The Milky Way Panorama Credit: ESO / S. Brunier

Newsletter of *A Cosmology Group* - December 2018

A Cosmology Group draws its mandate from the *Open Letter to the Scientific Community* to engage scientists in an open exchange of ideas beyond the mainstream framework of a Big Bang cosmology. The *ACG Newsletter* highlights observational results that are anomalous for the ΛCDM model and provides a critical examination[1] of the methods and investigations used in cosmology.

The *Newsletter* is published irregularly, editor's schedule permitting, and when interesting papers are available. ACG subscribers[2] receive notifications of *Newsletter* publications. You can subscribe to *ACG Notifications* either by sending a request to `redshift@cosmology.info`, by joining the ACG Forum 'Alt Cosmology' on *Yahoo! Groups* at `groups.yahoo.com/neo/groups/altcosmology/info#`, or by following `@CosmologyGroup` on Twitter.

If you would like to suggest a paper for review, please send a direct reference to `redshift@cosmology.info`. Published work in a refereed journal and with open access (e.g. a preprint on `arXiv` or `HAL`) is preferred. Summaries of new cosmologies are collected on A Cosmology Model or can be presented at the next ACG Conference.

ACG Editorial

This editorial is short to leave more room for dark matter problems, a massive black hole at $z = 7$ that is hard to explain, tension $> 4.8\sigma$ in the density of galaxy cluster, and working toward a well-founded cosmology.

Best wishes to all for 2019!

Louis Marmet, December 18, 2018
redshift@cosmology.info

Reviewed Publications

Most of the text given here is quoted and adapted from the original articles.
Underline is my emphasis and *my comments are in italics*.

"A unifying theory of dark energy and dark matter: Negative masses and matter creation within a modified CDM framework"
J.S. Farnes, Astronomy and Astrophysics **620**, A92, Dec. 2018
doi:10.1051/0004-6361/201832898, arXiv:1712.07962

Dark energy and dark matter constitute 95% of the observable Universe. Yet the physical nature of these two phenomena remains a mystery. Einstein suggested a long-forgotten solution: gravitationally repulsive negative masses, which drive cosmic expansion and cannot coalesce into light-emitting structures. However, contemporary cosmological results are derived upon the reasonable assumption that the Universe only contains positive masses.

[1]The thesis must be supported by empirical data.
[2]The ACG has 57 subscribers to *ACG Notifications* and 56 followers on *Alt Cosmology Yahoo! Group* and *Twitter*.

The author then makes the (perhaps) unreasonable assumption that the universe mostly contains negative mass. However, this is not enough to obtain compatibility with the observed universe, and matter creation is added to the model. How are "negative mass and matter creation" a better alternative to "dark matter and dark energy"?

"**The Discovery of A Luminous Broad Absorption Line Quasar at A Redshift of 7.02**"
F. Wang *et al.*, ApJL in press, 2018
arXiv:1810.11925

We report the discovery of a luminous quasar at $z = 7.021$, DELS J003836.10152723.6, the most luminous quasar known at $z > 7$. Deep optical to near infrared spectroscopic observations suggest that J0038-1527 hosts a 1.3 billion solar mass Black Hole accreting at the Eddington limit. J00381527 is the first quasar found at the epoch of reionization with strong outflows and provides a unique laboratory to investigate AGN feedback on the formation and growth of the most massive galaxies in the early universe. "The researchers added that in order to grow such a massive black hole at a redshift or around 7.0, it is necessary to have either massive seed black hole, or episodes of super-Eddington accretion, or a very low radiation efficiency." (From https://phys.org/news/2018-11-astronomers-luminous-high-redshift-quasar.html#jCp)

To create such a massive quasar in only 770 million years after the Big Bang, everything needs to be at the limit: Eddington limit, massive seen black hole (from what?), super-Eddington accretion, or a low radiation efficiency...

Three selected papers on dark matter and dark energy from the International Conference:
COSMOLOGY ON SMALL SCALES 2018: Dark Matter Problem and Selected Controversies in Cosmology

"**Constraint on the Existence of Dark Matter Haloes by the M81 Group and the Hickson Compact Groups of Galaxies**"
W. Oehm, P. Kroupa, Proceedings of Cosmology on Small Scales, Michal Krizek and Yurii Dumin (Eds.), Institute of Mathematics CAS, Prague, Sept. 2018
http://css2018.math.cas.cz/, arXiv:1811.03095

More falsification of dark matter... Taking into account dynamical friction between the dark matter haloes, the nearby located M81 group of galaxies as well as the Hickson compact groups of galaxies are here investigated with regard to their dynamical behaviour. *Numerical simulations show that the groups result from unlikely correlated motions and that* the observed compact configurations of major galaxies are a very unlikely occurence if dark matter haloes exist.

