The Milky Way Panorama Credit: ESO / S. Brunier

# Newsletter of the Alternative Cosmology Group - April 2018

The *Alternative Cosmology Group* draws its mandate from the *Open Letter to the Scientific Community* to engage scientists in an open exchange of ideas outside the mainstream framework of the Big Bang cosmology. The *ACG Newsletter* seeks to highlight published observational results which seem anomalous in terms of the ΛCDM model. These results, collected in a centralized resource are accessible to all scientists.

Critical examinations of the scientific methods and investigations used in cosmology are also the subject of the ACG Newsletter, as long as these are supported by empirical data. Purely theoretical work and new cosmologies not yet supported by observations are deferred to future discussions at the next ACG Conference.

If you would like to suggest a paper for review, please send a direct reference to `webmaster@cosmology.info`. Published work with full and open access is preferred. The Newsletter is published irregularly, editor's schedule permitting, and when interesting papers becomes available.

The ACG Newsletter is distributed gratis to our subscribers[1] who receive notifications from the ACG webmaster. You can subscribe to our mailing list at `cosmology.info`, join the ACG Forum 'Alternative Cosmology' on *Yahoo! Groups* at `groups.yahoo.com/neo/groups/altcosmology/info#` or follow @altCosmology on Twitter.

## ACG Editorial

The first publication reviewed below does not have full open access. However, it is included in the reviews because the results would falsify MOND. This is a very important result if it turns out to be confirmed.

Since `cosmology.info` returned online 59 days ago, the number of subscriptions (ignoring 'dead' e-mails) has increased from 44 to 79! Members are encouraged to advertize this Group to researchers who can supply meaningful observational data and analysis. A larger Group will increase our chances to be able to organize a conference.

Many thanks to Eric Lerner, Michel Mizony and others who sent me a list of papers to review for inclusion in the ACG Newsletter. I also include some older references to pioneer work which is still relevant today!

*Louis Marmet*, April 2, 2018
webmaster@cosmology.info

## Reviewed Publications

Most of the text given here is quoted and adapted from the original articles.

"**A galaxy lacking dark matter**", P. van Dokkum *et al.*, Nature, Vol. 555, pp. 629–632, 2018
2018-3-29: www.skyandtelescope.com/astronomy-news/a-galaxy-without-much-dark-matter/

The mass of the dark matter halo and the total stellar mass of a galaxy have an average ratio $M_{halo}/M_{stars} \sim 30$ for galaxies with stellar masses near that of the Milky Way, a ratio which increases both towards lower masses

[1] The ACG currently has a total of 79 followers on the mailing list, the 'Alternative Cosmology' *Yahoo! Group* and Twitter.

and towards higher masses. The ultra-diffuse galaxy NGC1052-DF2 has at most $^1/_{400}$ as much dark matter as expected, based on other systems of similar mass. In fact, the best explanation may be that there's no dark matter at all. NGC1052-DF2 demonstrates that dark matter is not always coupled with baryonic matter on galactic scales. The paper reports on the radial velocities of ten luminous globular-cluster-like objects orbiting NGC1052-DF2, which has a stellar mass of approximately $2 \times 10^8$ solar masses. The intrinsic velocity dispersion of the galaxy is less than $\sigma_{intr} = 10.5$ km/s with 90% confidence.

About MOND, the letter in Nature explains: "Furthermore, and paradoxically, the existence of NGC1052-DF2 may falsify alternatives to dark matter. In theories such as modified Newtonian dynamics (MOND) and the recently proposed emergent gravity paradigm, a 'dark matter' signature should always be detected, as it is an unavoidable consequence of the presence of ordinary matter. In fact, it had been argued previously that the apparent absence of galaxies such as NGC1052-DF2 constituted a falsification of the standard cosmological model and offered evidence for modified gravity. For a MOND acceleration scale of $a_0 = 3.7 \times 10^3 \mathrm{km^2 s^2 kpc^{-1}}$, the expected velocity dispersion of NGC1052-DF2 is $\sigma_M \approx (0.05 G M_{stars} a_0)^{1/4} \approx 20$ km s$^{-1}$, where $G$ is the gravitational constant – a factor of two higher than the 90% upper limit on the observed dispersion." Stacy McGaugh, a supporter of MOND points out that the galaxy is weird regardless of whether you accept dark matters existence or not.

