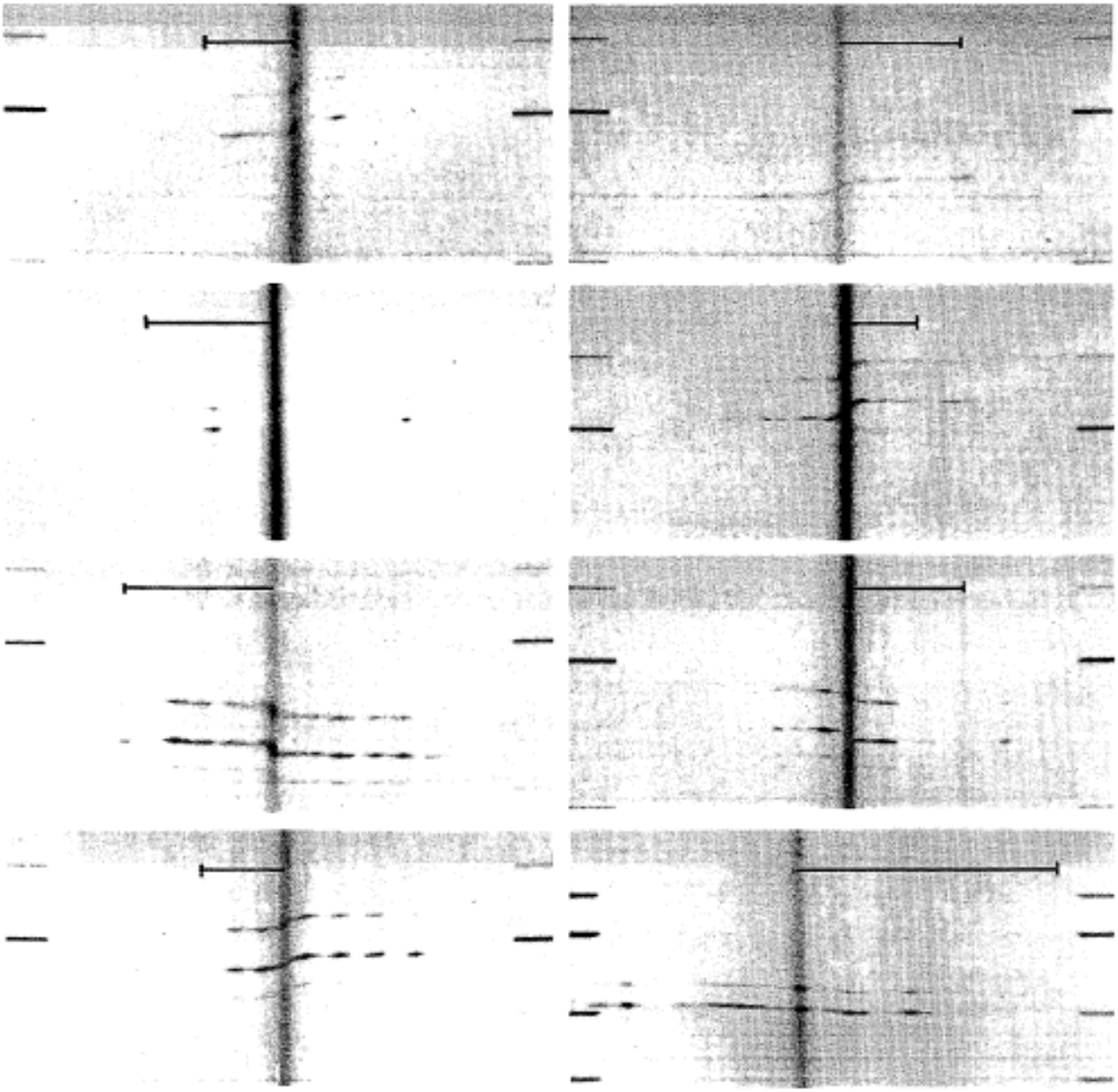


FIG. 1.—Hα region major axis spectra for galaxies of different Hubble types, taken with the 4 m RC spectrograph plus Carnegie image tube plus preflashed IIIa-J plate. Plates are (*) H_2 treated, 26 Å mm^{-1}, KPNO; or (†) N_2 baked, 52 Å mm^{-1}, CTIO. For all spectra, scale perpendicular to the dispersion is 24″ mm^{-1}, and transfer optics are f/2. (*a*)*NGC 2590, Sb, exposure 120 minutes. (*b*)*NGC 1620, Sbc, exposure 129 minutes. (*c*)†NGC 3145, Sbc I, exposure 90 minutes. (*d*)*NGC 801, Sbc–Sc, exposure 150 minutes. (*e*)*NGC 7541, Sbc–Sc, exposure 114 minutes. (*f*)*NGC 7664, Sbc–Sc, exposure 119 minutes. (*g*)*NGC 2998, Sc I, exposure 200 minutes. (*h*)†NGC 3672, Sc I–II, exposure 120 minutes. On each spectrum, Hα is strongest emission line; [N II] λ6583 is at longer λ (*up* on print). Vertical stripe is continuum from stars in nucleus. Solid horizontal line on each spectrum indicates 20 kpc in plane of galaxy. Linear extent of spectra varies from a radius of $r = 17.4$ kpc (NGC 2590) to $r = 49$ kpc (NGC 801). Note that velocity is often not constant across emission regions (spiral features) but is lower at inner edge and higher at outer edge, especially apparent in NGC 2998. The letters (*a*) and (*b*) refer to the upper left and upper right, respectively.