"**Problems with the dark matter and dark energy hypotheses, and alternative ideas**"
M. Lopez-Corredoira, Proceedings of Cosmology on Small Scales, Michal Krizek and Yurii Dumin (Eds.), Institute of Mathematics CAS, Prague, Sept. 2018
http://css2018.math.cas.cz/, arXiv:1808.09823

"**Can the Dark-Matter Deficit in the High-Redshift Galaxies Explain the Persistent Discrepancy in Hubble Constants?**"
Y.V. Dumin, Proceedings of Cosmology on Small Scales, Michal Krizek and Yurii Dumin (Eds.), Institute of Mathematics CAS, Prague, Sept. 2018
http://css2018.math.cas.cz/, arXiv:1804.00562

"**Evidence of a Flat Outer Rotation Curve in a Starbursting Disk Galaxy at z = 1.6**"
P.M. Drew *et al.*, Accepted for publication in the Astrophysical Journal, 2018
arXiv:1811.01958

Our results point to DSFG850.95 being a massive, rotationally-supported disk galaxy with a high dark-matter-to-baryon fraction in the outer galaxy, similar to disk galaxies at low redshift.

The "dark-matter-to-baryon fraction" is highly variable from one galaxy to another! How about the Milky Way?

“Shedding light on the Milky Way rotation curve with Gaia DR2”
M. Crosta *et al.*, arXiv:1810.04445 2018

Flat rotation curves in disk galaxies represent the main evidence for large amounts of surrounding ”dark” matter. Despite of the difficulty in identifying the dark matter contribution to the total mass density in our Galaxy, stellar kinematics, as tracer of gravitational potential, is the most reliable observable for gauging different matter components. Very recently, the Gaia mission has provided such data with unprecedented accuracy and consistency over a range of 11 kpc in Galactocentric distances.

By proving our relativistic Ansatz we suggest that geometry - unseen but perceived as manifestation of gravity according to Einstein’s equation - is responsible of the flatness at large Galactic radii. From Gaia DR2 it appears that just dust, namely pure matter made only of the non-collisional baryonic mass of the disk, fits the local energy-mass density in accordance with the observations.

“Towards a More Well-Founded Cosmology”
Hartmut Traunmüller, Zeitschrift für Naturforschung **A73**, Issue 11, p. 1005, 2018
doi:10.1515/zna-2018-0217, and https://www2.ling.su.se/staff/hartmut/Well-Founded_Cosmology.pdf

A very good discussion is presented that examines thoroughly the ΛCDM paradigm.

The history of science shows us that questionable assumptions on which previously established theories had been based tend to be retained not only as long as they remain compatible with the empirical evidence but as long as they can be made compatible with it by ad hoc means. Standard cosmology is a prominent case in point [...] it is not very rare in scientific practice that falsifications are brushed aside by advancing excuses in the form of ad hoc assumptions and constructs. Such adherence to traditional paradigms is [...] advantageous for those who aim for or depend on positive judgments by teachers, referees, editors and grant providers, and for extensive collaboration.

“The XXL Survey XXV. Cosmological analysis of the C1 cluster number counts”
F. Pacaud *et al.*, A&A 620, A10, 2018
doi:10.1051/0004-6361/201834022, and arXiv:1810.01624

Recent observations create a puzzle for astrophysicists: since the big bang, fewer galaxy clusters have formed over time than was actually expected. (https://www.sciencedaily.com/releases/2018/10/181004131828.htm

In this paper, we obtain cosmological constraints from the density and redshift distribution of the C1 galaxy cluster sample. [...] dividing by 3 the current cosmological constraints while keeping the same best-fit model would result for instance in a 4.8σ and 13.4σ tension, respectively in the ΛCDM and wCDM models based on our test.

