The Newton-Stefan-Boltzmann-Planck Code.
The Solar Microwave Background Formation on the Blackbody Sphere at the Distance $R = 140\,\text{AU}$

Jiří Stávek*

**ABSTRACT**

In this model the Solar System presented to observers on the planet Earth the elegant gift: the Solar Microwave Background (SMB) formed on the Blackbody Sphere at the distance $R = 140\,\text{AU}$. The thermalization of the Hydrogen wall at this distance was described using the Stefan-Boltzmann law where the temperature of the blackbody at the distance $R = 1\,\text{AU}$ is $T = 393.6\,\text{K}$. Newton's cooling law described the cooling of this blackbody surface temperature with the cooling constant $\kappa = 1.139 \times 10^{-4}\,\text{s}^{-1}$ calculated from data of the small planet Pluto (average distance $R = 39.5\,\text{AU}$ and the temperature $T = 44\,\text{K}$). The SMB monopole temperature $T = 2.7255\,\text{K}$ was fitted for the distance $R = 140\,\text{AU}$ with the temperature of the surrounding $T_{\text{ENV}} = 2.5887\,\text{K}$. The first important difference with the model of the cosmic microwave background (CMB) is the magnitude and direction of Newton's dipole $v = (200 + 141)\,\text{km/s}$ towards the galactic coordinates $(l, b) = (84^\circ, -48^\circ)$ while the magnitude and the direction of the Doppler's dipole of CMB is $v = 368\,\text{km/s}$ towards $(l, b) = (264^\circ, 48^\circ)$. This new model enables to estimate the rotation velocity of the Sun in the Milky Way Galaxy, the motion of the Milky Way Galaxy through the Universe, and the Harress-Sagnac color excess: $v = 200 + 141 + 27 = 368\,\text{km/s}$. The total motion of the Milky Way Galaxy through the Universe can be estimated with the knowledge of the Cold Spot direction in the SMB and the motion towards the Galactic South Pole. In this model, the Milky Way Galaxy can avoid collision with the Andromeda Galaxy. The observed quadrupole, octopole, and hemisphere structure of the SMB can be explained as the local motion of the Sun and the Solar axis inclination towards the ecliptic—the Axis of evil should be renamed as the Solar axis bringing to us a good opportunity to discover differences between the SMB and the CMB. The first peak in the power spectrum of the SMB at the distance $R = 140\,\text{AU}$ is observed from the COBE, WMAP, and PLANCK satellites rotating around the Sun at the distance $R = (2 \times 1)\,\text{AU}$ under the angle $\theta = 0.818^\circ$. The power spectrum observed from the planets Mercury and Jupiter will have different positions of the first and higher peaks. The original Solar signature should be visible as the moving shadows of the Sunspots on the Blackbody Sphere. There were proposed several experiments on how to distinguish between the SMB and the CMB.

**Keywords:** Cosmic microwave background (CMB), Newton's cooling law, Solar microwave background (SMB), Stefan-Boltzmann law.

1. **INTRODUCTION**

The cosmic microwave background (CMB) is microwave radiation that fills all space around the observer near the planet Earth. The precise measurements of the CMB are very critical to cosmology, therefore any proposed model of the Universe must explain this radiation, e.g., [1]–[13]. There were published many attempts to propose other origins of this cosmic microwave background, e.g., reviews.
There were published many models based on the thermalization of grains, e.g., [17]–[27]. However, these models cannot fully describe the observed properties of the microwave background and propose some new effects that could distinguish between the standard interpretation of the CMB and a newly proposed model.

The aim of this contribution is to interpret the observed properties of the microwave background based on the structures of the Solar System found by the twin spacecrafts Voyager 1 and Voyager 2, and on the old physics of Newton, Stefan, Boltzmann, and Planck. Is it possible to propose a reasonable alternative model for that intensively observed and analyzed microwave background and moreover to propose experiments for a deeper view into the origin of that microwave background?

2. THE HYDROGEN WALL, TERMINATION SHOCK, AND THE INTERSTELLAR TEMPERATURE

The twin spacecraft Voyager 1 and Voyager 2 were launched by NASA in 1977. During their long mission they collected valuable data about the Termination shock at the distance between 90 AU–120 AU, and the Hydrogen wall at the distance between 120 AU–160 AU [28]. Katushkina et al. [29] postulated the existence of the Hydrogen wall at the distances 120 AU–160 AU based on their emission data. In our model, we propose the existence of the Blackbody Sphere at the distance $R = 140$ AU where the Solar heat causes the formation of the blackbody radiation with the temperature $T = 2.7255$ K.

