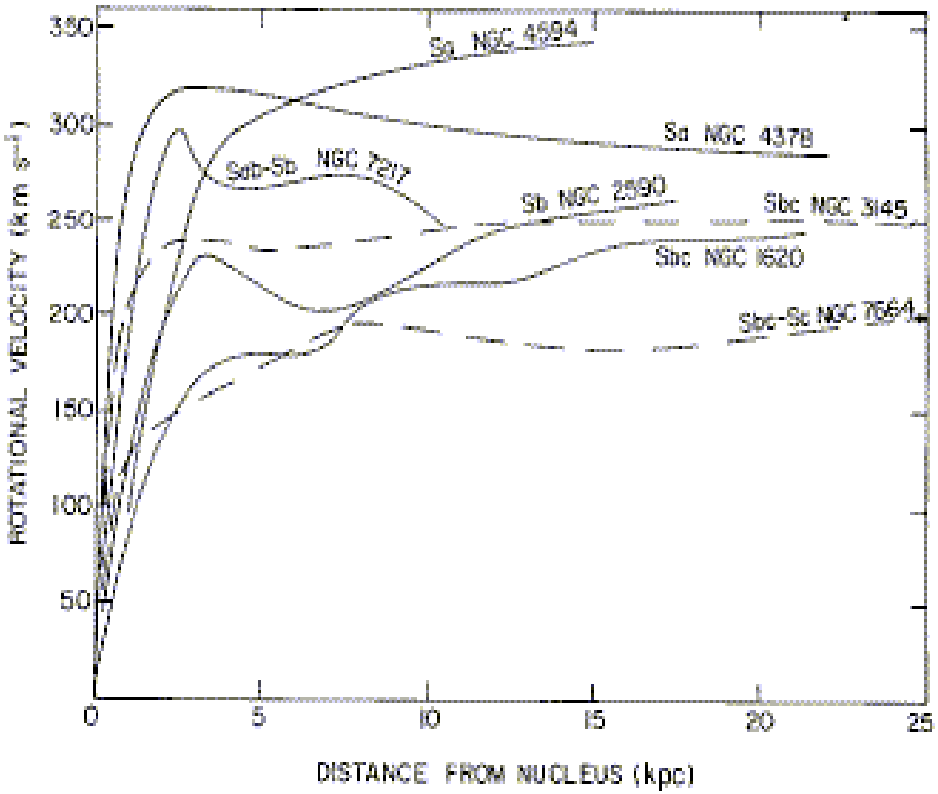


FIG. 3.—Rotational velocities for seven galaxies, as a function of distance from nucleus. Curves have been smoothed to remove velocity undulations across arms and small differences between major-axis velocities on each side of nucleus. Early-type galaxies consistently have higher peak velocities than later types.

(Rubin, Ford & Thonnard 1978)

SPIRAL ARMS IN GRAND-DESIGN SPIRALS

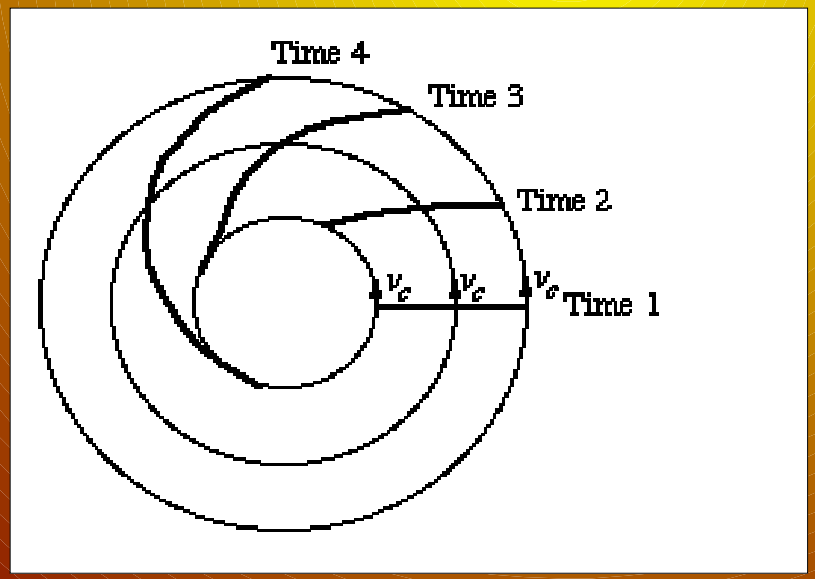
example: HST images of the center of M51

