

## Re: CMBR– A More Explicit Answer

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- *From:* "Spoonfed" <[jonathan.doolin@xxxxxxxxxxxxxxxxxxxxxxxxxxxxx](mailto:jonathan.doolin@xxxxxxxxxxxxxxxxxxxxxxxxxxxxx)>
  - *Date:* 29 Apr 2005 07:28:12 –0700
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Spoonfed wrote:

> Paul Valois wrote:

>> By comparing the red and blue shifts of the six transmitters as the  
> ship

>> moves in different inertial frames, it should be possible to easily  
>> determine the absolute motion of the ship relative to the  
background,

>

>> shouldn't it? From inside the ship.

>

I wanted to make a few clarifications, corrections

> By accelerating one way or another ,

....we would not easily see very much change in the apparent color of  
the CMBR. While it is easy to change our speed with reference to a  
stopped object, (like the ground), it is hard to change our speed with  
something traveling near the speed of light.

> you should think in terms of

> momentum instead of velocity. You would have very little success in

> changing your velocity with respect to the CMBR, although you might

> have some luck changing your relative momentum. The gas from which  
the

> CMBR emanates is moving around 0.999999976238c. (Calculation below)

....assuming the gas is burning at an actual temp of 25,000 K.

The cooler appearing portion of the gas is hurtling away with a lorentz  
factor of 4592, while the warmer appearing portion is hurtling away  
with a lorentz factor of 4581.

> If you accelerated a particle until its Kinetic Energy was 4 times  
its

> rest mass energy, you could center it in the CMBR.

Note: This would be 5 or 6 times, and this is a rough estimate. By

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accelerating until the gamma value on both sides was 4586.5 (halfway in between their current values) you could get rid of the dipole anisotropy. Relative to earth, this would be very close to the speed of light. However, relative with the gas, you would change your speed very little.

- >
- > First realize that an equipartition of energy over the momentum of all
- > the mass in the universe should result in a Lobachevskian pattern (if
- > you neglect all acceleration due to collisions and gravity).
- >
- > To get an idea what this pattern looks like
- > <http://www.d.umn.edu/~ddunham/mathhoriz/paper.html>

The important point about this pattern is that at the outer edges it becomes infinitely dense, even though the inner 38% or so is homogeneous within 8%.

(I use 38% because I read that the universe appeared homogeneous to 1 part in 10,000 in a region  $10^{23}$  km wide. Emperor's New Mind (Penrose), Page 328 (Penrose Cited: Davies 1987 I haven't tracked down the Davies Article to find out how he is able to state with such uncanny certainty what the density of the universe  $10^{23}$  km away.)

- >
- > The outer edges of this pattern are gasses from very early in the big
- > bang.
- >
- > They are incredibly hot, very new (primordial) and receding very
- > quickly from us. There are two reasons that they appear so young.
- > One, it has taken many billions of light years to reach us from the
- > gas
- > (but this is not the main reason) The main reason is that in our
- > reference frame, they have been traveling away from us at so close to
- > the speed of light that they have not aged.
- >
- > Now, the reason for them appearing to be at  $2.725 \pm .00335$  Kelvin
- > instead of over 25,000 Kelvin as we would suspect from a substance
- > that
- > should be hotter than the surface of an O–Class star, is that it is
- > highly red–shifted.
- >
- > The equation for relativistic doppler shift is
- >
- > (1)  $f_{\text{actual}}/f_{\text{observed}} = \sqrt{(1+v/c)/(1-v/c)}$
- >
- > By Wiens Law, the Temperature is directly proportional to the
- > frequency, so we can replace
- >
- > (2)  $f_{\text{actual}}/f_{\text{observed}} = T_{\text{Actual}}/T_{\text{observed}}$ .