From Rubin et al. 1978, ApJL, 225, 107

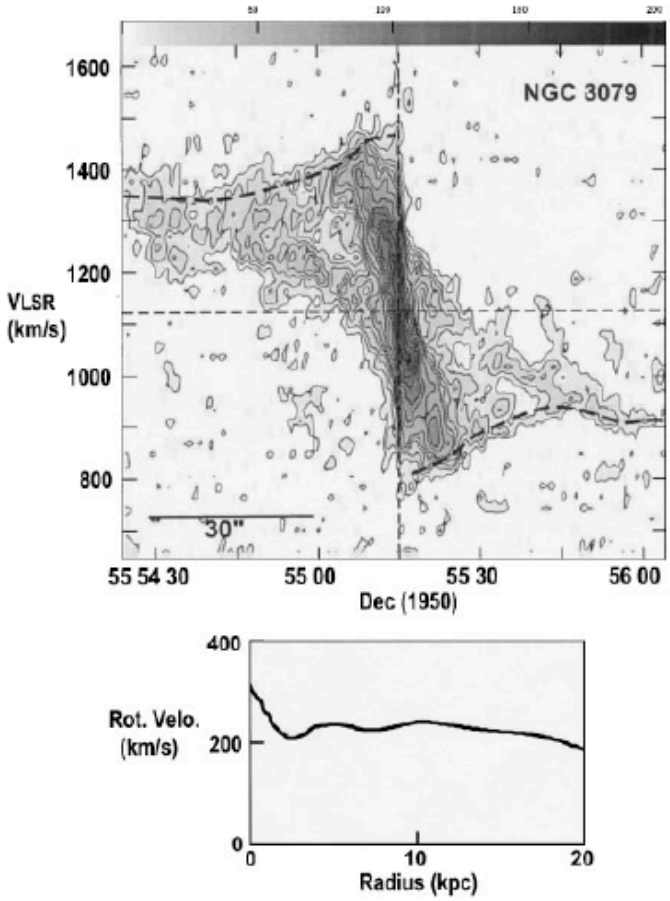


Figure 1 Position-velocity diagram along the major axis of the edge-on galaxy NGC 3079 in the CO ($J = 1-0$) line emission at a resolution of 1″.5 observed with the 7-element interferometer consisting of the six-element millimeter-wave array and the 45-m telescope at Nobeyama (Sofue et al. 1999b). The lower panel shows a composite rotation curve produced by combining the CO result and HI data (Irwin & Seaquist 1991) for the outer regions.

From Sofue & Rubin 2001, ARAA, 39, 137

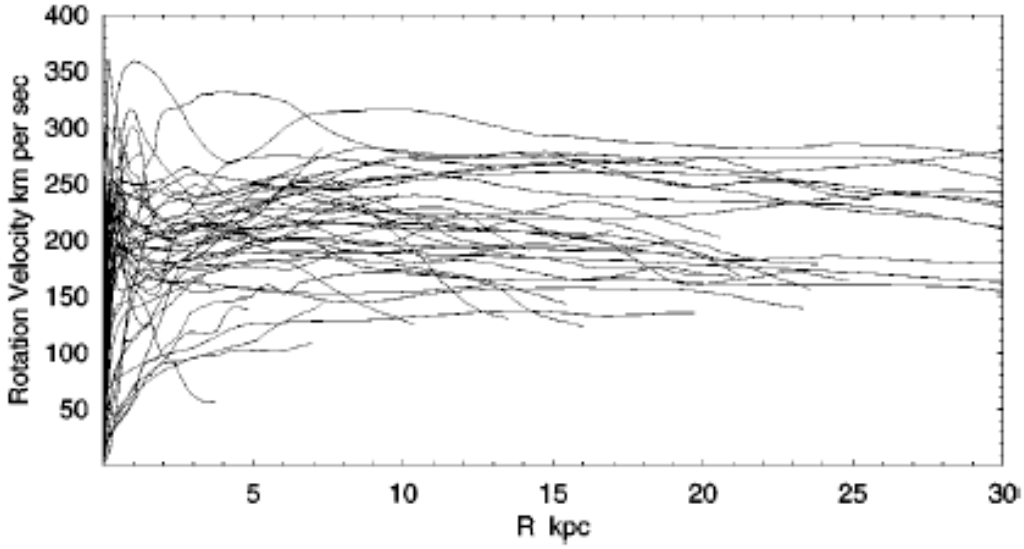


Figure 4 Rotation curves of spiral galaxies obtained by combining CO data for the central regions, optical for disks, and HI for outer disk and halo (Sofue et al. 1999a).

