Creation argument against the big bang no longer sustainable—CMB shadows and galaxy clusters

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I have previously made the argument that the *cosmic microwave background* (CMB) radiation, 'light' allegedly from the big bang fireball, casts no shadows in the foreground of galaxy clusters.[1] If the big bang were true, the light from the fireball should cast a shadow in the foreground of all galaxy clusters. This is because the source of the CMB radiation, in standard big bang cosmology, is what is known as the "*last scattering surface*".[2]

The last scattering surface is the stage of the big bang fireball that describes the situation when big bang photons cooled to about 1,100 K. At that stage of the story those photons separated from the plasma that had previously kept them bound. Then expansion of the universe is alleged to have further cooled those photons to about 3 K, which brings them into the microwave band. Thus if these CMB photons cast no shadows in front of all galaxy clusters it spells bad news for the big bang hypothesis.

The Sunyaev–Zel'dovich Effect

The CMB radiation shadowing effect, or more precisely the cooling effect, by galaxy clusters is understood in terms of the Sunyaev–Zel'dovich Effect (SZE). This is where microwave photons are isotropically scattered by electrons in the hot inter-cluster medium (ICM) (see figure 1) via an inverse Compton process leaving a net decrement (or cooling) in the foreground towards the observer in the solar system. Of those CMB photons coming from behind the galaxy cluster less emerge with the same trajectory due to the scattering. Even though the scattered photons pick up energy from the ICM the number of more energetic CMB photons is reduced. After modelling what this new CMB photon energy (hence temperature) should be, a decrement can, in principle, be detected.

Many studies found no shadowing

Starting around 2003 some published investigations, using this SZE, looked for the expected shadowing/cooling effect in galaxy clusters. No significant cooling effect was found, by multiple studies, including the WMAP satellite data.[4] This was considered to be very anomalous, significantly different from what was expected if the CMB radiation was from the big bang fireball. The anomaly was even confirmed by the early Planck satellite survey data in 2011.[5]

I published my original article[6] in 2006 using this as evidence against the big bang. I based that article on the work of Lieu *et al*. (2006).[7]

Lieu *et al*. (2006) found that about 25% of galaxy clusters showed a cooler shadow, 25% showed a warmer shadow, and 50% showed neither heating nor cooling. But a cooling effect is what was expected with a mean decrement of as much as 160 μK.

However, if another effect contaminated the data for those which showed no cooling effect then the test would be inconclusive. It could

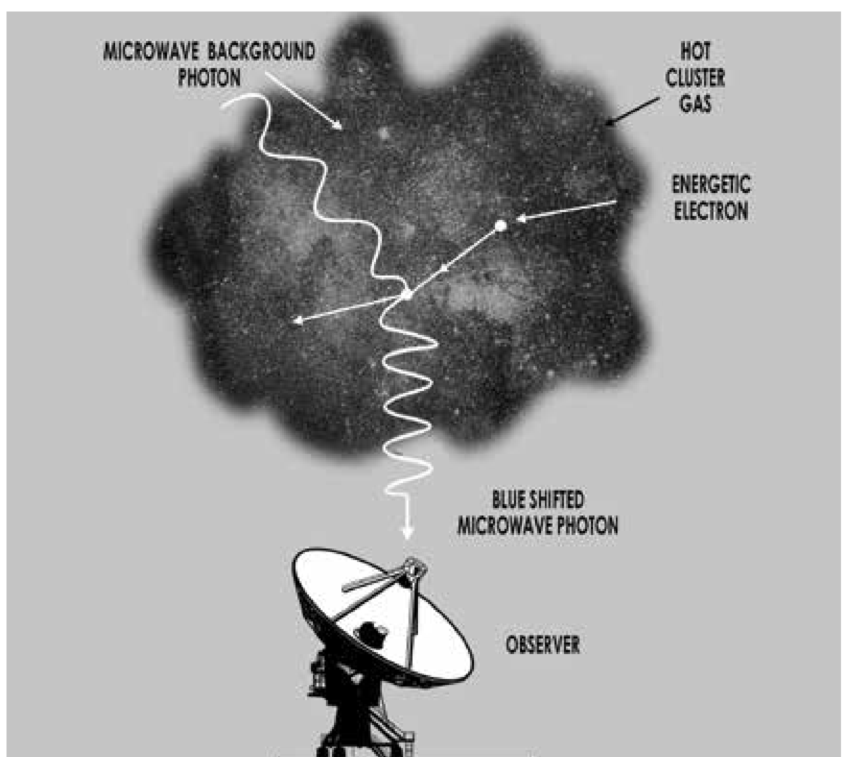

Figure 1. Schematic of the Sunyaev-Zel'dovich Effect that results in an increase in higher energy (or blue shifted) photons of the CMB when seen through the hot gas present in cluster of galaxies (after figure 8 in Weisskopf[3])

mean that where a cooling effect was observed it was due to the SZE. Where it was not observed it could have resulted from contamination due to some other source.

One of the problems in the studies listed above is that they had to assume some model of the cluster in order to extract the expected decrement (see figure 1). The scattered CMB radiation is at much higher temperatures than the expected decrement. Locally it has been measured near 2.725 K,[8] so a cooling effect of 160 μK is relatively very small against that 2,725,000 μK and the scattered CMB photons would be much hotter than this due to their picking up energy from the ICM.[9]

New study with new method

A new analysis method (published 2013)[10] confirmed that there was a measured cooling effect attributed to the SZE in about 100 clusters selected using the SZE[11] or by their X-ray emissions. However in about 10,000 optically selected clusters the opposite result was found, where the mean temperature *rises* to about 10 μK, an increment not a decrement. The scattered CMB photons are hotter than expected. There is a *heating not a cooling* effect observed in front of all those 10,000 clusters.

