The Alternative Cosmology Group Newsletter – December 2008

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This year-end edition is full to overflowing with new results. In this newsletter, we concentrate on observation and on results outside the mainstream, but sometimes we do add a conventional paper or two to show the flavour of current thinking.

Failures of LCDM

Once again, there are more papers pointing to the failure of predictions of LCDM, the conventional dark-matter, dark energy Big Bang model.

Too Little Mass

In an important paper, Lavaux et al analyse the velocities of galaxies within 100 Mpc of our own and compare them with the mass concentrations that theoretically produce the mass flows gravitationally. While a number of model-dependent assumptions go into this calculation, the velocities are clearly depend on the amount of mass, so the study can be used to estimate the mass density in the local universe, including all kinds of gravitating matter, dark or visible. The authors conclude that the mass density is not much more than a third that predicted by LCDM, a result that is 2 -3 sigma away from theory.

Title: **Cosmic flow from 2MASS redshift survey: The origin of CMB dipole and implications for LCDM cosmology**

Authors: G. Lavaux, R. Brent Tully, R. Mohayaee, S. Colombi

arXiv:0810.3658

In a closely related study, Karachentsev et al investigate the motion of galaxies in the Local Group's neighbourhood . They found that the velocities were half what was predicted, again implying much less density than required by LCDM theory.

Title: **The Hubble flow around the Local Group**
Authors: I.D. Karachentsev, O.G. Kashibadze, D.I. Makarov, R.B. Tully
arXiv:0811.4610

No Hierarchical formation

Conventional cosmology predicts the formation of galaxies by agglomeration of smaller galaxies. But a team led by Mike Disney has found evidence against this notion: *"Galaxies are complex systems the evolution of which apparently results from the interplay of dynamics, star formation, chemical enrichment, and feedback from supernova explosions and supermassive black holes. The hierarchical theory of galaxy formation holds that galaxies are assembled from smaller pieces, through numerous mergers of cold dark matter. The properties of an individual galaxy should be controlled by six independent parameters including mass, angular-momentum, baryon-fraction, age and size, as well as by the accidents of its recent haphazard merger history. Here we report that a sample of galaxies that were first detected through their neutral hydrogen radio-frequency emission, and are thus free of optical selection effects, shows five independent correlations among six independent observables, despite having a wide range of properties. This implies that the structure of these galaxies must be controlled by a single parameter, although we cannot identify this parameter from our dataset. Such a degree of organization appears to be at odds with hierarchical galaxy formation, a central tenet of the cold dark matter paradigm in cosmology."*
Title: **Galaxies appear simpler than expected**
Authors: M. J. Disney, J. D. Romano, D. A. Garcia-Appadoo, A. A. West, J. J. Dalcanton, L. Cortese .
arXiv:0811.1554

Conventional theory also assumes that magnetic fields are small in young galaxies and grow with time, but Arthur Wolfe used standard Zeeman splitting to measure a large magnetic field strength at high-z, and concluded that, *"our data support the inference from recent tentative evidence for Faraday rotation in high-z quasars that magnetic fields are generic features of galaxies at high redshifts, which potentially have a more important role in galaxy formation and evolution than hitherto realized Specifically, the highly magnetized gas that we have detected could suppress gravitational collapse and hence may be a reason for the low in situ star formation rates of high-z DLAs"*
Title: **AN 84-μG MAGNETIC FIELD IN A GALAXY AT Z = 0.692.**

Authors: Arthur M. Wolfe, Regina A. Jorgenson, Timothy Robishaw, Carl Heiles, Jason X. Prochaska

arXiv:0811.2408

Six Puzzles for LCDM Cosmology

Perivolaropoulos points to six cases of the failure of LCDM prediction to match observation. He states, *"These observations include the following: 1. Large Scale Velocity Flows (LCDM predicts significantly smaller amplitude and scale of flows than what observations indicate), 2. Brightness of Type Ia Supernovae (SnIa) at High Redshift z (LCDM predicts fainter SnIa at High z), 3. Emptiness of Voids (LCDM predicts more dwarf or irregular galaxies in voids than observed), 4. Profiles of Cluster Haloes (LCDM predicts shallow low concentration and density profiles in contrast to observations which indicate denser high concentration cluster haloes) 5. Profiles of Galaxy Haloes (LCDM predicts halo mass profiles with cuspy cores and low outer density while lensing and dynamical observations indicate a central core of constant density and a flattish high dark mass density outer profile), 6. Sizable Population of Disk Galaxies (LCDM predicts a smaller fraction of disk galaxies due to recent mergers expected to disrupt cold rotationally supported disks)."*

