The Milky Way Panorama Credit: ESO / S. Brunier

Newsletter of *A Cosmology Group* - March 2023

ACG Editorial

$\mathcal{M}$ore surprising results and impossible galaxies (for mainstream cosmologists) from the Webb Telescope. However, spectroscopic confirmations of galaxies at $z > 16$ have not been published yet...

Thanks to Abhas, Sahil, François, and all who contributed references to papers.

Louis Marmet, March 3, 2023
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Reviewed Publications[1]

- Redshift, Hubble parameter, Expansion

"Reconciling cosmic dipolar tensions with a gigaparsec void" T. Cai, Q. Ding, Y. Wang, arXiv:2211.06857 (2022-11-13) "Recent observations indicate a 4.9σ tension between the CMB and quasar dipoles. This tension challenges the cosmological principle. We propose that if we live in a gigaparsec scale void, the CMB and quasar dipolar tension can be reconciled. This is because we are unlikely to live at the center of the void. And a 15% offset from the center will impact the quasars and CMB differently in their dipolar anisotropies. As we consider a large and thick void, our setup can also ease the Hubble tension."

"Dusty Starbursts Masquerading as Ultra-high Redshift Galaxies in JWST CEERS Observations" J.A. Zavala *et al.* ApJL **943** L9 doi:10.3847/2041-8213/acacfe (2023-1-25) "Our analysis shows that robust (sub)millimeter detections of NIRCam dropout galaxies likely imply z $\sim$ 4-6 redshift solutions, where the observed near-IR break would be the result of a strong rest-frame optical Balmer break combined with high dust attenuation and strong nebular line emission, rather than the rest-frame UV Lyman break. This provides evidence that dusty star-forming galaxies may contaminate searches for ultra-high redshift LBG candidates from JWST observations." *All that dust makes me sneeze. It's easy to hide a bad theory under a layer of dust, but a spectroscopic measurement will clear up the confusion...* See also "Distance Makes the Galaxy Grow Redder... but So Does Dust" in aasnova.org/2023/02/08/are-dusty-galaxies-getting-in-the-way-of-high-redshift-studies/

"Is the Observable Universe Consistent with the Cosmological Principle?" P.K. Aluri *et al.*, arxiv:2207.05765 (2022-10-13) "Tensions have emerged within the ΛCDM model, most notably a statistically significant discrepancy in the value of the Hubble constant, H_0. Since the notion of cosmic expansion determined by a single parameter is intimately tied to the Cosmological Principle, implications of the H_0 tension may extend beyond ΛCDM to the CP itself. This review surveys current observational hints for deviations from the expectations of the CP, highlighting synergies and disagreements that warrant further study."

"A measurement of Hubble's Constant using Fast Radio Bursts" C.W. James *et al.* arxiv:2208.00819 (2022-8-1) "We constrain the Hubble constant H_0 using Fast Radio Burst (FRB) observations. We use the redshift-dispersion measure ('Macquart') relationship, accounting for the intrinsic luminosity function, cosmological gas

[1]For all reviews, quoted text is adapted from the original, underlined text is my emphasis, and *italicized text are my comments.*

distribution, population evolution, host galaxy contributions to the dispersion measure (DMhost), and observational biases due to burst duration and telescope beamshape. Our best-fitting value of H_0 is calculated to be 73^{+12}_{-8} km/s/Mpc. We demonstrate [...] the potential for clarifying the Hubble tension with an upgraded ASKAP FRB search system." *One more local (imprecise) measurement of H_0 giving ∼74 km/s/Mpc.*

"No Redshift Evolution of Galaxies' Dust Temperatures Seen from 0 < z < 2" P.M. Drew, C.M. Casey, ApJ **930** 142 (2022-5-12) https://iopscience.iop.org/article/10.3847/1538-4357/ac6270 "Some recent literature has claimed there to be an evolution in galaxies' dust temperatures toward warmer (or colder) spectral energy distributions (SEDs) between low and high redshift. These conclusions are driven by both theoretical models and empirical measurement. Such claims sometimes contradict one another and are prone to biases in samples or SED fitting techniques." *Astronomers are trying to save ΛCDM theory at all costs, even by contradicting claims made by other groups. There is no redshift evolution.*