One of the authors, Aaron J. Romanowsky, published a paper in 2003 reporting three galaxies with a velocity dispersion data following simple models containing no dark matter (see "A Dearth of Dark Matter in Ordinary Elliptical Galaxies" reviewed in the ACG Newsletter of March 2018). Strangely enough, no reference to that paper is given in the letter published in Nature.

"**Observations contradict galaxy size and surface brightness predictions that are based on the expanding universe hypothesis**"
E. Lerner, Monthly Notices of the Royal Astronomical Society, sty728, March 2018
2018-3-22: dx.doi.org/10.1093/mnras/sty728

This paper examines the hypothesis that the universe is expanding, but that the actual radii of galaxies of a given luminosity increase with time. It is shown that the radii data for both disk and elliptical galaxies are incompatible with any of the published size-evolution predictions based on an expanding universe. All the physical mechanisms proposed for size evolution, such as galaxy mergers, lead to predictions that are in quantitative contradiction with either the radius data or other data sets.

In addition, when the effect of telescope resolution is taken into account, the radius-redshift relationships for disk and elliptical galaxies are identical. Both are excellently fit by the static Euclidian universe predictions. For the data-set used here, there is a clear contradiction of predictions based on an expanding universe hypothesis.

"**Has the density of sources of gamma-ray burts been constant over the last ten billion years?**"
Yves-Henri Sanejouand, arXiv
2018-3-11: arXiv:1803.05303

When the Hubble law is explained through a generic tired-light mechanism, the density of GRB sources is found to be nearly constant up to $z \approx 4$ at least. This means that matter density may have been roughly constant over the last ten billion years, implying that, at least over this period, matter has been in an overall state of equilibrium.

"**What is our Universe now? For the century of the formula 15 written by de Sitter**"
M. Mizony, HAL
2018-2-2: hal-01629125

Recent data about the Hubble parameter H(z) provide a tool to estimate cosmological parameters for the de Sitter models and their Milne limits; we find: $H_o = 65 \pm 2 km/s/Mpc$, $\Omega_o = 0.05 \pm 0.02$ and an age $= 15.2 \pm 0.3 Gyr$.

This is consistent with a universe containing uniquely baryonic matter.

Within a radially inertial chart, there is no need for dark energy. The recent data about the Hubble parameter H(z) gives us the occasion to confront the de Sitter models with these data. The results are beyond all that could be expected; no conflict with the SN-Ia approach, no inflation, no problem of stability, no mystery about all which seems dark, but in conflict with the ΛCDM models.

"**A whirling plane of satellite galaxies around Centaurus A challenges cold dark matter cosmology**"
O. Müller, M.S. Pawlowski, H. Jerjen, and F. Lelli, Science, Vol. 359, No. 6375, pp. 534–537, Feb. 2018
2018-1-31: arXiv:1802.00081

The presence of planes of satellite dwarf galaxies around the Milky Way and Andromeda galaxies have challenged our understanding of structure formation on galactic and subgalactic scales. [...] the standard Lambda Cold Dark Matter (ΛCDM) cosmological model [...] predicts close to isotropic distributions and random kinematics for satellite systems. The existence of planes of satellite galaxies around these two largest galaxies in the Local Group is difficult to explain within the ΛCDM framework.

Some authors [...] suggest that the Local Group should be considered a rare exception in an otherwise successful cosmological model. This interpretation, however, has been challenged by emerging evidence for anisotropic satellite distributions around massive galaxies beyond the Local Group. [...] Could the coherent motion be the result of cosmic expansion? If that were the case, a correlation between the velocities of the satellites and their distances to the Milky Way would be expected. This is not found for the sample of Cen A satellite galaxies. We thus can rule out that the cosmic expansion is responsible for the observed velocity field.

"**Cosmological discordances II: Hubble constant, Planck and large-scale-structure data sets**"
W. Lin and M. Ishak, Physical Review D 96, p. 083532, Oct. 2017
2017-8-31: arXiv:1708.09813
"**Cosmological discordances: a new measure, marginalization effects, and application to geometry vs growth current data sets**"
W. Lin and M. Ishak, Physical Review D 96, p. 023532, July 2017
2017-5-15: arXiv:1705.05303

These papers find inconsistencies between experimental data and theory. The ΛCDM standard model of cosmology [... comes] with two intriguing conundrums. The first one is that it requires a dark matter component counting for about 26% of matter-energy content in the Universe. The second one is that the expansion of the Universe is accelerating and we do not know what is driving this acceleration. Associated with this cosmic acceleration is a dark energy component that could account for about 69% of the energy budget in the Universe.

