



The Milky Way Panorama Credit: ESO / S. Brunier

Newsletter of *A Cosmology Group* - January 2020

ACG Editorial

Welcome to the first Newsletter of the 20s! With this 82nd Newsletter since 2005, nearly 1000 articles that challenge Λ CDM have been reviewed. Born in the 20s, the Big Bang model has evolved and grown very strong despite numerous attacks. Sadly, the battles that were once fought by professional astronomers are now mostly in the hands of solitary amateurs. **No recently proposed cosmology** has convinced anybody else but their author!

If the Λ CDM model is to die in the 20s (this century), our concerted effort must become much more strategic and focused. **So the question asked to all ACG members is: what more can be done?**

In this Newsletter: surprising correlation with redshift, the route to solving the Hubble tension, redshift does not scale with distance, QSO/nebula association, dark energy bias, and stars born too soon after the Big Bang.

Regards,

Louis Marmet, January 29, 2020

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Reviewed Publications¹

- Redshift, Hubble constant, Expansion

“ZTF Early Observations of Type Ia Supernovae II: First Light, the Initial Rise, and Time to Reach Maximum Brightness”

A.A. Miller *et al.*, Monthly Notices of the Royal Astronomical Society, Volume 492, Issue 1, p. 1, February 2020
[arXiv:2001.00598](https://arxiv.org/abs/2001.00598)

While it is clear that Type Ia supernovae (SNe) are the result of thermonuclear explosions in C/O white dwarfs, a great deal remains uncertain about the binary companion that facilitates the explosive disruption of the white dwarf. Here, we present a comprehensive analysis of a unique, and large, data set of 127 SNe Ia with exquisite coverage by the Zwicky Transient Facility (ZTF).

Figure 7 additionally shows that both t_{rise} and α are correlated with redshift. This result is somewhat surprising: naively, it suggests some form of cosmic evolution in SNe Ia, with SNe at $z \simeq 0.08$ having rise times that are several days shorter than SNe at $z \simeq 0.02$.

Could it be that a bias is introduced in the analysis? See Crawford [arXiv:1711.11237](https://arxiv.org/abs/1711.11237).

¹Quoted text is adapted from the original articles: underlined text is my emphasis, *italicized text are my comments*.

“The Expansion of the Universe is Faster than Expected”

A.G. Riess, Nature Reviews Physics volume 2, p. 10, 2020

doi: [10.1038/s42254-019-0137-0](https://doi.org/10.1038/s42254-019-0137-0), and [arXiv:2001.03624](https://arxiv.org/abs/2001.03624)

The measurement of H_0 improved from 10% uncertainty at the start of the 2000s to less than 2% by 2019. In the past few years, reduced uncertainties from both the cosmic microwave background – the afterglow of the Big Bang – and local Universe measurements have revealed an underlying discrepancy that is growing harder to ignore.

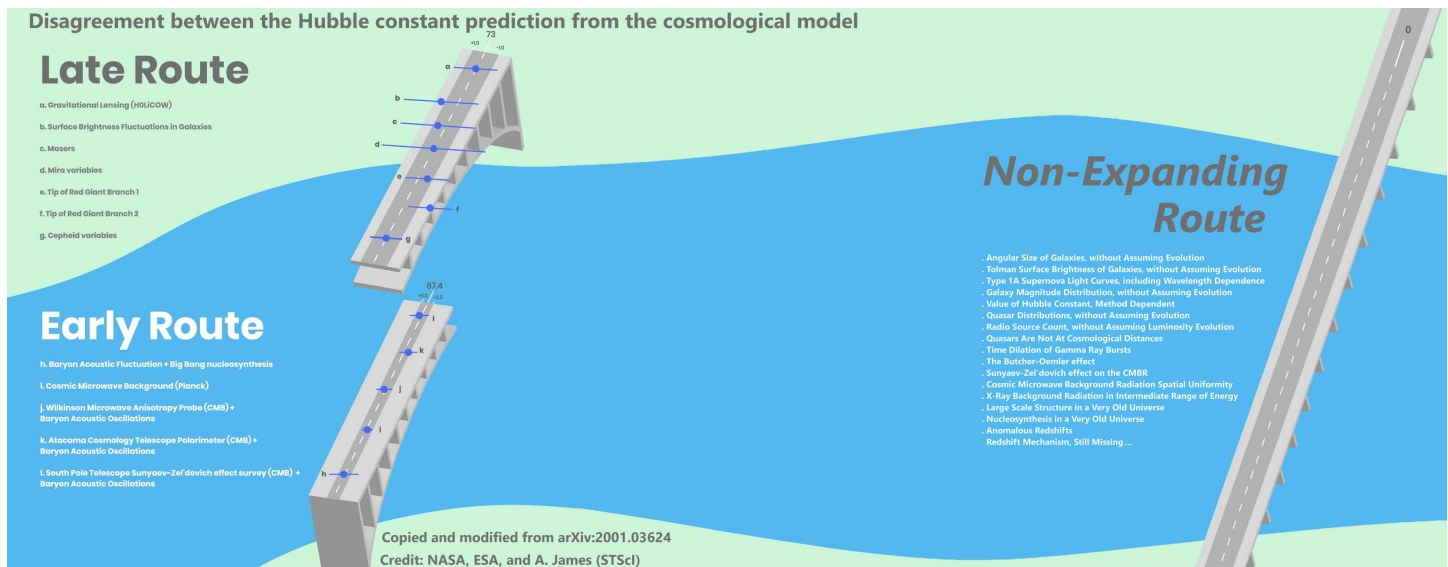
(Some are trying to ignore this by redefining what is meant by a ‘discrepancy’! See [arXiv1806.04292](https://arxiv.org/abs/1806.04292).)