"Hints of FLRW Breakdown from Supernovae" C. Krishnan *et al.* arxiv:2106.02532 (2021-6-4) "A 10% difference in the scale for the Hubble parameter constitutes a clear problem for cosmology. We record a ∼1 km/s/Mpc variation in H_0 at antipodal points on the sky within the Pantheon sample, which is evident in the Low z subsample ($z \leq 0.075$) and gets enhanced by higher redshift SN. Our work raises the possibility that we may be at the precision required to probe anisotropic Hubble expansions, while providing a concrete prediction for future inferences of H_0."

- Galaxy and Large-Scale Structure Formation

"A massive interacting galaxy 525 million years after the Big Bang" K. Boyett *et al.* arXiv:2303.00306 (2023-3-1) "JWST observations confirm the existence of galaxies as early as 300 Myr and at a higher number density than expected based on galaxy formation models and HST observations. Yet, sources confirmed spectroscopically in the first 500 Myr have estimated stellar masses $< 5 \times 10^8$ $M_\odot$, limiting the signal to noise ratio (SNR) for investigating substructure. We present a high-resolution spectroscopic and spatially resolved study of a rare bright galaxy at $z = 9.3127 \pm 0.0002$ with a stellar mass of $(2.5^{+0.7}_{-0.5}) \times 10^9$ $M_\odot$, forming 25^{+3}_{-4} $M_\odot$/yr and with a metallicity of ~ 0.1 $Z_\odot$ - lower than in the local universe for the stellar mass but in line with expectations of chemical enrichment in galaxies 1-2 Gyr after the Big Bang. Our observations provide evidence of rapid efficient build-up of mass and metals in the immediate aftermath of the Big Bang through mergers, demonstrating that massive galaxies with several billion stars exist earlier than expected. [...] No analogous galaxies were found in TNG100, the second largest simulation of the suite with a box length of 110 cMpc, indicating that such massive galaxies are rare objects in the early Universe." *Strangely enough, we keep finding the rare galaxies!*

"Discovery of a quiescent galaxy at z=7.3" T.J. Looser *et al.* arXiv:2302.14155 (2023-2-27) "Local galaxies are known to broadly follow a bimodal distribution: actively star forming and quiescent system (i.e. galaxies with no or negligible star formation activity at the epoch of observation). Why, when and how such bimodality was established, and whether it has been associated with different processes at different cosmic epochs, is still a key open question in extragalactic astrophysics. Here we report the discovery of a quiescent galaxy at $z = 7.3$, when the Universe was only 700 Myr old - about 5% of its current age. The JWST/NIRSpec spectrum of this galaxy from our JADES programme exhibits a complete absence of nebular emission lines, while the Balmer break and Lyα drop are unambiguously detected. We infer that this galaxy experienced a short and intense burst of star formation followed by rapid quenching, about 10-20 Myr before the epoch of observation. Particularly interesting is that the mass of this quiescent galaxy is only $\sim 4-6 \times 10^8$ $M_\odot$. This mass range is sensitive to various feedback mechanisms that can result in temporary or permanent quiescence."

A small galaxy that managed to stop growing very early.

"A population of red candidate massive galaxies ∼600 Myr after the Big Bang" I. Labbé, P. van Dokkum *et al.* Nature. doi: 10.1038/s41586-023-05786-2 (2023-2-22) "Here we make use of the $1-5\mu$m coverage of the JWST early release observations to search for intrinsically red galaxies in the first ≈ 750 million years of cosmic history. In the survey area, we find six candidate massive galaxies (stellar mass $> 10^{10}$ solar masses) at $7.4 \leq z \leq 9.1$, 500-700 Myr after the Big Bang, including one galaxy with a possible stellar mass of $\sim 10^{11}$ solar

masses. If verified with spectroscopy, the stellar mass density in massive galaxies would be much higher than anticipated from previous studies based on rest-frame ultraviolet-selected samples." *Impossible galaxies!*

