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The Baryonic Tully-Fisher Relation of Gas Rich Galaxies as a Test of LCDM and MOND

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(Submitted on 14 Jul 2011 (v1), last revised 7 Dec 2011 (this version, v2))

The Baryonic Tully-Fisher Relation (BTFR) is an empirical relation between baryonic mass and rotation velocity in disk galaxies. It provides tests of galaxy formation models in LCDM and of alternative theories like MOND. Observations of gas rich galaxies provide a measure of the slope and normalization of the BTFR that is more accurate (if less precise) than that provided by star dominated spirals, as their masses are insensitive to the details of stellar population modeling. Recent independent data for such galaxies are consistent with Mb = AVf^4 with A = 47+/-6 Msun (km/s)^-4. This is equivalent to MOND with $a_0 = 1.3 +/- 0.3 A/s/s. The scatter in the data is consistent with being due entirely to observational uncertainties. It is unclear why the physics of galaxy formation in LCDM happens to pick out the relation predicted by MOND. We introduce a feedback efficacy parameter E to relate halo properties to those of the galaxies they host. E correlates with star formation rate and gas fraction in the sense that galaxies that have experienced the least star formation have been most impacted by feedback.

Comments:	Astronomical Journal, in press. Added new figure (7 total); new version matches accepted version. Electronic data available at this http URL
Subjects:	**Cosmology and Extragalactic Astrophysics (astro-ph.CO)**
Cite as:	**arXiv:1107.2934 [astro-ph.CO]**
	(or **arXiv:1107.2934v2 [astro-ph.CO]** for this version)

Submission history

From: Stacy McGaugh [view email]
[v1] Thu, 14 Jul 2011 20:01:18 GMT (134kb)
[v2] Wed, 7 Dec 2011 21:12:12 GMT (142kb)

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