The structure of the heliosphere is schematically shown in Fig. 1.

Before the discovery of the microwave background by Penzias and Wilson in 1964, there were several predictions of the interstellar temperature for the static Universe. Assis and Neves summarized those predictions of the interstellar temperatures for the static Universe [30]. The history of the 2.7 K predictions is given in Table I.

In 1941 McKellar used the rotation mode of the cyanogen molecules CN to measure the interstellar temperature and found the value $T = 2.3$ K. Since that time many scholars used this molecule to determine the interstellar temperature.

![Fig. 1. Heliosphere structure based on the data of the twin spacecraft Voyager 1 and Voyager 2: Termination shock and the Hydrogen wall. Inspired by Katushkina et al. paper [29].](image)

<table>
<thead>
<tr>
<th>Year</th>
<th>Name</th>
<th>T [K]</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1896</td>
<td>Guillaume</td>
<td>5.6</td>
<td>[31]</td>
</tr>
<tr>
<td>1926</td>
<td>Eddington</td>
<td>3.18</td>
<td>[32]</td>
</tr>
<tr>
<td>1933</td>
<td>Regener</td>
<td>2.8</td>
<td>[33]</td>
</tr>
<tr>
<td>1937</td>
<td>Nernst</td>
<td>0.75</td>
<td>[34]</td>
</tr>
<tr>
<td>1941</td>
<td>McKellar (CN molecules)</td>
<td>2.3</td>
<td>[35]</td>
</tr>
<tr>
<td>1953</td>
<td>Finlay-Freundlich</td>
<td>$1.9 \leq T \leq 6.0$</td>
<td>[36]</td>
</tr>
</tbody>
</table>

PLANCK experimental determination of the cosmic microwave background $T = (2.7255 \pm 0.0006)$ K

CN molecule as the cosmic thermometer for low temperatures: histogram for 167 determinations gives $1.7 \leq T \leq 5.0$ [37]

"There is no physical interpretation for the temperatures lower than $T = 2.7255$ K, there is no clear interpretation for the excess temperatures above $T = 2.7255$ K."

This model: the Solar Hydrogen wall at the distance $R = 140$ AU has temperature $T = 2.7255$ K. The interstellar temperature is determined by Newton’s cooling law around that observed star. CN molecule temperature depends on the distance of CN molecules from that observed star.
measure the interstellar temperatures near various stars in the Milky Way Galaxy. Słyk et al. [37] surveyed those values and constructed the histogram of those temperatures (Fig. 2).

In the Big Bang model, the interstellar temperature below $T = 2.7255$ K has no physical interpretation. Such low interstellar temperatures could be explained in the context of Newton's cooling law: the value of the interstellar temperature depends on the distance from the central star.

3. The Stefan-Boltzmann Law and the Newton’s Cooling Law

The irradiance of the Sun on the outer atmosphere when the Sun and Earth are spaced at 1 AU is called the solar constant $G_{SC}$. The currently accepted value is $G_{SC} = 1361$ W/m$^2$. The Stefan-Boltzmann law then gives a temperature for the blackbody surface at the distance 1 AU:

$$T_{1\,AU} = \left( \frac{G_{SC}}{\sigma} \right)^{1/4} \approx 393.6 \, \text{K}$$  (1)

where $\sigma$ is the Stefan-Boltzmann constant. For the cooling of the blackbody surface in the Solar System we will use the very well-known Newton’s cooling law:

$$\ln \left( \frac{T(t) - T_{ENV}}{T(1\,AU) - T_{ENV}} \right) = -\kappa t = -\kappa \frac{R}{c}$$  (2)

where $T(t)$ is the blackbody surface temperature at time $t$, $T_{ENV} = 2.5887$ K (the interstellar temperature to fit the value $T = 2.7255$ K at $R = 140$ AU), $R$ is the distance from the Earth, $c$ is the light speed. For the determination of the cooling constant $\kappa$ we will use data for the small planet Pluto at the average distance $R = 39.5$ AU and its surface temperature $T = 44$ K. This will give the value $\kappa = 1.139 \times 10^{-4}$ s$^{-1}$. This new appearance of the old Newton’s cooling law might contribute to numerous applications and deeper knowledge about this classical physical law, [38]–[67]. Surprisingly, the value of the cooling constant $\kappa$ for the Solar System is in the range of values of cooling constants for liquid water [68]. It seems that behind Newton’s cooling law might be the blackbody surface of the surroundings. Fig. 3 depicts the temperature of the blackbody surface in the Solar System. One of the future experiments in the Solar System might be the measurement of the blackbody surface temperatures at various distances from the Sun.