"Discovery of a Dusty, Chemically Mature Companion to a $z \sim 4$ Starburst Galaxy in JWST ERS Data" B. Peng *et al.*, ApJL **944** L36 (2023-2-17). doi: 10.3847/2041-8213/acb59c *Since this doesn't make sense in a ΛCDM cosmology,* "We attempt to reconcile the high metallicity in this system by invoking early onset of star formation with continuous high star-forming efficiency or by suggesting that optical strong line diagnostics need revision at high redshift." *A mature galaxy in the "early" universe.* See also phys.org/news/2023-02-astronomers-metal-rich-galaxy-early-universe.html

"Discovery of an isolated dark dwarf galaxy in the nearby universe" J.-L. Xu *et al.* arxiv:2302.02646 (2023-2-6) "Based on a new HI survey using the Five-hundred-meter Aperture Spherical radio Telescope (FAST), combined with the Pan-STARRS images, we identified an isolated HI cloud without any optical counterpart, named FAST J0139+4328. The newly discovered HI cloud appears to be a typical disk galaxy since it has a double-peak shape in the global HI profile and an S-like rotation structure in the velocity-position diagram. Moreover, this disk galaxy has an extremely low absolute magnitude [...] implying that dark matter dominates over baryons in FAST J0139+4328. This is the first time that an isolated dark galaxy has been detected in the nearby universe."

"JWST Census for the Mass-Metallicity Star-Formation Relations at z=4-10 with Self-Consistent Flux Calibration and the Proper Metallicity Calibrators" K. Nakajima *et al.* arxiv:2301.12825 (2023-1-30) "We present the evolution of the mass-metallicity (MZ) relations at z=4-10 derived with 111 galaxies identified in the JWST/NIRSpec data. We find that there is a small evolution of the MZ relation from z∼2-3 to z=4-10, while interestingly that the SFR-MZ relation shows no evolution up to z∼8 but a significant decrease at z>8 beyond the error. This SFR-MZ relation decrease at z>8 may suggest a break of the metallicity equilibrium state via star-formation, inflow, and outflow, while further statistical studies are needed for a conclusion." For a review of the paper **"Mass + metals + making history = constraining the mass-metallicity relation with JWST"** L. Rowland, Astrobites astrobites.org/2023/02/09/mass-metallicity-relation-jwst/

"A massive quiescent galaxy at redshift 4.658" A.C. Carnall *et al.* arxiv:2301.11413 (2023-1-26) "We report the spectroscopic confirmation of a massive quiescent galaxy, GS-9209 at a new redshift record of z=4.658. We find that this galaxy formed its stellar population over a ≃200 Myr period, approximately 600-800 Myr after the Big Bang, before quenching at $z_{quench} = 6.7 \pm 0.3$. This galaxy clearly demonstrates that the earliest onset of galaxy quenching was no later than ≃800 Myr after the Big Bang. The significant integrated quantity of accretion implied by [a] large black-hole mass suggests AGN feedback plausibly played a significant role in quenching star formation in this galaxy. GS-9209 is also extremely compact, with an effective radius of just 215±20 parsecs." *Another apparently "compact galaxy" (as seen under the illusion of space expansion.)*

"Intracluster light is already abundant at redshift beyond unity" H. Joo, M.J. Jee, Nature 613, 37–41 (2023-1-4), doi: 10.1038/s41586-022-05396-4. "Contrary to the leading theories, our study finds that Intracluster Light (ICL) is already abundant at $z \geq 1$, with a mean ICL fraction of approximately 17%. Moreover, no significant correlation between cluster mass and ICL fraction or between ICL colour and cluster-centric radius is observed." "Hubble finds that ghost light among galaxies stretches far back in time" phys.org/news/2023-01-hubble-ghost-galaxies.html