NICMOS filters (NIR: K,J)

WFPC2 filters (I,V,B)

THE ORIGIN OF SPIRAL ARMS

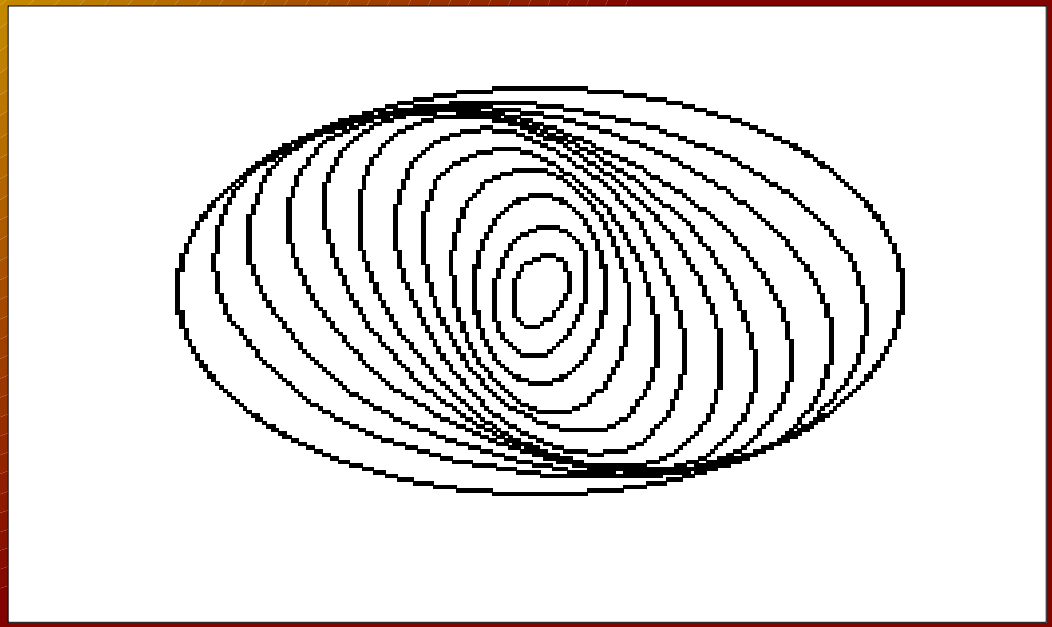
The winding dilemma:
differential rotation rapidly winds up spiral arms