4. The Newton’s SMB Dipole and the Doppler’s CMB Dipole

The CMB dipole represents the largest anisotropy with the amplitude of CMB dipole $(3.3621 \pm 0.001$ mK), e.g., [69]–[74]. This Doppler’s CMB dipole is interpreted as the Sun motion at $368$ km/s relative to the reference frame of the CMB towards the galactic coordinates $(l, b) = (264^\circ, 48^\circ)$. However, this Doppler’s dipole direction leads to the opposite direction of the rotation of the Sun in the Milky Way Galaxy and the opposite direction from the Andromeda Galaxy (the observed Doppler blueshift on the level of $110$ km/s). Therefore, this kinematic interpretation of CMB anisotropy was recently questioned with high statistical confidence [75].

Fig. 2. Histogram of interstellar temperatures of the CN molecules (based on the Słyk et al. paper [37]).
Fig. 3. The blackbody surface temperature in the Solar System is based on the Stefan-Boltzmann law and Newton’s cooling law.

![Graph showing blackbody temperature vs. distance from the Sun observed on Earth]

Fig. 4. Newton’s SMB dipole direction opposite to Doppler’s CMB dipole direction, sky map in galactic coordinates.

**TABLE II: Doppler’s Dipole Magnitude and Direction, Newton’s Dipole Magnitude and Direction**

<table>
<thead>
<tr>
<th>Relationships</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doppler’s CMB dipole direction towards the warmer photons</td>
<td>( v = 368 \text{ km/s} )</td>
</tr>
<tr>
<td>Newton’s SMB dipole direction towards the cooler photons (fitted for the Doppler dipole data)</td>
<td>( v = (200 + 141) = 341 \text{ km/s} ) towards (l, b) = (84°, −48°)</td>
</tr>
<tr>
<td>( v_1 ) = 200 km/s —the true Sun rotation velocity in the Milky Way Galaxy</td>
<td>( v_2 = 141 \text{ km/s} ) —the Milky Way Galaxy motion towards (l, b) = (84°, −48°)</td>
</tr>
<tr>
<td>( v_3 = 27 \text{ km/s} ) —the Harress-Sagnac color excess [^{[76]}]</td>
<td>( v_4 = 16 \text{ km/s} ) —the Milky Way Galaxy motion towards the Cold spot (l, b) = (209°, −57°)</td>
</tr>
<tr>
<td>( v_5 = 8 \text{ km/s} ) —the Milky Way Galaxy motion towards the South galactic pole (l, b) = (0°, −90°)</td>
<td></td>
</tr>
</tbody>
</table>

The Milky Way Galaxy will avoid the predicted collision \[^{[77]}\] with the Andromeda Galaxy ([l, b] = (121°, −22°)]. The apparent velocity towards the Andromeda Galaxy is \( v_{\text{apparent}} = 141 \times \cos (40°) = 108 \text{ km/s} \), the real velocity 141 km/s leads towards (l, b) = (84°, −48°). (Based on the haversine formula)

The observed microwave background dipole is interpreted newly using Newton’s cooling law: the longer the path of the Solar radiation heat towards the Blackbody Sphere, the cooler the Hydrogen wall and the cooler photons radiating from that cooler site \[^{(3)}\]:

\[
\ln \left( \frac{T(t) - T_{\text{ENV}}}{T(1AU) - T_{\text{ENV}}} \right) = -\kappa t = -\kappa \frac{R \pm x}{c}
\]

\[^{(3)}\] where \(+x\) is a longer path in the direction of motion of the Sun, and \(-x\) is a shorter path of the Blackbody Sphere behind the moving Sun. Therefore, Newton’s SMB dipole leads in the opposite direction in comparison with Doppler’s CMB dipole (Fig. 4).

This model predicts several new facts because the Sun and the Milky Way Galaxy move differently in comparison with the traditional interpretation based on Doppler’s CMB model (Table II).