Remarkably (!) dark components (matter and energy) account for 95% of the Universe, as described by Λ CDM, their presence robustly inferred from their gravitational effects. Yet despite the success in better understanding our Universe confirmed by a wealth of precise measurements, in the past few years there has been growing evidence that the expansion of the Universe is still exceeding our predictions.

If the Universe fails this crucial end-to-end test (it surely hasn’t yet passed), what might this tell us? It is tempting to think we may be seeing evidence of some ‘new physics’ in the cosmos.

If the true expansion rate is the higher, local value, the Universe may actually be up to a billion years younger than expected. More work on the theoretical side and new data are badly needed before we may hope to reach the long sought end-to-end understanding of the Universe.

It’s not the universe that’s failing the crucial end-to-end test, it’s Λ CDM. Curve fitting does not give us a “better understanding” of our universe but only adds to the plethora of epicycles and other complexities of the Big Bang model.



Perhaps this is how Λ CDM will collapse? Zooming out of the image presented by Riess, the ‘Non-Expanding route’ seems a lot safer: a redshift mechanism is the only ‘new physics’ that is required - the rest is already built.

“The analogy of K-correction in the topic of gamma-ray bursts”

L. Borvák, A. Mészáros, J. Rípa, Proceedings of the International Astronomical Union, 14(S346) p. 380, 2018

doi: [10.1017/S1743921318008025](https://doi.org/10.1017/S1743921318008025), and [arXiv:2001.00932](https://arxiv.org/abs/2001.00932)

It is well-known that there are two types of gamma-ray bursts (GRBs): short/hard and long/soft ones, respectively. In this contribution, the redshifts of GRBs are studied. The surprising result - namely that the apparently fainter GRBs can be in average at smaller distances - is discussed again. In essence, the results of Mészáros et al. (2011) are studied again using newer samples of GRBs. The former result is confirmed by the newer data.

Once again, redshift does not always scale with distance.

“Quasar quartet embedded in giant nebula reveals rare massive structure in distant universe”

J.F. Hennawi *et al.*, Science 348, Issue 6236, p. 779, 2015

doi: [10.1126/science.aaa5397](https://doi.org/10.1126/science.aaa5397), and [arXiv:1505.03786](https://arxiv.org/abs/1505.03786)

All galaxies once passed through a hyperluminous quasar phase powered by accretion onto a supermassive black hole. But because these episodes are brief, quasars are rare objects typically separated by cosmological distances. In a survey for Lyman-alpha emission at redshift $z \sim 2$, we discovered a physical association of four quasars embedded in a giant nebula. Located within a substantial overdensity of galaxies, this system is probably the progenitor of a massive galaxy cluster. The chance probability of finding a quadruple quasar is estimated to be $\sim 10^{-7}$, implying a physical connection between Lyman-alpha nebulae and the locations of rare protoclusters. Our findings imply that the most massive structures in the distant universe have a tremendous supply ($\sim 10^{11}$ solar masses) of cool dense (volume density $\sim 1 \text{ cm}^{-3}$) gas, which is in conflict with current cosmological simulations.

- Large-Scale Structure

“Discovery of a large HI ring around the quiescent galaxy AGC 203001”

O. Bait *et al.*, Monthly Notices of the Royal Astronomical Society, Volume 492, Issue 1, p. 1, February 2020

doi: [10.1093/mnras/stz2972](https://doi.org/10.1093/mnras/stz2972), and [arXiv:1910.08794](https://arxiv.org/abs/1910.08794)

Here we report the discovery with the Giant Metrewave Radio Telescope of an extremely large ($\sim 115 \text{ kpc}$ in diameter) HI ring off-centered from a massive quenched galaxy, AGC 203001. This ring does not have any bright extended optical counterpart, unlike several other known ring galaxies. Our deep optical imaging of the HI ring shows several regions with faint optical emission at a surface brightness level of $\sim 28 \text{ mag/arcsec}^2$. Such an extended HI structure is very rare with only one other case known so far. Conventionally, off-centered rings have been explained by a collision with an “intruder” galaxy leading to expanding density waves of gas and stars in the form of a ring. However, in such a scenario the impact also leads to large amounts of star formation in the ring which is not observed in the ring presented in this paper.