From Sofue & Rubin 2001, ARAA, 39, 137

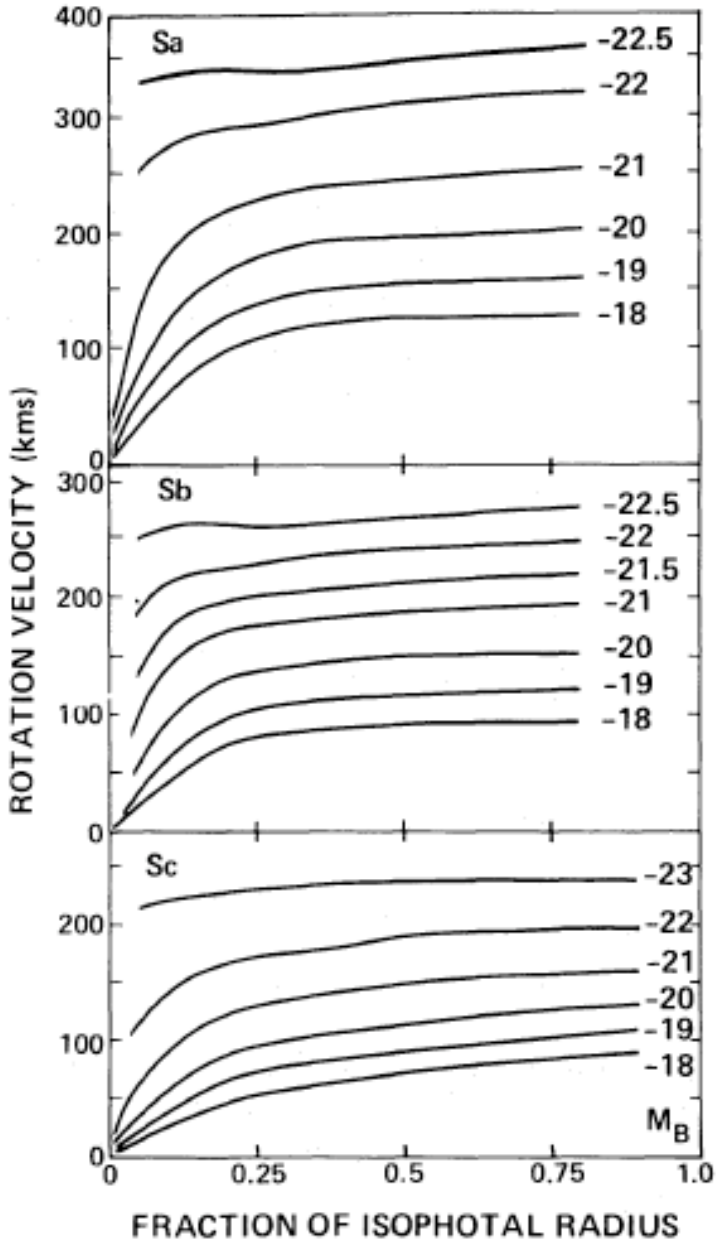


FIG. 4.—Synthetic rotation curves showing average smoothed rotation velocity as a function of fraction of isophotal radius, R_{25}, for (*top*) Sa galaxies of successive luminosities, (*middle*) Sb galaxies, and (*bottom*) Sc galaxies. The procedure for synthesizing these curves is described in Appendix B.

From Rubin et al. 1985, ApJ, 289, 81

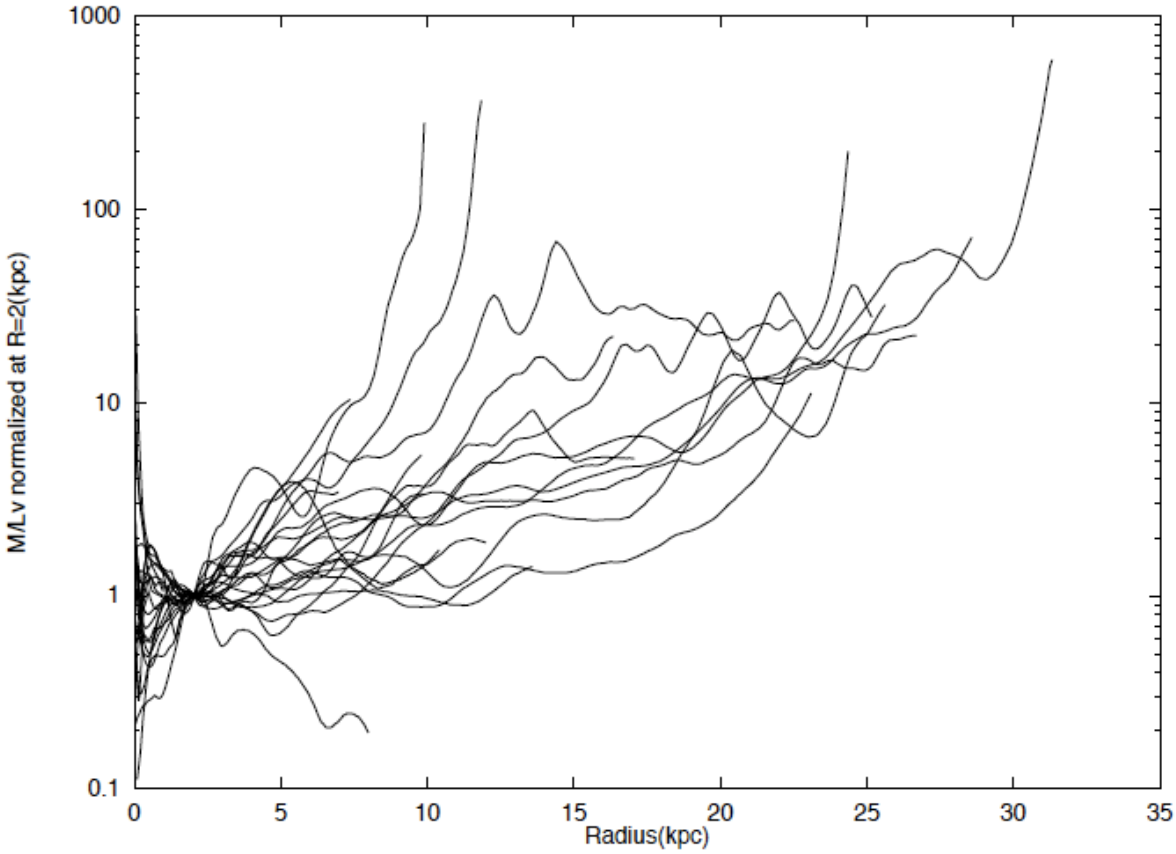


FIG. 8.—M/L distributions normalized at $r = 2$ kpc, as obtained by using the SMD and the V-band photometric data of Kodaira et al. (1990).