Title: **Six Puzzles for LCDM Cosmology**

Authors: L. Perivolaropoulos

arXiv:0811.4684

Supernovae

The discovery of patterns in SNe rise times suggesting an accelerated expansion created great excitement in cosmology. However, subsequent studies, many listed in the ACG's newsletters, have damped the enthusiasm somewhat, and like some analyses of the CMBR, now argue against the model they were invoked to support. In particular, the unexpected high-z brightness of 1A SNe makes a direct challenge to the LCDM model.

Title: **Bright High z SnIa: A Challenge for LCDM?**

Authors: L. Perivolaropoulos, A. Shafieloo

arXiv:0811.2802

Microwave Background

The prediction is **Gaussianity**. Observation is **non-Gaussianity**. Paper after paper attempts to explain away the bad fit. Here are some examples:

Title: **Non-Gaussianity in Cosmic Microwave Background Temperature Fluctuations from Cosmic (Super-)Strings**

Authors: Keitaro Takahashi, Atsushi Naruko, Yuuiti Sendouda, Daisuke Yamauchi, Chul-Moon Yoo, Misao Sasaki

arXiv:0811.4698

Title: **On the non-Gaussianity from Recombination.**

Authors: Nicola Bartolo and Antonio Riotto .

arXiv:0811.4584

Title: **Scale-dependent bias induced by local non-Gaussianity: A comparison to N-body simulations**

Authors: Vincent Desjacques, Uros Seljak, Ilian T. Iliev

arXiv:0811.2748

Glenn Starkman had two papers in the proceedings of CCC1, and has for years been on the cusp of admitting that the SCM is more questions than answers. In his latest paper, he starts off, *"There are things we know, things we know we don't know, and then there are things we don't know we don't know. In this paper we address the latter two issues in a Bayesian framework, introducing the notion of doubt to quantify the degree of (dis)belief in a model given observational data in the absence of explicit alternative models."*

Title: **Introducing doubt in Bayesian model comparison**

Authors: Glenn D Starkman, Roberto Trotta, Pascal M Vaudrevange

arXiv:0811.2415

In response to these problems, the measures taken to explain away the anomalies in observed effects seem to your editors to almost reach a level of desperation. Jimenez and Maroto explain the now well established *"Axis of Evil"* by invoking "moving Dark Energy". They state, *"The unexpectedly large measured amplitudes are however difficult to understand within the context of standard ΛCDM cosmology…[]…we would like to comment on the fact that the total quadrupole have (sic) a preferred axis which happens to coincide with the direction of the velocities and, as a consequence, with that of the dipole. Therefore, a moving dark energy model could also shed some light on the so-called axis of evil problem."*

Title: **Large-scale cosmic flows and moving dark energy**

Authors: Jose Beltran Jimenez, Antonio L. Maroto .

arXiv:0811.3606

Zhao on the other hand argues that the dark elements of cosmology are all linked, under the auspices, it would appear, of a Cosmic Chameleon. *"MOND-like MG and Cold DM are often taken as antagonizing frameworks, e.g.*

in the muddled debate around the Bullet Cluster. Here we argue that these ad hoc divisions of sectors miss important clues from the data. The data actually suggest that the physics of all dark sectors is likely linked together by a self-interacting oscillating field, which governs a chameleon-like dark fluid, appearing as DM, DE and MG in different settings."