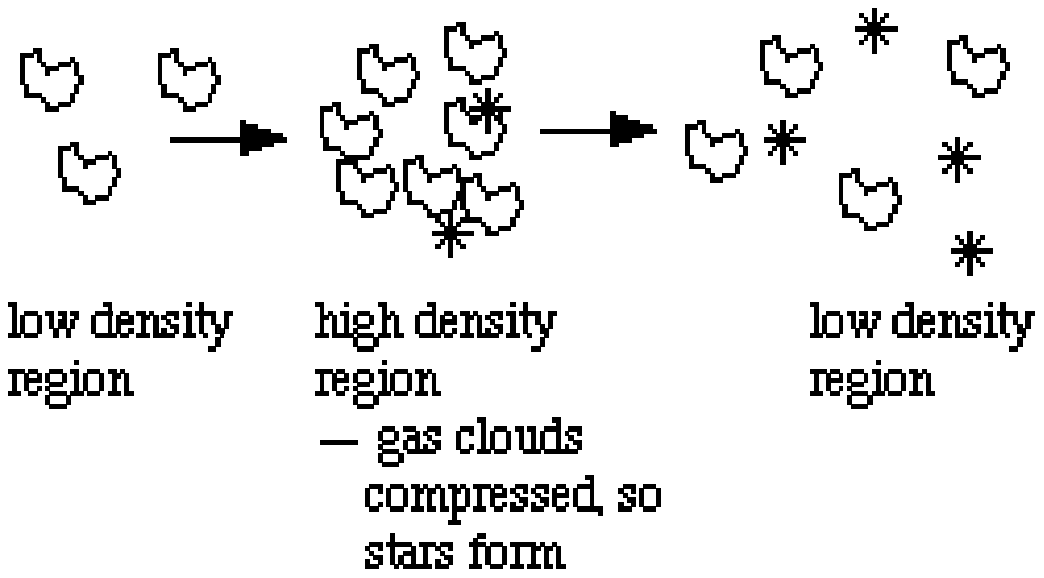
The Lin & Shu solution:
the spiral density wave

➔the stars are on elliptical orbits

➔the orbits are correlated



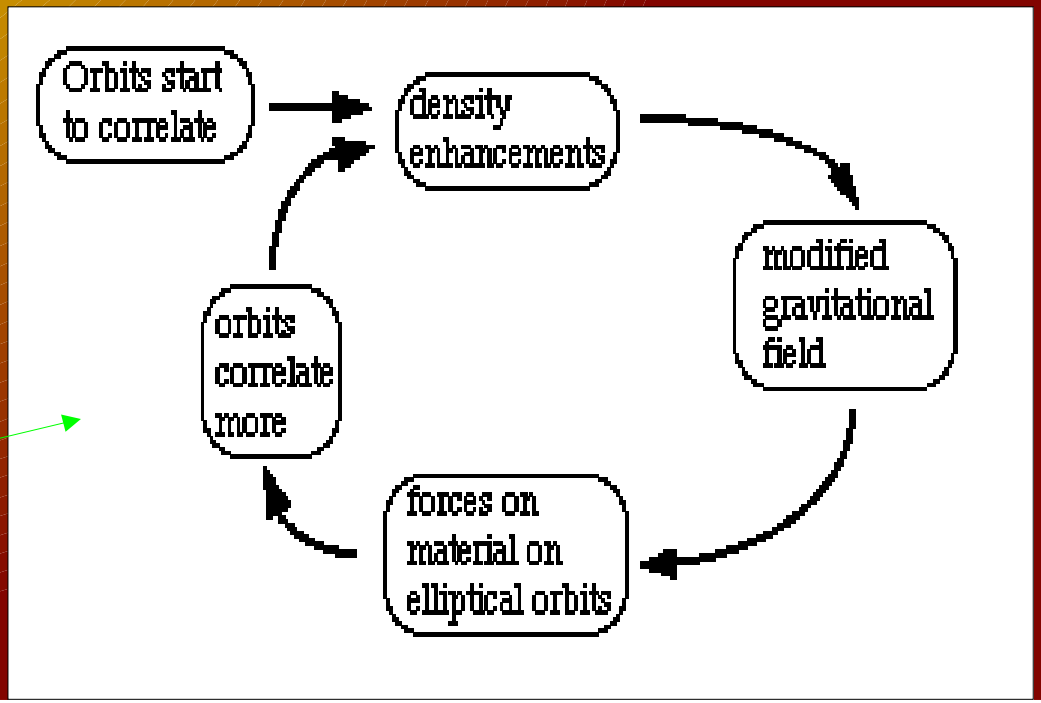
(M. Merrifield 1996)