From Takamiya & Sofue 2000, ApJ, 534, 670

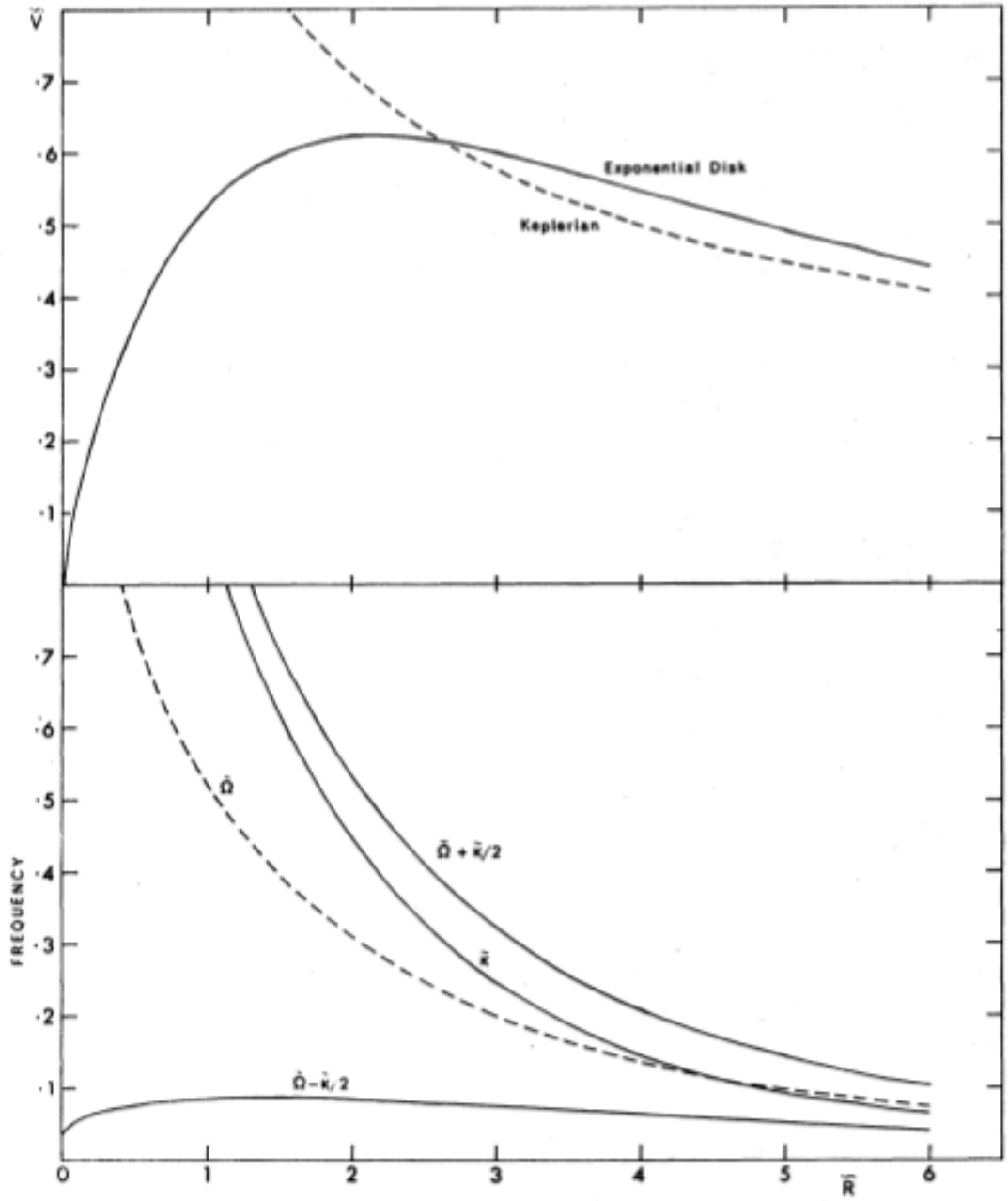


FIG. 2 (*top*).—Dimensionless rotation curve for the exponential disk. $\tilde{V}$ and $\tilde{R}$ are defined in § II*a*. Broken line shows the corresponding Keplerian curve.

FIG. 3 (*bottom*).—Dimensionless angular velocity, epicyclic frequency, and Lindblad-resonance frequencies for the exponential disk (see § II*c*).

From Freeman 1970, ApJ, 160, 811 (horizontal axis is r/r_d)

