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The Atlas3D project - X. On the origin of the molecular and ionised gas in early-type galaxies

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(Submitted on 30 Jun 2011)

We make use of interferometric CO and HI observations, and optical integral-field spectroscopy to probe the origin of the molecular and ionised interstellar medium (ISM) in local early-type galaxies (ETGs). We find that 36\pm5% of our sample of fast rotating ETGs have their ionised gas kinematically misaligned with respect to the stars, setting a strong lower limit on the importance of externally acquired gas (e.g. from mergers and cold accretion). Slow rotators have a flat distribution of misalignments, indicating that the dominant source of gas is external. The molecular, ionised and atomic gas in all the detected galaxies are always kinematically aligned, even when they are misaligned from the stars, suggesting that all these three phases of the ISM share a common origin. In addition, we find that the origin of the cold and warm gas in fast-rotating ETGs is strongly affected by environment, despite the molecular gas detection rate and mass fractions being fairly independent of group/cluster membership. Galaxies in dense groups and the Virgo cluster nearly always have their molecular gas kinematically aligned with the stellar kinematics, consistent with a purely internal origin. In the field, however, kinematic misalignments between the stellar and gaseous components indicate that >46% of local fast-rotating ETGs have their gas supplied from external sources. We discuss several scenarios which could explain the environmental dichotomy, but find it difficult to simultaneously explain the kinematic misalignment difference and the constant detection rate. Furthermore, our results suggest that galaxy mass may be an important independent factor associated with the origin of the gas, with the most massive fast-rotating galaxies in our sample (M_K<-24 mag; stellar mass of >8x10^10 Msun) always having kinematically aligned gas. (abridged)

Comments:	19 pages, 9 figures and 4 tables. Accepted to MNRAS
Subjects:	**Cosmology and Extragalactic Astrophysics (astro-ph.CO)**
Journal reference:	MNRAS.(2011).417.882
DOI:	10.1111/j.1365-2966.2011.19355.x
Cite as:	**arXiv:1107.0002 [astro-ph.CO]**
	(or **arXiv:1107.0002v1 [astro-ph.CO]** for this version)

Submission history

From: Timothy Davis [view email]
[v1] Thu, 30 Jun 2011 20:00:01 GMT (198kb)

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