The Milky Way Panorama Credit: ESO / S. Brunier

Newsletter of the Alternative Cosmology Group - May 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 list of reviewed publications starts with a paper by Stephen Hawking. In his last paper we find an attempt to correct a problem with inflation theory. So apparently, there *is* a problem with inflation theory!

Many thanks to all who sent links to interesting papers. I also include some references to older work which is still relevant today.

Louis Marmet, May 21, 2018
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Reviewed Publications

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

"**A smooth exit from eternal inflation?**"
S.W. Hawking and T. Hertog, J. High Energy Phys., Vol. 147 https://doi.org/10.1007/JHEP04(2018)147, 2018
2018-4-27: arXiv:1707.07702

Eternal inflation refers to the near de Sitter regime deep in which the quantum fluctuations in the energy density of the inflaton are large. It is argued eternal inflation produces universes that are typically highly irregular, hence this correlates with the fluctuations seen on the CMBR. However this account is questionable because the dynamics

[1] The ACG currently has a total of 89 followers on the mailing list, the 'Alternative Cosmology' *Yahoo! Group* and Twitter.

of eternal inflation wipes out the separation into classical backgrounds and quantum fluctuations. In other words, inflation never becomes the "classical" universe we observe.

This paper presents a new quantum cosmological model of scalar-field driven eternal inflation by using gauge-gravity duality. The Euclidean dual theory is defined on the threshold surface of eternal inflation, which therefore describes the transition from the quantum realm of eternal inflation towards a classical universe, in line with the original vision behind inflation.

Hawking uses Conformal Field Theory to create instabilities that limit the eternal growth of inflation. Whether this means something is debatable, but this highlights the fact that if such a contrived explanation is needed to justify inflation, the 40-year-old inflation model still offers weak support for the Big Bang theory.

"**Universe opacity and CMB**"
V. Vavryčuk, MNRAS, sty974, https://doi.org/10.1093/mnras/sty974, 2018
2018-4-18: doi.org/10.1093/mnras/sty974 Also: arXiv:1706.04771

The CMB as a relic radiation of the hot Big Bang is now commonly accepted even though it is not the only theory offering an explanation of the CMB origin. The 'dust theory' assumes the CMB to be produced by dust thermalization at high redshifts.

In this paper, it is shown that under some assumptions about the stellar and dust mass evolution in the Universe the idea of the CMB produced by dust thermalization can be reconciled with observations. If the CMB is a thermal radiation of dust but not a relic radiation of the Big Bang, the concept of the Big Bang is seriously disputed: except for the CMB, no direct observations indicate the Big Bang and no measurements provide information on the actual expanding history of the Universe. Secondly, predictions of some cosmological constants and quantities based on the interpretation of the CMB anisotropies such as the baryonic density, helium abundance and dark matter density in the Universe, or timing of the reionization epoch are invalidated.

The only remaining argument for the Big Bang theory is its prediction of primordial abundances of deuterium, helium and lithium in the Universe. The baryon density is usually determined from deuterium abundance observations, so that the theory predicts only the other two values: the helium and the lithium abundances. Initially, observations did not match the predicted ^{4}He/H abundance well (Pagel *et al.* 1992; Peimbert *et al.* 2000) but after adopting a large number of systematic and statistical corrections, a satisfactory fit has finally been achieved. By contrast, the fit of the lithium abundance is much worse. As stated by Cyburt *et al.*, to date, there is no solution of the discrepancy of the ^{7}Li abundance without substantial departures of the Big Bang Nucleosynthesius (BBN) theory. Hence, the BBN theory may not provide us with fully-established firm evidence of the Big Bang.

"**Probing the Cosmological Principle in the counts of radio galaxies at different frequencies**"
Carlos A. P. Bengaly *et al.*, Journal of Cosmology and Astroparticle Physics, JCAP04(2018)031
2018-4-9: doi.org/10.1088/1475-7516/2018/04/031

A fundamental hypothesis of the current standard model of cosmology is statistical homogeneity and isotropy, i.e., the absence of privileged positions and directions in the Universe on sufficiently large scales. Our velocity relative to fundamental observers is deduced from the dipole anisotropy in the cosmic microwave background (CMB) temperature. In the standard cosmological model, this dipole arises from the Doppler boost of CMB photons due to our relative peculiar velocity. A critical requirement of statistical isotropy is that the Solar System rest frame seen *in the CMB* and *in the number counts of distant radio sources* should be consistent.

The dipole directions obtained in this work are very close to the CMB kinematic dipole. On the other hand, the amplitudes are much higher than the expected value: the NVSS dipole is ~ 3 times larger and the TGSS is ~ 8 times larger. This striking result shows a disagreement between the CMB and the radio continuum dipole amplitudes. More data will be needed in order to clarify this large discrepancy with the ΛCDM model.

"**Alignments of parity even/odd-only multipoles in CMB**"
P.K. Aluri *et al.*, Monthly Notices of the Royal Astronomical Society, Volume 472, Issue 2, 1 December 2017
2017-12-1: https://doi.org/10.1093/mnras/stx2112 Also: arXiv:1703.07070

Many tests of symmetry of the cosmic microwave background (CMB) sky have revealed unexplained anomalies on large angular scales, namely among low multipoles. Many low multipoles are plagued with anomalous features, associated with a breakdown of isotropy. In this paper we uncover yet another peculiarity associated with low multipole CMB data.

Under the assumption of statistical isotropy, different spherical harmonic coefficients are uncorrelated and point in random directions. We find that the quadrupole-octopole modes are well aligned with a separation of only 6^o, corresponding to a random chance occurrence probability of which is close to a 3σ significance. The odd-multipoles also show a collective alignment with a significance at the 2σ-level or above. The alignment axis of even multipole drifts towards the galactic plane as more and more low-l are discarded.

