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Disk galaxy evolution up to redshift z = 1

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We have performed intermediate-resolution VLT/FORS spectroscopy and HST/ACS imaging of 129 field spiral galaxies within the FORS Deep Field. The galaxies cover the redshift range $0.1 < z < 1.0$ and comprise all types from Sa to Sdm/Im. Spatially resolved rotation curves were extracted and fitted with synthetic velocity fields that take into account all geometric (e.g., inclination and misalignment) and observational effects (in particular, blurring due to optical beam smearing and seeing). Using these fits, the maximum rotation velocity V_{max} could be determined for 77 objects. The Tully-Fisher relation of this sample at a mean look-back time of ~5 Gyrs shows a luminosity evolution which amounts to ~ 2 mag in rest-frame B for low-mass spirals (V_{max} ~ 100 km/s) but is negligible for high-mass spirals (V_{max} ~ 300 km/s). This confirms our previous analysis which was limited to ground-based imaging (Böhm et al. 2004, A&A, 420, 97). The observed overluminosity of low-mass galaxies is at variance with predictions from numerical simulations (e.g., Boissier & Prantzos 2001, MNRAS, 325, 321). On the other hand, at given V_{max}, we find slightly smaller disk sizes towards higher redshifts, in compliance with the CDM hierarchical model. The observed mass-dependent luminosity evolution might therefore point towards the need for a more realistic modelling of the stellar (i.e. baryonic) component in N-body codes.

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