“The progeny of a Cosmic Titan: a massive multi-component proto-supercluster in formation at $z = 2.45$ in VUDS”
O. Cucciati *et al.*, A&A 619, A49, 2018
doi:10.1051/0004-6361/201833655, and arXiv:1806.06073

Using the VIMOS instrument of ESO’s Very Large Telescope, astronomers have uncovered a titanic structure in the early Universe. This galaxy proto-supercluster - which they nickname Hyperion - is the largest and most massive structure yet found at such a remote time and distance - 2.3 billion years after the Big Bang. (ESO 1833 - Science Release) “This is the first time that such a large structure has been identified at such a high redshift,” explained Olga Cucciati. “Normally these kinds of structures are known at lower redshifts, which means when the Universe has had much more time to evolve and construct such huge things. It was a surprise to see something this evolved when the Universe was relatively young!”

"**Probing the environment of high-z quasars using the proximity effect in projected quasar pairs**"
P. Jalan, H. Chand, R. Srianand, submitted to ApJ, 2018
arXiv:1809.04614

Quasars are not at the distance indicated by their redshifts. The redshifted HI Lyα absorption lines seen in the Lyα forest are indicative of the physical conditions in the inter-galactic medium, where [...] most of the Lyα lines with column density $N_{HI} \leq 10^{14}$ cm^{-2} originate from density fluctuations in which HI is in ionization equilibrium with the meta-galactic UV background. An estimation of the HI photoionization rate is obtained from Lyα absorption sufficiently close to the quasar, where the UV-field is dominated by the quasar's radiation which leads to a deficit of Lyα absorption lines (i.e. the proximity effect).

Based on the extent of the proximity region along with the fact that the HI photoionization rate due to quasar radiation can be determined directly from its observed luminosity, one can infer the photoionization rate using the line-of-sight proximity effect (i.e., longitudinal proximity effect). The environment of a quasar can also be probed in the transverse direction using quasar pairs, commonly known as transverse proximity effect.

The authors use a sample of 181 project quasar pairs, but the opposite signal is seen for the transverse proximity effect. The difference in the Lyα transmission along the longitudinal and transverse directions, with higher absorption in the latter case, is unexpected if quasar radiation and matter distribution are isotropic.

"**Predictions for the sky-averaged depth of the 21cm absorption signal at high redshift in cosmologies with and without non-baryonic cold dark matter**"
S. McGaugh, Phys. Rev. Lett. 121, 081305, August 2018, 2018
doi:10.1103/PhysRevLett.121.081305, and arXiv:1808.02532

The expected absorption at cosmic dawn has recently been detected by EDGES. The depth of the observed absorption is consistent with no-Cold-Dark-Matter. In contrast, ΛCDM is not consistent with EDGES. I worry that the current picture allows so much room for auxiliary hypotheses that there is no possibility of discerning that it is incorrect, should that happen to be the case. *Stacy McGaugh supports MoND.*

See also: "**Can Conformal and Disformal Couplings Between Dark Sectors Explain the EDGES 21cm Anomaly?**", L.-F. Xiao, arXiv:1807.05541, 2018. *The short answer is 'no':* there is tension in corresponding parameter space between EDGES and other cosmological observations for this model.

See also: "**Can Early Dark Energy Explain EDGES?**", J.C. Hill, E.J. Baxter, Journal of Cosmology and Astroparticle Physics, Vol. 2018, No. 8, 2018. doi:10.1088/1475-7516/2018/08/037, and arXiv:1803.07555. *The short answer is 'no':* non-finely-tuned modifications of the background cosmology are unlikely to explain the EDGES signal while remaining consistent with other cosmological observations.

"**The Age of Large Globular Clusters of Galaxies**"
F. Zwicky, Publications of the Astronomical Society of the Pacific, Vol. 72, No. 428, p.365, Oct. 1960
doi:10.1086/127558, and Full Refereed Journal Article (PDF/Postscript)

"The age of 10^{18} years for rich compact clusters of galaxies may be shortened somewhat by considering certain interactions that lead to more inelastic and resonant encounters between galaxies. Unless, however, far greater efficiency for the transfer of energy and momentum is postulated for such interactions than is possible with our present-day knowledge of physical phenomena, the age of spherically symmetrical and compact clusters of galaxies is greater than 10^{15} years. This conclusion is on much safer grounds than any of the estimates of ages of stars, which so far have all been derived from very questionable assumptions about stellar energy generation."

What is this physical phenomenon, not known in 1960, which has such a "far greater efficiency for the transfer of energy and momentum between galaxies" that it can reduce the age of rich compact clusters from 10^{15} years to 10^{10} years?