The origin of such HI-dominated rings is still poorly understood.

“Early-type Host Galaxies of Type Ia Supernovae. II. Evidence for Luminosity Evolution in Supernova Cosmology”

Y. Kang *et al.*, Monthly Notices of the Royal Astronomical Society, Volume 492, Issue 1, p. 1, February 2020

[arXiv:1912.04903](https://arxiv.org/abs/1912.04903)

The most direct and strongest evidence for the presence of dark energy is provided by the measurement of galaxy distances using type Ia supernovae (SNe Ia). This result is based on the assumption that the corrected brightness of SN Ia through the empirical standardization would not evolve with look-back time. Recent studies have shown, however, that the standardized brightness of SN Ia is correlated with host morphology, host mass, and local star formation rate, suggesting a possible correlation with stellar population property.

We show that the previously reported correlations with host morphology, host mass, and local star formation rate are most likely originated from the difference in population age. This indicates that the light-curve fitters used by the SNe Ia community are not quite capable of correcting for the population age effect (*that's not their only drawback: see Crawford [arXiv:1711.11237](https://arxiv.org/abs/1711.11237)*), which would inevitably cause a serious systematic bias with look-back time. Notably, taken at face values, a significant fraction of the Hubble residual used in the discovery of the dark energy appears to be affected by the luminosity evolution. We argue, therefore, that this systematic bias must be considered in detail in SN cosmology before proceeding to the details of the dark energy.

- Old Systems

“Spectroscopic confirmation of a mature galaxy cluster at a redshift of 2”

J.P. Willis *et al.*, Nature 577, p. 39 (2020)

doi: [10.1038/s41586-019-1829-4](https://doi.org/10.1038/s41586-019-1829-4), and [arXiv:2001.00549](https://arxiv.org/abs/2001.00549)

Galaxy clusters are the most massive virialized structures in the Universe and are formed through the gravitational accretion of matter over cosmic time. The discovery of an evolved galaxy cluster at redshift $z = 2$, corresponding to a look-back time of 10.4 billion years, provides an opportunity to study its properties. For the canonical model employing zero dust absorption the mean stellar age of 2.98 Gyr at $z = 1.98$ corresponds to a mean star formation redshift of $z = 12.0$ (or 372 Myr).

If the mean star formation time is 372 Myr, many of those stars started forming even before that time! Too early to be possible?

“A Metal-poor Damped Ly α System at Redshift 6.4”

E. Bañados *et al.*, The Astrophysical Journal 885, Number 1, 2019

doi: [10.3847/1538-4357/ab4129](https://doi.org/10.3847/1538-4357/ab4129), and [arXiv:1903.06186](https://arxiv.org/abs/1903.06186)

The epoch of reionization started a few hundred million years after the Big Bang when the collapse of the first dark matter halos and gas cooling led to the formation of the first generation of stars (Population III stars) and galaxies. These sources are thought to play an important role in the production of the high-energy photons required to reionize the intergalactic medium and end the cosmic dark-ages within the first 10^9 years of the universe.

Nevertheless, our understanding of the properties of the Population III stars is limited and mainly based on theoretical models while their direct observational characterization is likely beyond the capabilities of existing telescopes. Current observational efforts focus on the study of chemical abundances of very metal-poor stars which could still retain the chemical enrichment signatures produced by the first and second generation of stars.

We identify a strong Ly α damping wing profile in the spectrum of the quasar P183+05 at $z = 6.4386$. This object is among the most metal-poor damped Ly α systems known and, even though it is observed only ~ 850 Myr after the big bang, its relative abundances do not show signatures of chemical enrichment by Population III stars.

No observation yet of hypothesized Population III stars...

A Cosmology Group

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 framework of a Big Bang cosmology. The *ACG Newsletter* highlights observational results that are anomalous in terms of the Λ CDM model and provides a critical examination² of the methods and investigations used in cosmology.

The *Newsletter* is published irregularly, editor’s schedule permitting, and when interesting papers are available. ACG subscribers³ receive notifications of *Newsletter* publications. You can subscribe to *ACG Notifications* or join the ACG Forum by sending a request to redshift@cosmology.info.

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](https://arxiv.org/) or [HAL](https://hal.archives-ouvertes.fr/)) is preferred. Summaries of new cosmologies are collected on [A Cosmology Model](#) or can be presented at the next [ACG Conference](#).

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²When the thesis is supported by empirical evidence.

³ACG has 53 subscribers to *ACG Notifications* and 41 followers on *A Cosmology Group* on the Goggle Mail forum.