Title: **An ecological approach to problems of Dark Energy,**
Dark Matter, MOND and Neutrinos
Authors: HongSheng Zhao
arXiv:0811.3465

The seemingly limitless expansion of hypothetical entities is causing widening concern, however. George Ellis, a former ally and co-author of Stephen Hawking writes:
"The issue of what is testable and what is not testable in cosmology is a key issue. Some dark energy proposals, specifically from multiverse advocates, propose weakening the link to observational tests, because they believe we have such a good theory that it must be right. But if a proposal is not testable, we certainly need to consider observationally testable alternatives. The acceleration indicated by supernova data could possibly be due to small scale inhomogeneity that definitely exists, but may not be sufficiently significant to do the job. It could be due to large scale inhomogeneity that can probably do the job, but may not exist. Observational tests of the latter possibility are as important as pursuing the dark energy (exotic physics) option in a homogeneous universe. Theoretical prejudices as to the universe's geometry, and our place in it, must bow to such observational tests. We should stand firm and insist that genuine science is based on observational testing of plausible hypotheses."

Title: **Dark matter and dark energy proposals: maintaining cosmology as a true science?**
Authors: George F. R. Ellis
arXiv:0811.3529

Alternatives: Steady State and MOND

With LCDM in deep trouble, alternative cosmologies are gaining some additional attention. The following paper is an address given by eminent theoretical astrophysicist Geoffrey Burbidge, at a conference entitled *"A century of Cosmology"*. It is both historical perspective and revue, well worth reading.

Title: **A Realistic Cosmological Model Based on Observations and Some Theory Developed over the Last 90 Years.**

Authors: Geoffrey Burbidge.

arXiv:0811.2402

De-Chang Dai et al critique Modified Newtonian Dynamics, finding on theoretical grounds that there should be much greater influence of distant objects than for General Relativity.

Title: **Birkhoff's theorem fails to save MOND from non-local physics**

Authors: De-Chang Dai, Reijiro Matsuo, Glenn Starkman
arXiv:0811.1565

Gravitational lensing

Despite the confidence with which gravitational lenses are brought into play in cosmology, they remain shrouded in uncertainties, so much so that they can hardly be included in a toolkit of reliable astrophysical techniques.

Title: **Parameter degeneracies and (un)predictability of gravitational microlensing effects.**

Authors: M. Dominik .

arXiv:0811.4173

Redshift

There have been several attempts to explain away anomalous redshift measurements. Niemi and Valtonen use mock catalogues based on the Friends-of-Friends algorithm to reach the following conclusion: *"We have found an explanation for positive redshift excess found by many authors from different observational groups…[]…there is no need to introduce any 'anomalous' redshift mechanism to explain the redshift excess of Arp."*

Have they? Their argument rests principally upon the question of whether the groups are gravitationally bound or not, and although their firm conclusion finds that they are not, they admit that identifying gravitationally-bound groups is difficult: *"Even then, dark matter and the lack of knowledge of relative distances inside observed groups complicates matters."*

Title: **Origins of redshift asymmetries: how LCDM explains anomalous redshift.**

Authors: Sami-Matias Niemi, Mauri Valtonen .

arXiv:0811.3968

Evolution

In terms of the Standard Model, there should be an inverse relationship between redshift and age. We would expect that local galaxies and stars should show signs of great age. Many key indicators in observation show the opposite. Morel's paper points out two intriguing results: *"(a) nearby stars exhibit metal abundances generally* **lower** *than*

solar/meteoritic estimates; (b) evolutionary models of single objects including rotation are largely unsuccessful in explaining the CNO properties of stars in the Galaxy and in the Magellanic Clouds."

Title: **Abundances of Massive Stars: Some Recent Developments**

Authors: T. Morel .

arXiv:0811.4114

Nucleosynthesis

Supernovae are critical component in BB nucleosynthesis. They are essential in the distribution of metals in the BB evolutionary scheme. However, we lack definitive knowledge of SN morphogenesis and dynamic processes, to the extent that even relatively unconstrained modelling produces no useable fit with chemical abundances. Chris Fryer and colleagues have been intensively involved in trying to establish the science of core-collapse SNe, as these two papers show:

Title: **Difficulties in probing Nuclear Physics: A Study of ^{44}Ti and ^{56}Ni.**

Authors: Aimee Hungerford , Christopher L. Fryer et al..

arXiv:0811.4645

Title: **Nucleosynthesis calculations from Core-Collapse Supernovae.**

Authors: Christopher L. Fryer et al.

arXiv:0811.4648