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On the preferred reference frame existence in the Universe

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1. The dipole anisotropy of the cosmic microwave background radiation

In 1964th Arno Penzias and Robert Wilson were performing a careful calibration of their radio telescope at the Bell Laboratory at Whippany, New Jersey. They found that their receiver reached a "noise" pattern as if it was inside a container whose temperature was near to 3 K - i.e. as if it was in equilibrium with a black body at 3 K. This "noise" seemed to be coming from all directions. In 1978th Penzias and Wilson have got the Nobel prize in physics for this discovery. This radiation was identified as cosmic microwave background radiation (CMBR) and supposed to be connected with the Universe early process. Accordingly to the last data this radiation corresponds to a black body radiation at 2.72548±0.00057 K with the peak at 160.2 HHz (wavelength is 1.063 mm). The radiation is isotropic to roughly one part in 100,000: the root mean square variations are only 18 µK, after subtracting out a dipole anisotropy from the Doppler shift of the background radiation. The CMB's redshift is a little more than 1000.

A black body at such the temperature emits most of its energy in the microwave wavelength range. Molecules in the earth's atmosphere absorb this radiation therefore astronomers cannot make observations from the ground in this wavelength region. So, these measurements were executed firstly from the stratosphere using planes and balloons and then from the open space using satellites. When cosmologists first looked for the microwave sky (several decades ago), they noticed it was nearly uniform.

However, as observations improved, they detected the *dipole anisotropy*. The noted Russian scientist Ya.B. Zeldovitch wrote in the Editorial Addition to **[Weinberg, 2000]:** "… these careful measurements allowed to find out some anisotropy of CMBR. An antenna oriented to the Lion constellation detects that the radiation temperature is 0.013% more, than mean one. The radiation temperature in the opposite direction is 0.013% less, than mean one. Generally, a temperature varies continuously between these two values[1]."

Finally, the Cosmic Background Explorer (COBE)[2] satellite that started in 1989th, surely detected several cosmological fluctuations and dipole anisotropy in the microwave background temperature. The CMBR spectrum was measured at 0.005% precision level; it was found out this radiation has essential anisotropy at relative order 10^{-5}.

The temperature deviations map is shown on the Figure 1, the mean value is 2.728 К at the microwave spectra range. The stratified map structure corresponds with the dipole anisotropy.

In addition to its infrared component the much more wide CMBR spectra range was studied. Starting since 1990th the X-radiation and gamma-radiation are studied with help of several sattelites. The X-radiation observable dipole anisotropy just corresponds with background 3К-radiation (see for **[Klapdor-Kleingrothaus, Zuber, 1997]**). The common

[1] My own translation.
[2] The information presented by Goddard Space Flight Center, NASA, USA (COBE Science Working Group, NSSDC).

explication of this effect consists in the Solar system motion with velocity 369 ± 0.9 km/s to the point (l, b) = (264°,48°) on the sky.

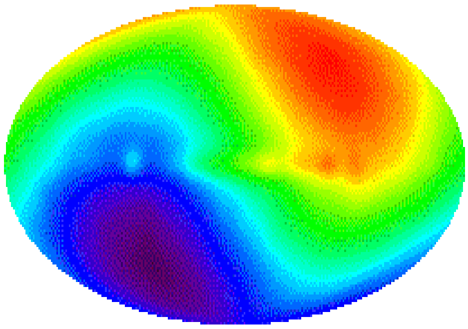

Figure 1. The CMBR temperature dipole anisotropy

2. The radiation anisotropy and the preferred reference frame

The Michelson and Morley's experiments and the Einstein's Special Relativity proved that any preferred inertial reference frame couldn't exist as well as any ether does not exist where electromagnetic waves may propagate. So, at the border between the 19th and the 20th centuries the absolute space concept seemed to be rejected forever.

However, the Solar system motion corresponding with the CMBR dipole anisotropy has an absolute character. As Ya.B. Zeldovitch continues in **[Weinberg, 2000]**:

"The isotropy presents only for some imaginary observer. *The Solar system, Earth move to the Lion constellation relative to this observer having velocity 390 ± 60 km/s*. Hence, as a result of the Doppler effect, a meeting radiation seems to be more hot, and an overtaking radiation seems to be more cold. This example shows that an observer exists in every point of the Universe, for which a CMBR is isotropic. We may consider this observer and a connected reference frame as preferred. The preferred reference frame existence at the Universe every point looks like the physicists commonly held view preceding to Relativity. They thought that the light presents the ether oscillations occupying whole the Universe. They thought also that the reference frame connected with ether is preferable, or preferred one. They tried to detect the Earth motion relative to ether.

