FORMATION AND EVOLUTION OF DISK GALAXIES

C. FIRMANI AND V. AVILA-REESE
Centro de Instrumentos-UNAM, A.P.70-186,04510 Mexico D.F.
Instituto de Astronomia-UNAM, A.P.70-264,04510 Mexico D.F.

We have developed a semianalitical approach to study galaxy formation and evolution in the cosmological context. Disk galaxies (dark matter halo+luminous disk) are considered to be formed through an extended process of gravitational collapse, whose character is determined by the statistical properties of the density fluctuation field assumed here to be Gaussian. Gas disks in centrifugal equilibrium within the collapsing dark halos are built up (detailed angular momentum conservation is assumed), and their galactic evolution is calculated with a model which consider all the gravitational interactions, the hydrodynamics of the ISM, and the SF process. A bulge as product of stellar disk gravitational instabilities is constructed. To study general behaviors a Gaussian $\sigma_8 = 1$ SCDM model is used. For a given mass one obtains a range of dark matter configurations. The average case is in excellent agreement with results of cosmological N-body simulations. The slope of the mass-velocity relation agrees with the slope of the H- and I-band Tully-Fisher relations, but the velocities are too high. This problem dissapears if the power spectrum is renormalized to $\sigma_8 = 0.57$, suggesting that the TF relation is result of the natural extension to galactic scales of the galaxy distribution power spectrum, and that on the basis of its origin are the cosmological initial conditions. The scatter on the mass-velocity relation is realistic. The models predict disk exponential surface brightness (SB) profiles, nearly flat rotation curves, and negative radial gradients in the B-V color. The obtained, gas fractions, B-V colors, central SBs μ_{B_0}, bulge-to-disk (b/d) ratios, and rotation velocities (for $\sigma_8 = 0.57$) are in agreement with observations, and their correlations are similar to those which define the Hubble sequence, including the LSB galaxies. These properties and correlations are the product of the combination of three fundamental physical factors: the mass, the mass aggregation history (MAH), and the initial angular momentum. The intensive properties are almost invariant to the mass, the MAH determines the B-V color, and the spin parameter λ mainly influences on μ_{B_0}, and b/d ratio.

K. Sato (ed.), Cosmological Parameters and the Evolution of the Universe, 153.