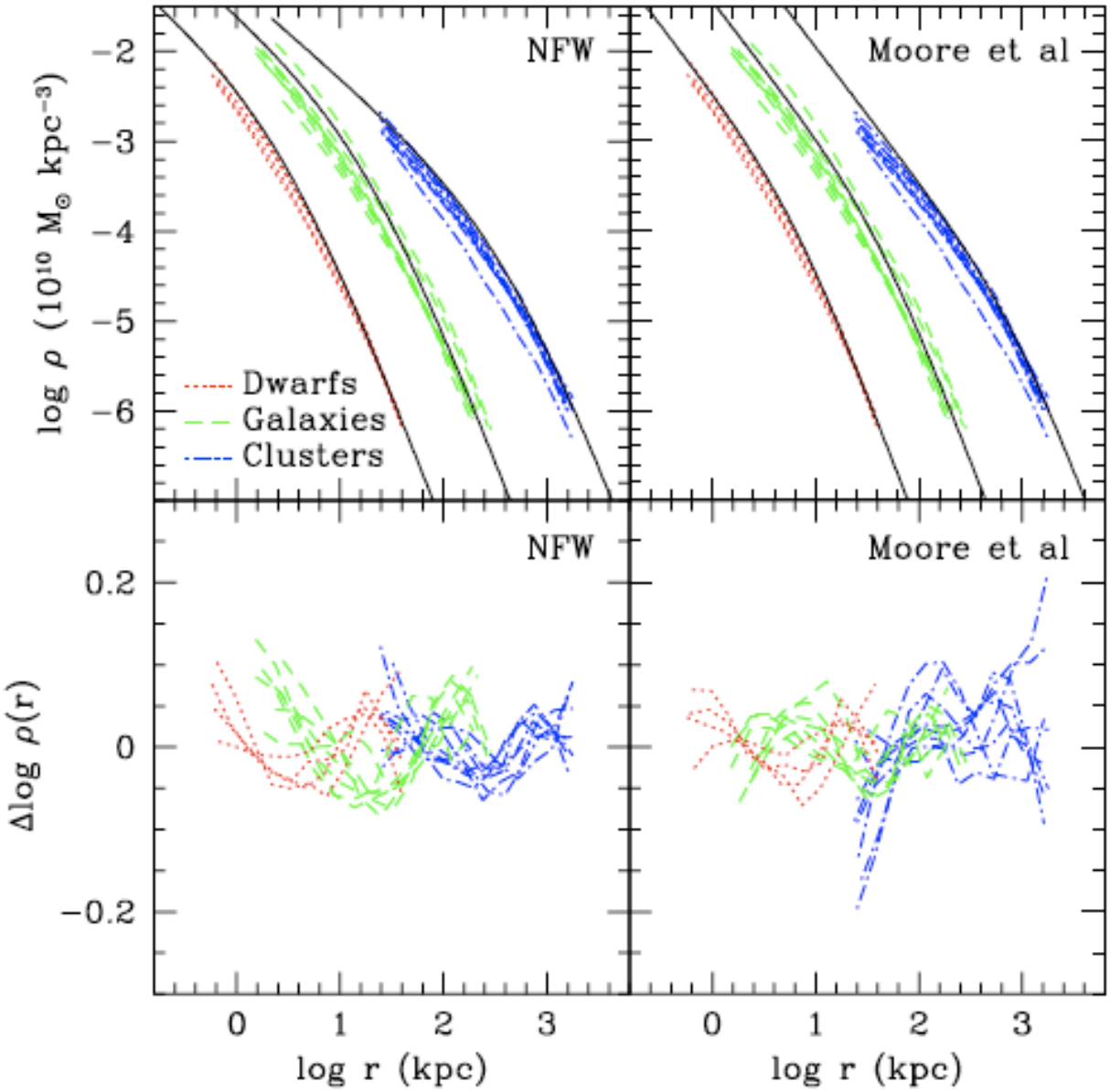
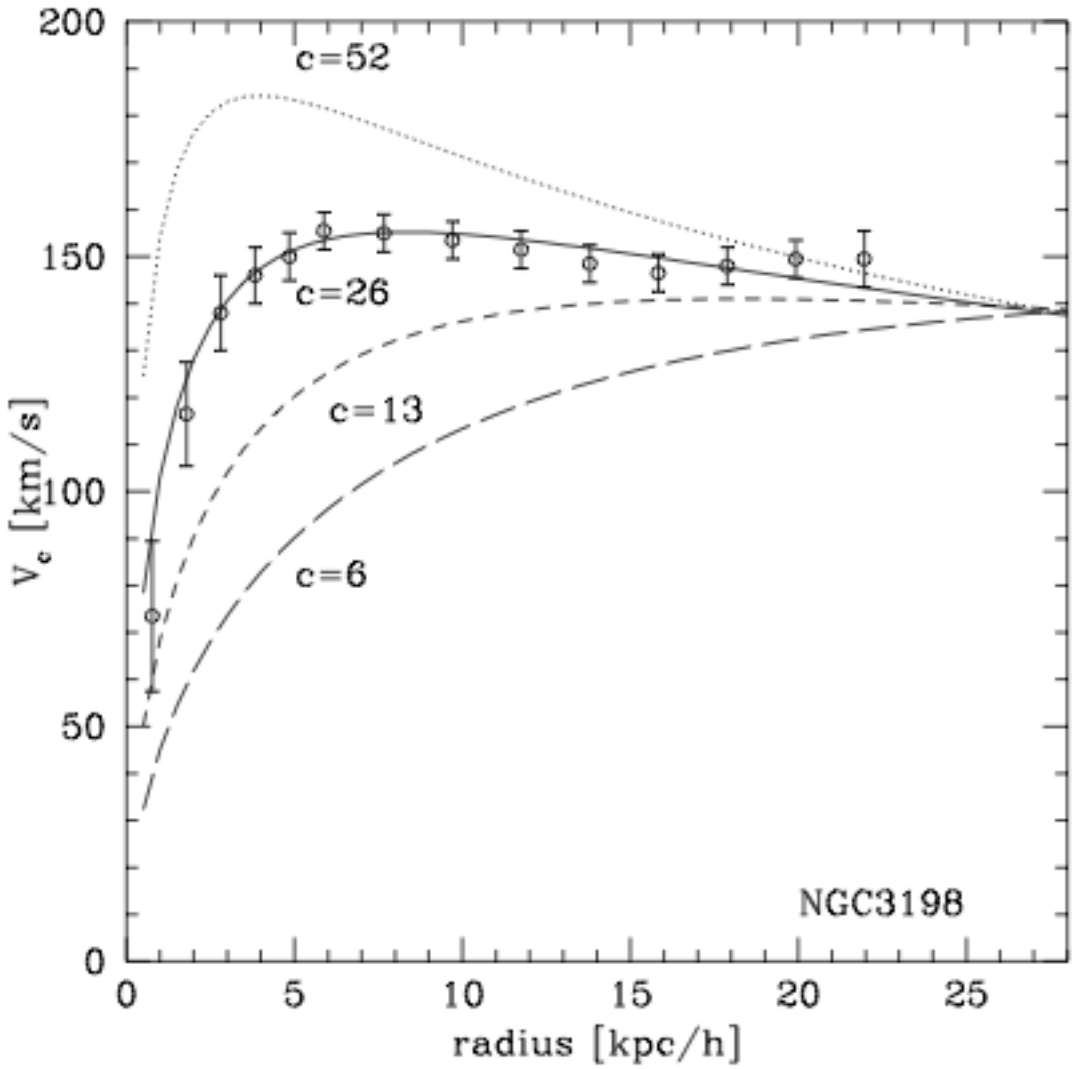


