Alternative Cosmology Group Newsletter - September 2007

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Note—this newsletter does not publish new research, but reports on research already public—mainly that in arXiv. We invite readers to suggest noteworthy papers.

More—much more—on surface brightness and size

In the last newsletter, I made the prediction that there was more to come in the debate over surface brightness. Indeed this prediction has been verified by observation, with five papers bearing on this question in the last month, one including a direct reply to Scarpa, Falamo and Lerner's paper noted in last month's newsletter. Since I am one of the authors I am of course a participant in this debate. However, I think a few remarks on these papers will be of interest to our newsletter readers. To be clear what is a summary of the paper and what are my editorial comments, I have put my comments in italics.

To review, if the universe is expanding, the surface brightness of distant galaxies will be much less than that of nearby ones. But if it is not expanding, the surface brightness will be the same. It turns out that the surface brightness is in fact the same. The conventional, Big Bang, explanation of this observation is that the distant galaxies have extremely high intrinsic surface brightness but with cosmological dimming, by coincidence, they appear to have the same surface brightness as nearby ones.

Scarpa et al argued that there are no galaxies in the local universe with the extremely high surface brightness that this explanation requires. However, this month Overzier et al reply with Hubble Space Telescope observations that, they claim, shows that extremely small bright galaxies do exist today, so could have existed at high z. The catch is that only one of the galaxies observed with HST was observed in the far UV wavelengths that the high-z galaxies are observed at. This one galaxy had a surface brightness intermediate between that claimed by Hoopes and that claimed for the same galaxy by Scarpa based on ground telescope observations. It still had however 35 times less surface brightness than the most extreme high-z galaxies would have with cosmological dimming. Next year, more observations of nearby galaxies with HST in the far UV should resolve this question.

HST morphologies of local Lyman break galaxy analogs I: Evidence for starbursts triggered by merging
Authors: Roderik A. Overzier, Timothy M. Heckman, Guinevere Kauffmann, Mark Seibert, R. Michael Rich, Antara Basu-Zych, Jennifer Lotz, Alessandra Aloisi, Stephane Charlot, Charles Hoopes, D. Christopher Martin, David Schiminovich
http://arxiv.org/abs/0709.3304v1

In a closely related paper, Hathi et al contend that the maximum intrinsic surface brightness of high-z galaxies is roughly the same as the maximum for nearby galaxies, taking into account cosmological dimming. This is viewed as a confirmation of the cosmological expansion and a refutation of the alternative, tired light, theory which ascribes the redshift to some other physical phenomenon. Here, too, there are serious methodological problems. For one thing the paper shows that the maximum cosmologically corrected surface brightness of high-z galaxies is 12 times that of low-z ones, not really a good agreement. Second, if bright galaxies have a size distribution that extends below the resolution of a given telescope, the maximum surface brightness observable will be defined by the telescope resolution, not by some physical attribute.

In a second paper, the same authors look at composite images formed by stacking several high-z galaxy images, but do not use these images for size or surface brightens comparisons.

Starburst Intensity Limit of Galaxies at z~5-6
Authors: N. P. Hathi, S. Malhotra, J. E. Rhoads
http://arxiv.org/abs/0709.0520v1

Surface Brightness Profiles of Composite Images of Compact Galaxies at z~4-6 in the HUDF
Authors: N. P. Hathi, R. A. Jansen, R. A. Windhorst, S. H. Cohen, W. C. Keel, M. R. Corbin, R. E. Ryan Jr
http://arxiv.org/abs/0710.0007v1

Other papers published this month look at size or surface brightness changes in longer wavelengths. Trujillo et al look at massive galaxies and find that at z=1.85 the most massive, >10^11 stellar mass, galaxies are five times smaller than nearby galaxies, taking into account the assumed cosmological formula for converting angular dimensions to linear dimensions. (The expanding universe formula makes objects (1+z)^1.5 times smaller than they appear to be.) This implies that they are 125 times denser than massive galaxies today and such dense galaxies are not found in the nearby universe. Trujillo et al hypothesize that mergers could reduce their density, but such mergers would make them into extremely massive galaxies, which are very rare. By contrast, if the universe is not expanding, the distant galaxies would be close to present galaxies in size, with ellipticals being 75% of current radius and spirals 158% of current size.

Strong size evolution of the most massive galaxies since z~2
Authors: Ignacio Trujillo, Christopher J. Conselice, Kevin Bundy, M. C. Cooper, P. Eisenhardt, Richard S. Ellis
http://arxiv.org/abs/0709.0621v1

Finally, Akiyama et al studying size and surface brightness of galaxies in the optical V band find that at z=3, the highest surface brightnesses, assuming cosmological dimming are 16 times brighter than any in the nearby universe. Their comparison of the average surface brightness is limited since if the non-expanding hypothesis is valid, their telescope can not resolve at z=3 galaxies as small as those in the z=0 samples, thus possibly biasing the results.

Adaptive Optics Rest-Frame V-band Imaging of Lyman Break Galaxies at z~3: High-surface Density Disk-like Galaxies ?
Authors: M.Akiyama, Y.Minowa, N.Kobayashi, K.Ohta, M.Ando, I.Iwata
http://arxiv.org/abs/0709.2714v1

Lithium problem gets worse

It has long been known that there is much less lithium –Li7--in old stars than is predicted by Big Bang nucleosynthesis. .The discovery of Li6 as well in these stars has made the problem worse. On the one hand, Li6 is very easily burned in stars, so if some of the Li7 was destroyed by stellar nuclear reactions, all of the Li6 would have been, implying there has been very little destruction. But in addition the Big Bang does not predict the production of any Li6. Prodanovic and Fields assume that the Li6 is produced by cosmic rays, and find that these must produce some Li7 as well. This makes the contradiction between the predicted amount of Li7 and observation even worse.

Cosmological Cosmic Rays: Sharpening the Primordial Lithium Problem
Authors: Tijana Prodanovic, Brian D. Fields
http://arxiv.org/abs/0709.3300v1

A modified gravity cosmology

Modified gravity has long been discussed as an attentive to dark matter. However, Moffat and Tooth have gone much further and tried to show how modified gravity could change other things in an expanding universe cosmology. For one thing, this would greatly increase the age of the universe to 34 billion years. This would of course help relieve problems of Big Bang theory involving too-old galaxies and large scale structures. However, some tests, like the surface brightness test, would be still a valid way to distinguish all expanding universe models from non-expanding ones.

Modified Gravity: Cosmology without dark matter or a cosmological constant
Authors: J. W. Moffat, V. T. Toth
http://arxiv.org/abs/0710.0364v2