The previous studies necessarily used model-dependent methods. Whereas in this newest study[9] the authors employed a statistical method that was free from such assumptions. They instead used the temperature of the CMB data pixels found near or away from the galaxy cluster under investigation.

> "To study foreground effects of galaxy clusters, one can consider the viewpoint of CMB data pixels, simply taking each pixel as a probe. For one galaxy cluster in an ideal isotropy CMB, a simple method is used to compare the probe data (temperature data of this pixel) of angular regions affected and unaffected by the cluster. For real CMB data, the fluctuation temperature of each pixel can be taken as another Gaussian distribution error of the detector. Considering the different properties of noise signals and the SZ signal, one can use statistical methods to compare the mean probe data of angular regions considered 'to be' or 'not to be' affected by the sample clusters. The noise signal will have similar effects on these two kinds of pixels, but *the thermal SZ signal will only depress the temperature of 'to be' affected pixels* [emphasis added]."[9]

The results of their study suggested this heating effect could be attributed to contamination due to radio emission of the cluster itself. This accounts for the anomaly in 99% of the clusters. That means that the small SZ cooling—a thermal effect—was possibly completely masked by contamination from the clusters. Considering that the original studies could not account for the increments in thermal emissions in front of the galaxy clusters, when decrements were expected, I think this analysis needs to be taken notice of.

Conclusion

Without anything to contradict their result, and the analysis seems strong, one must entertain the possibility that the anomaly first found by Lieu *et al*. in 2006 has been adequately explained. The problem of course is that astrophysics is not exactly operational science.[12] At best my original no-shadow argument (2006) is now equivocal and hence I suggest that it should no longer be used as a creationist argument against the big bang hypothesis.

References

1. Hartnett, J.G., The big bang fails another test, *J. Creation* **20**(3):15,16, 2006; creation.com/the-big-bang-fails-another-test, 2007; Hartnett, J.G., 'Light from the big bang' casts no shadows, creation.com/big-bang-casts-no-shadows, *Creation* **37**(1):50–51, January 2015.
2. The *last scattering surface* allegedly produced the first photons that were free to travel throughout the volume of the universe. Thus they should be the oldest photons and should be travelling throughout the volume constantly, creating an isotropic background, which today is called the cosmic microwave background (CMB). In any direction we look in the universe, we should see galaxy clusters 'back lit' by those CMB photons travelling toward us, thus creating a 'shadow'.
3. Weisskopf, M.C., The making of the Chandra X-Ray Observatory: the project scientist's perspective, PNAS **107**(16):7135–7140, 2010, pnas.org/content/107/16/7135.
4. This anomaly was measured by Lieu, R., Mittaz, J.P.D., and Zhang, S.N., The Sunyaev–Zel'dovich Effect in a sample of 31 clusters: a comparison between the x-ray predicted and WMAP observed cosmic microwave background temperature decrement, *Astrophysical J.* **648**:176, 2006, and was confirmed by several others: Bielby, R.M. and Shanks, T., Anomalous SZ contribution to three-year WMAP data, MNRAS **382**:1196–1202, 2007; Diego, J.M. and Partridge, B., The Sunyaev–Zel'dovich Effect in Wilkinson Microwave Anisotropy Probe data, MNRAS **402**:1179–1194, 2010; Jiang, B-Z., Lieu, R., Zhang S-N., and Walker, B., Significant foreground unrelated non-acoustic anisotropy on the 1 degree scale in Wilkinson Microwave Anisotropy probe 5-year observations, *Astrophysical J.* **708**:375–380, 2010.
5. Planck Collaboration, Planck early results, XII, Cluster Sunyaev-Zeldovich optical scaling relations, *Astronomy & Astrophysics* **536**:A12, 2011.
6. Hartnett, J.G., The big bang fails another test, *J.Creation* **20**(3):15,16, 2006.
7. Lieu, R., Mittaz, J.P.D., and Zhang, S.N., The Sunyaev–Zel'dovich Effect in a sample of 31 clusters: a comparison between the x-ray predicted and WMAP observed cosmic microwave background temperature decrement, *Astrophysical J.* **648**:176, 2006
8. The CMB temperature at the cluster is higher by a factor (1+z), where z is the cluster redshift.
9. Modelling of the cluster needs to accurately reproduce the intercluster cluster medium (ICM) electron density. CMB photons, with a temperature of 2.725(1+z) K on entering the cluster, pick up energy from the energetic electrons in the ICM but due to their isotropic scattering they are slightly cooled in the line-of-sight direction towards the observer than would be expected if they were not scattered by the SZE. Thus, these photons are slightly less 'warm' than expected. This is the shadowing effect.
10. Xiao, W., Chen, C., Zhang, B., Wu, Y., and Dai, M., Sunyaev–Zel'dovich effect or not? Detecting the main foreground effect of most galaxy clusters, MNRASL **432**:L41–L45, 2013; academic.oup.com/mnrasl/article/432/1/L41/1137531.
11. Clusters found from the CMB by the cooler shadows attributed to the SZE.
12. It largely boils down to what I call 'stamp-collecting' (accumulating an ensemble of similar objects) and statistical arguments based on whether or not one has a representative sample. But because of the inherent restricted access to what you cannot see in the cosmos even that is subject to modelling.