when many orbits come together, the density increases

Star formation

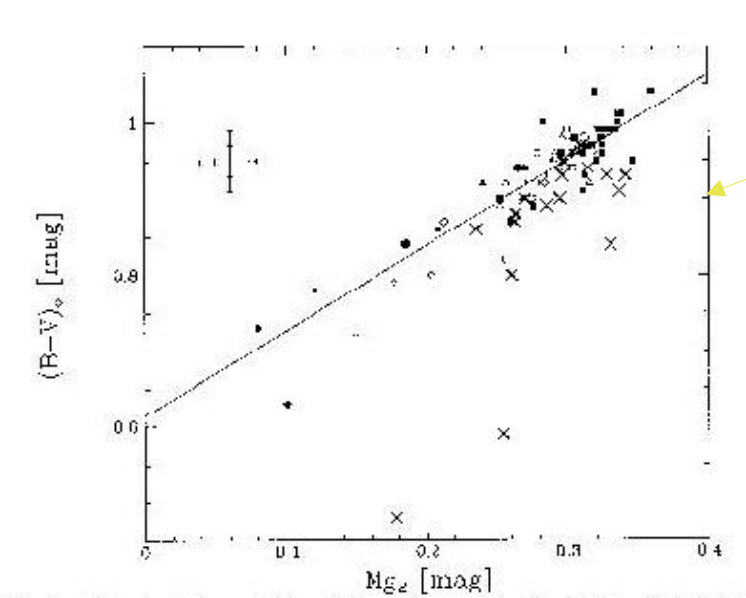
orbits correlates with a feedback loop



SPECTRAL INDEXES AND COLOUR GRADIENTS

ELLIPTICALS

Global B-V



Spectral index Mg2

weak line ← → strong line

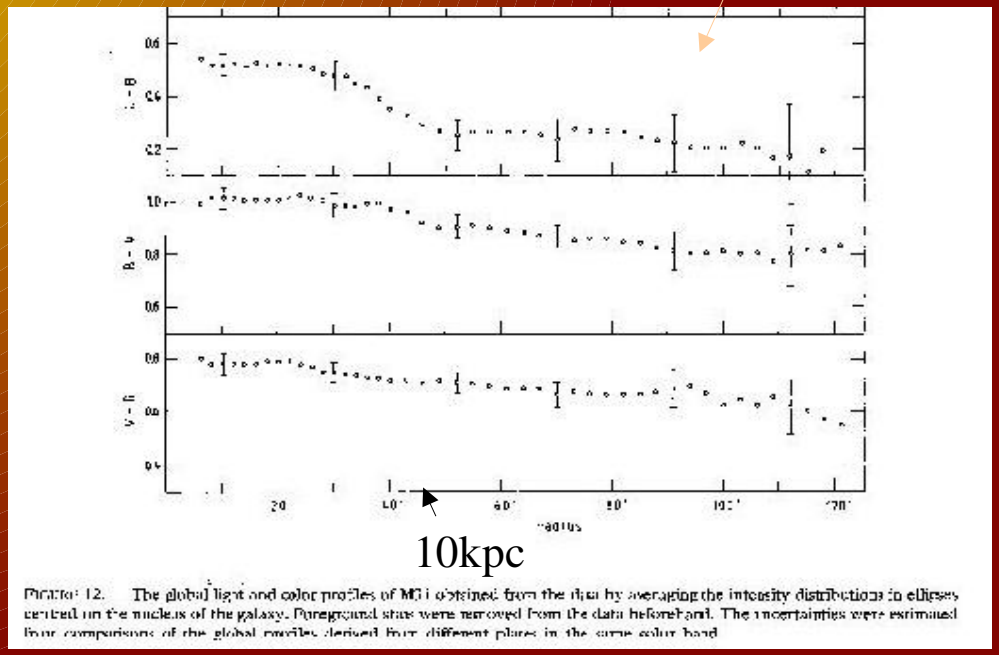
(Bender, Burstein & Faber 1993)

M31 (Spiral)

U-B

B-V

V-R



10kpc

(Walterbos & Kennicut 1987)

Radial distance (averaged over ellipses)