We know that these experiments gave the negative result: any ether doesn't exist. But the Universe evolution follows that when CMBR is observed (and only in this case!), the preferred reference frame (called sometime "new ether") appears. This new ether at one place is moving relative to new ether at other one. *The new ether or CMBR just provides the motion accordingly to the Hubble's law*[3]*.*"

Ya.B. Zeldovitch himself proposed an explanation of this radiation anisotropy based on the probable early Universe anisotropy **[Zeldovitch, Novikoff, 1975]**. But I propose the more fundamental explanation. It states that any acceleration (including the rotating and oscillating ones) selects in general the absolute reference frame. Since any electromagnetic radiation is generated by oscillating electrical charges, therefore it allows in principle to an observer to select the absolute reference frame.

As I wrote in the works **[Shulman, 2006]**, **[Shulman, 2007]** an own unique direction and velocity value must exist in each point of the Universe*, that define a preferred reference frame* (in fact, that is "the 4D time arow""). I found out this results in 1997th before I knew about the

[3] My own translation.

CMBR dipole anisotropy discovery. Therefore, a demande to experimentally valide (or to reject) the new theory appeared.

If an observer Is absolutely immobile during the Universe expanding, then a radiation will be ideally isutropic relative him. But if the observer world line presents some non-zero angle to the absolute time axis, then such moving observer using Doppler effect can detect the absolute velocity of its motion. For this he must detect that radiation anisotropy, due to the direction and velocity of a meaurement device relative to the absolute reference frame. Quantitatively this anisotropy will depend on the value (in fact, $v/c \sim 0.0015$) and on the angle α related to the preferred motion direction, as Doppler effect theory predicts.

In the previous version of the paper I supposed to use the sunlight spectrum measurements at different Earth locations relative to Sun or mutually immobile system "light source – spectrum analyzer". However, two independent expert said me that such the effect should be large enough to pass unnoticedbe so far. So, I had to revisit the situation and understood that Earth together with Sun (or a proposed light source) moves relative to the absolute reference frame, so one cannot see any effect. Then I came to conclusion that it enough to use the *gedanken* experiment only! In fact, let us have a light source that is *immovable relative to CMBR*, i.e., relative to the absolute reference frame. But then this source will move relative Earth and therefore a terrestrial observer will reach its Doppler's frequency shift. In other words, each *local* radiation source will give the same effect as the *global* CMBR (the Zeldovitch's opinion).

I also belive, a purely mechanical experiments are possible too (see for. **[Shulman, 2006]**). If the Earth having some velocity moves relative to the absolutely immobile (preferred) reference frame, then one could valide this reference frame existence by measuring the force/acceleration relation along the velocity and perpendicularly to it. If that velocity is really determined by the CMBR dipole anisotropy direction and value, then we may find out the relative acceleration difference near $2{,}25 \times 10^{-6}$.

Finally, I would like to note the "new ether" preferred reference frame is connected not only with a motion 3D direction in the Universe (like the"old ether"), but also with a 3D velocity along this direction. Summary some 4D vector (the time arrow) appears, which presents a normal one to the 4D spherical hypersurface, or to our Universe.

References

[Weinberg, 2000] Weinberg Steven. *The First Three Minutes. A Modern View of the Origin of the Universe*. See Russian Edition: Moscow, R&C Dynamics Ed., 2000 (in Russian).

[Zeldovitch, Novikoff, 1975] Zeldovitch J.B., Novikoff I.D. *The Universe structure and evolution.* Moscow, Nauka, 1975 (in Russian).

[Klapdor-Kleingrothaus, Zuber, 1997] H.V.Klapdor-Kleingrothaus, K.Zuber *Teilchenastrophysik*. B.G. Teubner GmbH, Stutgart, 1997

[Shulman, 2006] Shulman M.H. *Paradoxes, Logics, and Physical Nature of Time.* Available at: http://www.chronos.msu.ru/RREPORTS/shulman_paradoksy.pdf (in Russian)

[Shulman, 2007] Shulman M.H. *Cosmology: a New Approach*. Available at: http://www.timeorigin21.narod.ru/eng_time/Cosmology.pdf