Figure 1. Spherically-averaged density profiles of all our simulated halos. Densities are computed in radial bins of equal logarithmic width and are shown from the innermost converged radius (r_{conv}) out to about the virial radius of each halo (r_{200}). Our simulations target halos in three distinct mass groups: "dwarf", "galaxy", and "cluster" halos. These groups span more than five decades in mass. Thick solid lines in the top panels illustrate the expected halo profile for each mass range according to the fitting formula proposed by NFW (top-left) or M99 (top-right). Bottom panels indicate the deviation from the *best* fit achieved for each individual halo (simulation minus fit) with the NFW profile (eq. 1) or with its modified form, as proposed by M99 (eq. 2).

From Navarro et al. 2004, MNRAS, 349, 1039



From Navarro 1998 (astro-ph/9801073). Different velocity curves for DM halo profiles with similar v_{200} values and different values of c, compared to data.

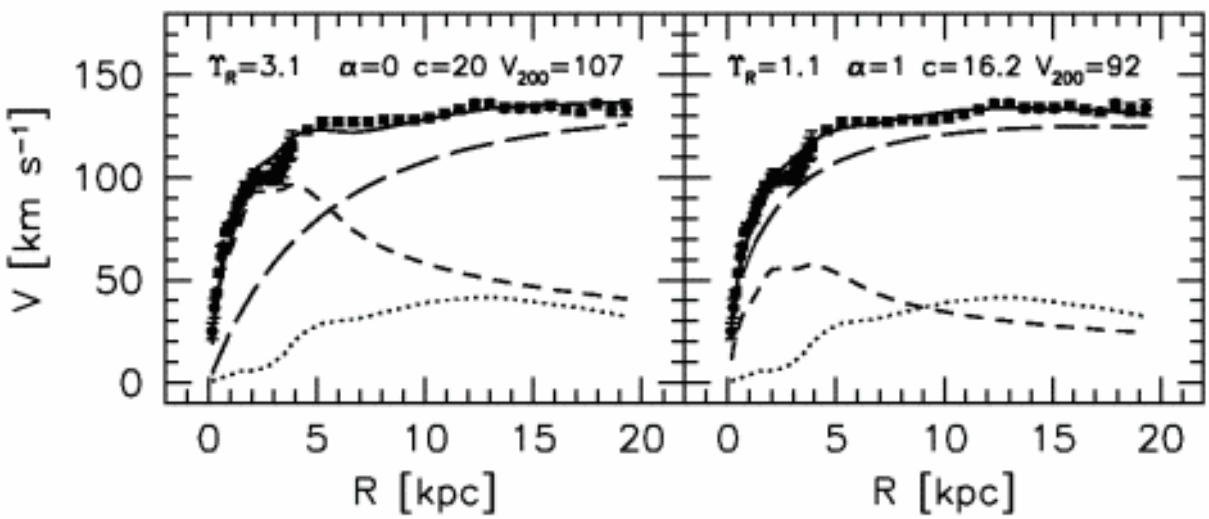


Fig. 11.1. The rotation curve of NGC 2403 (solid dots with error bars) and two decompositions in contributions from the stellar disk (short-dashed lines), the gas disk (dotted lines) and the dark matter halo (long-dashed lines). In the left panel, a maximal disk with $\Upsilon_R = 3.1(M/L_R)_\odot$ is used together with a dark matter halo with a central density core, while the decomposition in the right panel uses a NFW halo and a submaximal disk with $\Upsilon_R = 1.1(M/L_R)_\odot$. Both decompositions fit the observations equally well, illustrating the disk–halo degeneracy. [After Dutton et al. (2005); courtesy of A. Dutton]