This SMB model enables to describe the total motion of the Milky Way Galaxy through the Universe. The main velocity component directs towards the galactic coordinates (l, b) = (84°, −48°)
5. The Axis of Evil Renamed as the Solar Axis of a Good Opportunity

The unexpected features of the microwave sky at large angular scales revealed unique patterns somehow associated with the Ecliptic plane, e.g., [84]–[91]. This preferred axis was termed the Axis of evil and many papers studied those patterns in details, e.g., [92]–[98]. The detailed map of these unique patterns is shown in Fig. 6 from the valuable paper of Copi et al. [95].

The probability of these alignments in Fig. 6 is about one part in a thousand. We predict that a deeper study of the Sun local motions with an amplitude of about 10 km/s can be seen as the blue patterns (the Sun forward motion cools a little bit the Blackbody Sphere on a longer path), and red patterns (on the opposite side of the Sun motion the Blackbody Sphere is a little bit warmer—a shorter path). Because the Sun rotation axis is inclined to the Ecliptic plane, the South hemisphere should be a little bit warmer in comparison with the North hemisphere. Therefore, we propose to rename the “Axis of evil” into the “Solar axis of a good opportunity” because we might distinguish between the SMB and CMB predictions.
6. The Power Spectrum of the Microwave Background—The First Peak

The power spectrum of the microwave background [99] can support or exclude the SMB model. In this experiment, we observe the Blackbody Sphere at the distance $R = 140$ AU from satellites on the orbit near the Earth at a distance of 1 AU from the Sun on a circle with a diameter equal to $D = 2$ AU. The same structure we observe under the angle $\theta \approx 0.818^\circ$ shown in Fig. 7.

In order to test the reality of this SMB model, we should observe the first peak position in the power spectrum at different angles. Fig. 8 predicts the positions of the first peak in the power spectrum observed from the planets Jupiter and Mercury. We propose to perform this experiment in the Solar System near other planets in order to reveal if the SMB model describes the real Nature. This experiment could be very valuable for the estimation of the reality of the Newton-Stefan-Boltzmann-Planck Code. The joint project “ICURE” (India, China, United States of America, Russia, and European Union) could bring new data for the properties of microwave background observed until now in the vicinity of the Earth only. This experiment can reveal to us if our cosmological models are universal or “Geocentric”, “Heliocentric”, or “Galaxy centric”.

7. The Solar Signature on the Blackbody Sphere—Moving Sunspots

Sunspots are very well-documented phenomena of the Sun’s photosphere that appear as temporary spots that are darker than the surrounding areas. Sunspots are regions of reduced surface temperature caused by the concentrations of magnetic flux. Sunspots have diameters from 16 km to 160,000 km and rotate on the surface of the Sun. We predict that we should observe on the Blackbody Sphere at the distance $R = 140$ AU moving shadows of these Sunspots with the average angular size $1^\circ–2^\circ$. This Solar signature on the Blackbody Sphere is reversible: when the Sunspot’s shadow moves away,
8. Conclusion

This contribution is based on the classical Newton’s cooling law, the Stefan-Boltzmann law, and the Planck blackbody radiation law. This Newton-Stefan-Boltzmann-Planck Code can newly interpret the microwave background observed in the Solar System as the Solar microwave background (SMB).

1. We propose to measure the temperature of the blackbody surface throughout the Solar System, especially on the Termination shock and the Hydrogen wall.
2. The Newton’s SMB dipole directs to the antipode of the Doppler’s CMB dipole. The magnitudes of velocities of the Milky Way Galaxy were presented.
3. The collision between the Andromeda Galaxy and the Milky Way Galaxy can be avoided in this model.
4. The “Axis of evil” was renamed as the “Solar axis of a good opportunity”: it could distinguish between the CMB and the SMB.
5. The position of the first peak in the power spectrum should depend on the observer’s position in the Solar System.
6. The original Solar signature in the form of moving shadows of the Sunspots on the Blackbody Sphere was predicted.

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Conflict of Interest

Author declare that they do not have any conflict of interest.

References


Bensson U. The history of the cooling law: when search for simplicity can be an obstacle.

Vollmer M. Newton’s law of cooling revisited.

Winterton RHS. Early study of heat transfer: Newton and Fourier.

Ruffner JA. Reinterpretation of the genesis on Newton’s “Law of Cooling”.

Cheng KC, Fujii T. Isaac Newton and heat transfer.

Guillaume CE. La température de l’espace. [The temperature of the space].

Nernst W. Die Strahlungstemperatur des Universums. [The radiation temperature of the Universe].

Barragán D. Entropy production and Newton’s cooling law.


Biot M. Surla loi de Newton relative à la communication de la chaleur [On Newton’s law relating to the communication of heat].