"**A dusty, normal galaxy in the epoch of reionization**"
D. Watson *et al.*, Nature (2015 March 2) doi:10.1038/nature14164
2015-3-2: http://www.nature.com/nature/journal/vaop/ncurrent/full/nature14164.html Also: arXiv:1503.00002

A dusty galaxy that shouldn't exist was discovered within the cluster Abell 1689. This object from the very early universe is rich with dust. The galaxy is highly evolved: it has a large stellar mass, and is heavily enriched in dust, with a dust-to-gas ratio close to that of the Milky Way. Dusty, evolved galaxies are thus present among the fainter star-forming population at $z > 7$, in spite of the very short time since they first appeared.

"**First Direct Measurement of the ^{2}H$(\alpha,\gamma)^6$Li Cross Section at Big Bang Energies and the Primordial Lithium Problem**"
M. Anders *et al.* (LUNA Collaboration), Phys. Rev. Lett. 113, 042501 Published 21 July 2014
2014-7-21: https://phys.org/news/2014-08-big-conditions-lithium-problem.html

The field of astrophysics has a stubborn problem and it's called lithium. The quantities of lithium predicted to have resulted from the Big Bang are not actually present in stars. Recent observations of ^{6}Li in metal poor stars suggest a large production of this isotope during big bang nucleosynthesis (BBN). In standard BBN calculations, the ^{2}H$(\alpha,\gamma)^6$Li reaction dominates ^{6}Li production.

Here, [...] the primordial ^{6}Li/^{7}Li isotopic abundance ratio has been determined to be $(1.5 \pm 0.3) \times 10^5$, from our experimental data and standard BBN theory. The much higher ^{6}Li/^{7}Li values reported for halo stars will likely require a nonstandard physics explanation, as discussed in the literature.

By *nonstandard physics*, the Alternative Cosmology Group can propose "*physics outside the framework of the Big Bang cosmology*".

"**Molecular Hydrogen as Baryonic Dark Matter**"
A. Heithausen, The Astrophysical Journal, 606:L13L15, 2004
2014-4-1: iopscience.iop.org/article/10.1086/421111/meta

In recent years molecular hydrogen has been detected in the diffuse interstellar medium directly via absorption-line measurements toward many distant quasars. Such observations, which trace mainly warm gas with low column densities, show that H_2 is widespread in the Galaxy even outside star-forming regions. However, they provide only little information on the spatial structure of the clouds.

The emission-line observations presented here for the first time disclose that molecular clouds in the diffuse interstellar medium are fractally structured. They can form or survive even in regions with low column densities.

From ^{12}CO and ^{13}CO observations of molecular gas in translucent clouds the existence of small-scale structure down to a few hundred AU has been inferred.

Whether or not fractally structured clouds similar to the ones described here could account for all the missing baryonic dark matter in our Galaxy is hard to determine. Because of their small sizes and their narrow linewidths, both the hypothetical dark matter clumpuscules and the clumps described here are notoriously hard to detect unless they form small clusters and thus fill at least some part of the beam of a larger telescope. With small telescopes used to survey the Galaxy, they are undetectable because of the low beam filling; high angular resolution and high-sensitivity observations are needed for detection. Such clouds thus provide an ideal means to hide matter from the observer.

"**The 2dF Redshift Survey. I. Physical Association and Periodicity in Quasar Families**"
C.C. Fulton and H.C. Arp, The Astrophysical Journal, 754:134, 2012
2012-9-1: iopscience.iop.org/0004-637X/754/2/134/

Physical associations of candidate companion quasars with putative parent galaxies are found in the 2dF Galaxy Redshift Survey (2dFGRS) and quasars from the 2dF Quasar Redshift Survey (2QZ). Control trials against the pure physical associations are obtained by replacing the actual redshifts of the candidate companion quasars with quasar redshifts drawn randomly from each respective right ascension hour.

This work supports Arp's claim of quasar-galaxy associations. The ΛCDM cosmology cannot explain such associations.

"**The Dark Matter Crisis: Falsification of the Current Standard Model of Cosmology**"
P. Kroupa, Publications of the Astronomical Society of Australia, 2012, 29, 395433
2012-6-20: dx.doi.org/10.1071/AS12005

The current standard model of cosmology requires The Dual Dwarf Galaxy Theorem to be true according to which two types of dwarf galaxies must exist. Type A dwarfs surround the host approximately spherically, while type B dwarfs are typically correlated in phasespace. Type B dwarfs must exist in any cosmological theory in which galaxies interact. This long paper shows that only one type of dwarf galaxy is observed to exist on the baryonic Tully-Fisher plot and in the radius-mass plane. Therefore, The Dual Dwarf Galaxy Theorem is falsified by observation and dynamically relevant cold or warm DM cannot exist.

Taking all arguments shows that the standard model of cosmology is falsified and that dark-matter sub-structures do not exist. If they do not exist, then DM particles that are dynamically relevant on galactic scales cannot exist. This is consistent with such particles not appearing within the standard model of particle physics, which is at present the most successful existing theory of physics, and the simple empirical fact that they have not been found despite a massive world-wide search for their existence.

"**VLT Observations of Gamma-ray Burst Reveal Surprising Ingredients of Early Galaxies**"
S. Savaglio, ESO1143 - Science Release, 2011
2011-11-2: www.eso.org/public/news/eso1143/

The European Southern Observatory reported a surprisingly high content in heavy elements in the cool gas surrounding young galaxies. The international team used the flash of a distant gamma-ray burst GRB 090323 as a probe to study the spectra of the two galaxies. The galaxies, at a redshift $z = 3.57$, show that the cool gas in these presumably young galaxies was very rich in heavy elements, a chemical composition usually only seen in older galaxies because it takes so long to make heavy elements.