"Dwarf Galaxies with Central Cores in Modified Newtonian Dynamics Gravity" J.S. Almeida ApJ **940** 46 (2022-11-18) iopscience.iop.org/article/10.3847/1538-4357/ac9520 arxiv:2209.12547 "Some dwarf galaxies are within the Mondian regime at all radii. These dwarf galaxies often show cores, in the sense that, assuming Newton's gravity to explain their rotation curves, the total density profile presents a central plateau or core. Here we show that under modified Newtonian dynamics (MOND) gravity, the existence of this core implies a baryon content whose density must decrease toward the center of the gravitational potential. Such a drop of baryons toward the central region is neither observed nor appears in numerical simulations of galaxy formation following MOND gravity. We analyze the problem posed for MOND as well as possible work-arounds." *Trouble for MOND.*

"CEERS Key Paper III: The Diversity of Galaxy Structure and Morphology at z=3-9 with JWST" J.S. Kartaltepe *et al.* arXiv:2210.14713 (2022-10-26) "We present a comprehensive analysis of the evolution of the morphological and structural properties of a large sample of galaxies at z=3-9 using early JWST CEERS NIRCam observations. We present the fraction of galaxies of each morphological type as a function of redshift. Overall, these trends suggest that galaxies with established disks and spheroids exist across the full redshift range of this study and further work with large samples at higher redshift is needed to quantify when these features first formed."

- Cosmology

"The shaky foundations of cosmology" Interview with Bjørn Ekeberg, IAI youtu.be/XmzulJsGtZ4 (2023-3-2) "It's impossible to create a cosmology, or to have a cosmological understanding, without having made some metaphysical assumptions." *A good discussion here: youtu.be/XmzulJsGtZ4?t=896 Based on the metaphysical assumption that the laws of physics are the same everywhere, in which case either data are not interpreted correctly, or our laws of nature are just wrong, it is hopefully clear that the papers selected for this* **Newsletter** *show that the problems with the Big Bang model arise from an incorrect interpretation of astronomical data.*

"Scientists release new map of all the matter in the universe" https://phys.org/news/2023-01-scientists-universe.html "Matter is not as "clumpy" as we would expect based on our current best model of the universe, which adds to a body of evidence that there may be something missing from our existing standard model of the universe." *Thinking that they observed "all the matter of the universe" is already a stupid mistake.* The paper is **"Joint analysis of Dark Energy Survey Year 3 data and CMB lensing from SPT and Planck. III. Combined cosmological constraints"** T.M.C. Abbott *et al.* Phys. Rev. D **107**, 023531 – Published (2023-1-31) journals.aps.org/prd/abstract/10.1103/PhysRevD.107.023531

"JWST high redshift galaxy observations have a strong tension with Planck CMB measurements" D.Wang, Y. Liu, arxiv:2301.00347 (2023-1-1) "JWST high redshift galaxy observations predict a higher star formation efficiency than the standard cosmology does, which poses a new tension to ΛCDM. We find that the situation is worse than expected. The true situation is that the Planck CMB measurement has a strong tension with JWST high redshift galaxy observations."

"The Violent Universe" Carl Sagan, Robert MacNeil, youtu.be/Fprjlcmvnbo?t=590 (1969) *Some haven't stopped asking this question. And it turns out that everything we see, when interpreted correctly, is in favour of the latter possibility considered by Sagan. Fred Hoyle says here youtu.be/Fprjlcmvnbo?t=8307 "The trouble is, the observers are working near limit of what can be done." This will always be true in a boundless universe!*

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 Standard Cosmology through a critical examination[2] of the methods and investigations of cosmology. The *ACG Newsletter* highlights observational results that are anomalous in terms of the *Horrendous Space Kablooie* paradigm.

The *Newsletter* is published irregularly, editor's schedule permitting, and when interesting papers are available. ACG subscribers[3] receive notifications of *Newsletter* publications and a few additional announcements. You can subscribe to *ACG* 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` or `HAL`) is preferred.

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[2] When the thesis is supported by empirical evidence.
[3] ACG currently has 67 members.