From Mo et al. textbook, Ch. 11

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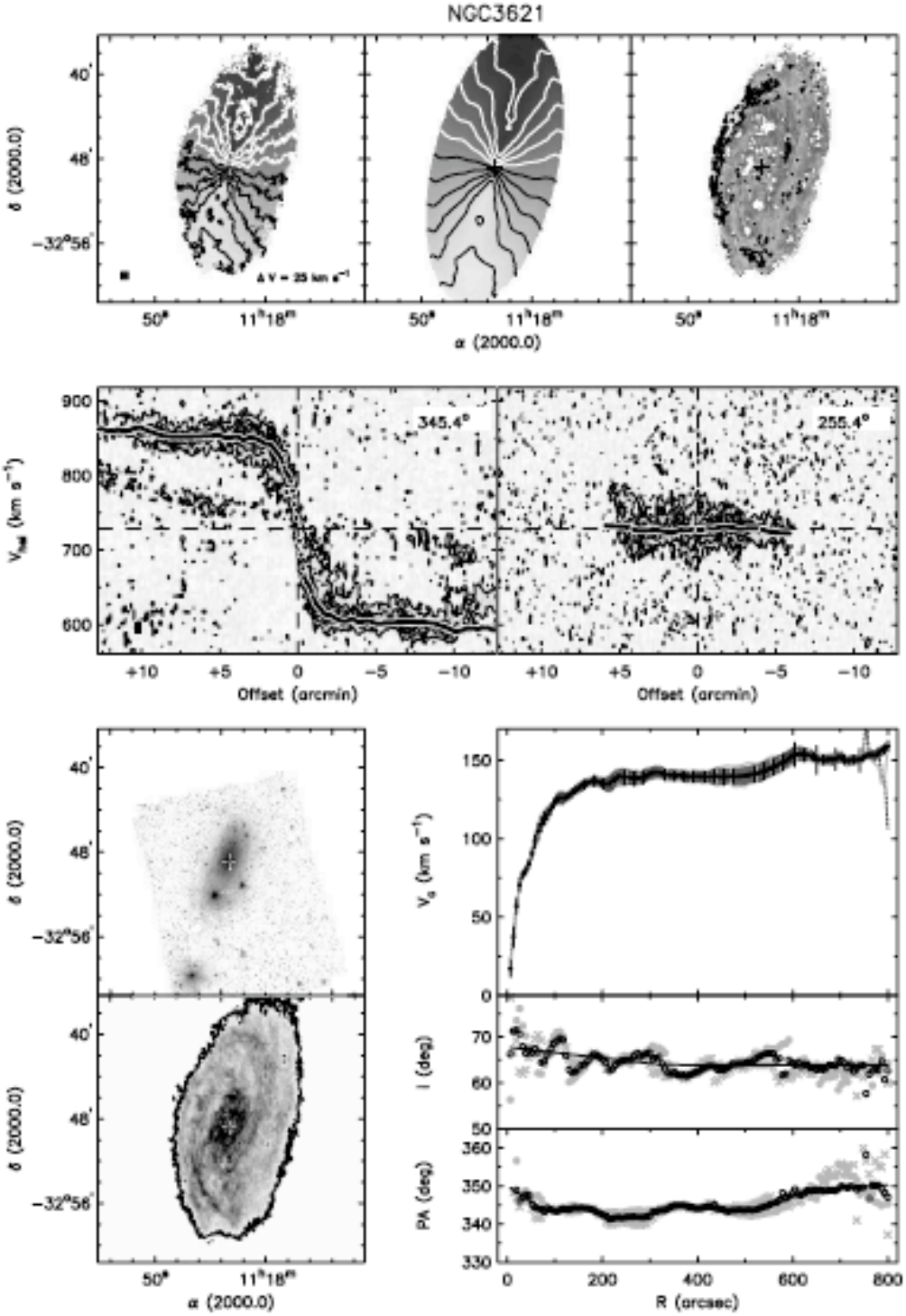

Figure 78. Summary panel for NGC 3621. See the Appendix for more information.

From de Blok et al. 2008, AJ, 136, 3648

Top row. Left*:* velocity field derived from fitting Hermite polynomials to the natural-weighted data cube. See Section 3.1 for a description. The systemic velocity is indicated by the thick contour. The spacing Δ*V* between velocity contours is indicated in the figure. The approaching side can be identified by the light gray scales and the dark contours. The receding side can be identified by the dark gray scales and the white contours. The adopted dynamical center is indicated with a cross. The beam size is indicated by the ellipse enclosed by the rectangle in the bottom-left corner. ***Center:*** model velocity field derived from the tilted-ring model. Gray scales and contour levels are identical to those in the observed velocity field in the left panel. Right: residual velocity field defined as the observed velocity field minus the model velocity field. The gray scale range runs from −20 km s−1 (white) to +20 km s−1 (black). Contour levels are −10*,−20,−30, . . . km s−1 (black) and +10, +20, +30, . . .* km s−1 (white). ***Centre row. Left:*** *position–velocity diagram taken along the* average P.A. of the major axis as listed in Table 2. This P.A. is also indicated in the top-left of the panel. The thickness of the slice equals one pixel (typically 1. 5; see Walter et al. 2008) in the corresponding cube. Contours start at +2*σ in steps of 4σ* (full contours), and −2*σ in steps of −4σ (dotted contours). The* systemic velocity and position of the center are indicated by dashed lines. Overplotted is the rotation curve projected onto the average major axis using the derived radial variations of P.A. and *i. The spatial and velocity resolutions are indicated by* the cross enclosed by the rectangle in the bottom-left corner. ***Right:*** position–velocity diagram taken along the average minor axis. Contours and symbols are as in the major axis diagram Overplotted is the rotation curve but projected onto the average minor axis using the derived radial variations of P.A. and *i. Bottom-left panel. Top: the 3.6 μm IRAC Spitzer image.* For all galaxies, the same logarithmic intensity scale was used, running from log(*I/(MJy ster−1)) = −2 (white) to* log(*I/(MJy ster−1)) = +1 (black). The dynamical center is* indicated by a cross. ***Bottom:*** integrated Hi map. The dynamical center is indicated by a cross. The maximum column density level displayed (black) is 2 °ø 1021 cm−2. The contour indicates the 3*σ level. This level was computed as follows: for the* standard THINGS cubes *σtot =√ Nσchan, where σtot is the noise* in the integrated Hi map, *σchan the noise in one channel, and N* the number of channels contributing to a pixel. ***Bottom-right panel. Top****: the rotation curve corresponding* to the tilted-ring model is represented by the black filled circles. The error-bars correspond to the dispersion of the velocity values found along the corresponding ring. This rotation curve was derived with all parameters fixed to their final values (as indicated by the thick black curves in the P.A. and inclination panels below). The full drawn gray line shows the corresponding rotation curve of the approaching side derived using these adopted distributions of inclination and P.A. The dashed gray line shows the equivalent rotation curve of the receding side. The dotted black curve indicates the rotation curve of the entire disk derived with P.A. and inclination as free parameters. The uncertainties in the rotation velocity are defined as the quadratic addition of the dispersion in velocities found along each ring and one quarter of the difference between the approaching and receding sides velocity values. See Section 3.5 for a full discussion. ***<u>Center and bottom</u>*****:** inclination and P.A. values used in the tilted-ring models. The open circles show the distribution of inclination and P.A. when left as free parameters. These These values result in the dotted black rotation curve described above. The crosses show same for the approaching side, the gray filled circles for the receding side. The thick black lines indicate the distributions for P.A. and inclination that were ultimately adopted to derive the rotation curves in the panel above.