We defined a moment-based measure that we call the index of inconsistency. [...] different experiments have been yielding constraints of parameters that do not perfectly agree with each other. These include Supernovae Type Ia compilation, baryon acoustic oscillations from 6dF, SDSS MGS and Lyman-$\alpha$ forest, high-script l CMB temperature data from Planck, Redshift Space Distortions from WiggleZ and SDSS, Weak Lensing from CFHTLenS, CMB Lensing, Sunyav-Zeldovich effect, and low- sccript l CMB temperature and polarization data from Planck-2015.

We find that a persistent inconsistency is present between the two data sets.

"**The Impossibly Early Galaxy Problem**"
C.L. Steinhardt *et al.*, The Astrophysical Journal, Vol. 824, No. 1, p. 21, June 2016
2016-6-6: http://stacks.iop.org/0004-637X/824/i=1/a=21

The current hierarchical merging paradigm and ΛCDM predict that the $z \sim 48$ universe should be a time in

which the most massive galaxies are transitioning from their initial halo assembly to the later baryonic evolution seen in star-forming galaxies and quasars. However, CANDELS and SPLASH report several orders of magnitude more $M \sim 10^{12-13} M_{\odot}$ halos than are possible to have formed by those redshifts, implying these massive galaxies formed impossibly early. Even taking the most conservative view of the observations, there remains considerable tension with current theory.

Recent observations of high-redshift galaxies are inconsistent with current theoretical models of galactic assembly. As a general principle, when theory and observation disagree, it is historically best to believe the observational result. However, in this case the observations also rely on untested theoretical assumptions about stellar evolution. Thus, something is wrong, but what? We can divide the possible flaws and explanations into three possible categories: 1. Failed Template Fitting or Redshift Determination, 2. New Clustering Physics, 3. Early Star Formation. All three answers carry major consequences for both our current understanding of the initial stages of galactic formation and our future plans for studying high-redshift galaxies. So, better observations are needed.

"**Sandage versus Hubble on the reality of the expanding universe**", Domingos S.L. Soares, arXiv
2006-5-11: arXiv:physics/0605098

A critical reading of Lubin & Sandage's 2001 paper (Lubin, L.M. & Sandage, A. 2001, Astron. J. 122:1084-1103, 2001 http://stacks.iop.org/1538-3881/122/i=3/a=1084)) on the Tolman effect for the reality of the expansion of the universe clearly reveals that Sandage is far from winning the dispute with Hubble on the issue. After all the years, Hubble's doubt about the reality of the expansion remains as valid as Sandage's certainty expressed in a series of papers in the last decade.

"**A high abundance of massive galaxies 3-6 billion years after the Big Bang**"
K. Glazebrook *et al.*, Nature, Vol. 430, pp. 181–184, July 2004
2004-7-7: spaceref.com/news/viewpr.html?pid=14524

Observations challenge standing view of how and when galaxies formed. A rare glimpse back in time into the universe's early evolution has revealed something startling: mature, fully formed galaxies where scientists expected to discover little more than infants.

Hierarchical galaxy formation is the model whereby massive galaxies form from an assembly of smaller units. The most massive objects therefore form last. The model succeeds in describing the clustering of galaxies, but the evolutionary history of massive galaxies, as revealed by their visible stars and gas, is not accurately predicted. Here we report the results of a spectroscopic redshift survey that probes the most massive and quiescent galaxies back to an era only 3Gyr after the Big Bang. We find that at least two-thirds of massive galaxies have appeared since this era, but also that a significant fraction of them are already in place in the early Universe.

"**A group of Quasi-Stellar Objects closely associated with NGC 1068**"
M. Burbidge, The Astrophysical Journal Letters, Vol. 511, No. 1, pp. L9–L11, 1999
1998-12-23: stacks.iop.org/1538-4357/511/i=1/a=L9

In previous studies, it has been shown that a number of [...] bright galaxies with active nuclei have an excess number of X-rayemitting QSOs surrounding them. This has been found in the case of NGC 4258, NGC 2639, NGC 3516, and NGC 5548, NGC 5689, and NGC 5985. In the case of NGC 1068, we have the added advantage that the region of the sky around it has been surveyed for QSOs that are not powerful X-ray sources. Thus, we have evidence that more than twice as many bright QSOs are found near NGC 1068 than have been detected around the other galaxies.

Thus, despite their large redshifts, these QSOs appear to lie at the distances of the active galaxies and not at cosmological distances.