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- >
- > Defining  $\beta = v/c$  and solving for  $\beta$ , we get
- >
- > (3)  $\beta = (T_{\text{actual}}^2 - T_{\text{observed}}^2) / (T_{\text{actual}}^2 + T_{\text{observed}}^2)$
- >
- > Convention: In this case a positive  $\beta$  represents motion away from
- > the observer, and a negative  $\beta$  indicates motion toward the
- > observer.
- > A cool object coming toward us at nearly the speed of light will
- > appear to have an infinite temperature by this equation; neat, huh?
- >
- > Just for the sake of having a number to work with, I assume that the
- > actual temperature,  $t_{\text{actual}}$ , of the gas is 25,000 K (the surface
- > temp
- > of an O–Class Star.) The temperature should be some sort of
- > uncoupling
- > temperature where the gas becomes cool and spread out enough that it
- > becomes possible for the light to propagate toward us. This density
- > and pressure combination is set by the properties of matter, not by
- > some massive coincidence.
- >

I have occasionally seen the decoupling temperature given as 3000 K, as the temperature at which matter uncouples and light can pass through. Since the surface temperature of our own sun is 6000 K, it is hard for me to believe that the hottest visible light from the big bang itself would be 3000 K.

- > For  $t_{\text{observed}}$ , I have my choice between  $2.725 + .00335$  and
- >  $2.725 - .00335$ .
- > Either one yields approximately the same  $\beta$  value.
- >
- >  $\beta = 0.999999976238$  (assuming  $T_{\text{actual}} = 25,000$  K)
- >
- > This suggests at first that there is no velocity difference between
- > the
- > two sides of the universe, which is pretty–much true.
- >

Except of course, they are going in opposite directions.

- > However, the lorentz factor,  $\gamma$ , represents the time dilation
- > factor
- > and gives us a measure of the kinetic energy of the gas
- >
- > (4)  $\gamma = 1/\sqrt{1 - \beta^2}$ ,
- >
- > (5) Kinetic Energy =  $(\gamma - 1) m c^2$
- >
- > And we can solve equations (3) and (4) for  $\gamma$  to get
- >

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- > (6)  $\gamma = \sqrt{(T_{\text{actual}}^2 + T_{\text{observed}}^2)} / (2 T_{\text{actual}} T_{\text{observed}})$
- >
- > This time, we have the numbers  $\gamma = 4581$  and  $\gamma = 4592$
- >

Chart:

gamma velocity

1 0c

2 .86c

7 .99c

Once your target get past  $\gamma = 7$  huge amounts of energy must be expended to make significant changes in the relative speed. With  $\gamma = 4581$ , the gasses velocity is going to be very hard to touch by accelerating toward it.

Aside: Using Age of Universe/Age of decoupling era to calculate gamma.

- > Another approach might be to use the estimated time at which light
- > purportedly began propagating through the universe, which is
- > somewhere
- > around 400,000 years. Using 13.7 billion years/400 thousand years,
- > gives  $\gamma = 34250$ . If this is accurate, then the Actual Temperature
- > of
- > the CMBR is somewhere close to 200,000 K. However, this would not be
- > appropriate.
- >

Note: Gamma is the time dilation factor, giving the ratio of time experienced by the observer and the observed object. The problem is that this calculation requires both the observed and observer to be inertial (no acceleration) the whole time.

- > Although our local universe is approximately 13.7 billion years old,
- > every particle in it underwent many relativistic accelerations in the
- > first few years.

This is the thermal accelerations when (our part of) the universe was well over 25000 K. With each bump the universe grows asymmetrically. However, over a large number of bumps, in alternate directions, the appearance is of nearly symmetric growth.

In this process gravitational attraction may or may not be significant. If the universe is infinite, then there should be no center, and no more gravitational attraction in one direction than another. However, if it is finite, then at the beginning when everything was clustered together, there would have been a huge acceleration toward the center.

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The thermal acceleration, however, should not be controversial. A hot dense early universe will have to involve thermal collisions and acceleration of particles in the gas.

- > With each (noninertial) bump, the dense, primordial
- > local supercluster would have found itself in an older universe,
- while
- > the edges (inertial) receded away. Just as the moving twin in the
- > infamous Twin Paradox finds himself still young, while the world has
- > aged, our galaxy, finds itself only 13.7 billion years old in a much
- > more ancient universe.
- >
- > Regards,
- > Jonathan Doolin
- > www.spoonfedrelativity.com

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• *Follow-Ups:*

- ◆ *Re: CMBR– A More Explicit Answer*

◇ *From:* Tom Roberts

• *References:*

- ◆ *Postulates of Relativity and The Cosmic Background – Question*

◇ *From:* Paul Valois

- ◆ *Re: Postulates of Relativity and The Cosmic Background – Question*

◇ *From:* Spoonfed

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