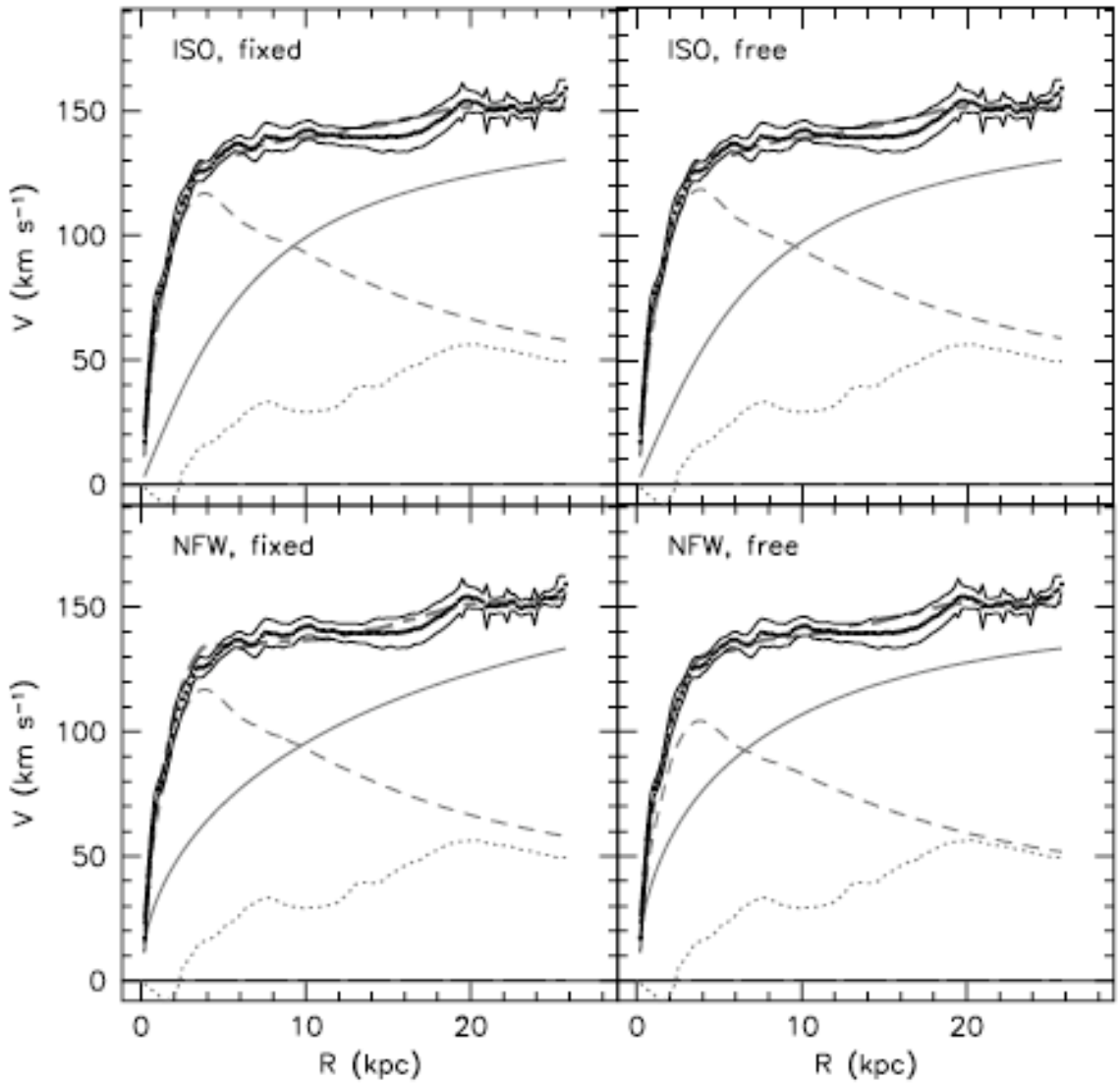

Figure 42. ISO and NFW rotation curve fits for NGC 3621. Lines and symbols are as in Figure 25.

Dotted: gas; dashed: stars; solid: DM

From de Blok et al. 2008, AJ, 136, 3648