

# Solar Radiant Heat Reflected on the Termination Shock Might Create Excess Microwave Radiation in the Horn Antenna (Thermal Telescope)

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**Abstract** — In this contribution, we model the Solar radiant heat as waves obeying the Stefan-Boltzmann law. The Solar radiant heat is reflected on the termination shock (TS) back towards the Solar System. The geometry of the TS is known from the recent data of Voyager 1 and Voyager 2. This reflected radiant heat might create the observed excess microwave background (MB) in heated thermal telescopes (e.g., the Holmdel horn antenna). This model can be easily experimentally falsified in the spirit of Karl Popper by measuring the microwave background monopole, the microwave background dipole, and the small heat fluctuations coming from the sound waves in the TS shock and not uniform distribution of particles in the TS. This proposed experiment can be realized by the existing technology in the Solar System between the Sun and the termination shock.

**Keywords** — Solar radiant heat, termination shock, excess microwave background, MB monopole, MB dipole, fluctuations.

## I. INTRODUCTION

The microwave background (MB) observed by Penzias and Wilson using the Holmdel horn antenna in 1965 [1] was interpreted as: “a possible explanation for the observed excess noise temperature is the one given by Dicke, Peebles, Roll, and Wilkinson (1965) in a companion letter in this issue.” Since that time the cosmic microwave background (CMB) introduced by Dicke, Peebles, Roll, and Wilkinson [2] became the leading interpretation of MB in all cosmological models and they concluded: “While all data are not yet in hand, we propose to present here the possible conclusions to be drawn if we tentatively assume that the measurements of Penzias and Wilson (1965) do indicate black-body radiation at 3.5 K.”

Published literature on the microwave background is very extensive and inspirational, e.g. [3]–[10]. There were numerous attempts to find an alternative scenario for the interpretation of the observed MB but without any success, e.g. [11]–[13]. In our model, we try to newly apply the forgotten wave model of the radiant heat obeying the Stefan-Boltzmann law. The Solar radiant heat can be reflected on the termination shock and be returned back to heat thermal telescopes in any place in the Solar System. This model can be easily falsified in the spirit of Karl Popper using the existing technology. Can we find a new road leading to an alternative interpretation of the observed excess of the microwave background?

## II. THE EARLY MEASUREMENTS OF THE EXCESS MICROWAVE BACKGROUND

There is a rich history of the early measurements of the excess microwave background in horn antennas summarized in Table I.

The gist of our model we have discovered in the paper of Tigran Shmaonov [15] where one remark is hidden as an unnoticed comment on the excess microwave background present in his horn antenna:

“Это указывает на наличие собственного излучения в антенной системе, обусловленного поглощением, что подтверждается тем, что абсолютная величина эффективной температуры радиоизлучения, определенная с рупорной антенной, в среднем оказалась равной  $3.7 \pm 3.7$  К (в зените) и  $3.9 \pm 4.2$  К (в полярной области) и не менялась существенно со временем.”

(“This indicates the presence of natural radiation in the antenna system due to absorption, which is confirmed by the fact that the absolute value of the effective radio emission temperature determined with the horn antenna was equal to  $3.7 \pm 3.7$  K (in the zenith) and  $3.9 \pm 4.2$  K (in the polar region) in average and did not change significantly with time.”).

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TABLE I: THE EARLY MEASUREMENTS OF THE EXCESS MICROWAVE BACKGROUND

Year	Name	Excess temperature [K]	Origin	Reference
1955	Le Roux	3±2	Extragalactic microwaves	[14]
1957	Shmaonov	3.7±3.7	Excess microwaves in the horn antenna	[15]
1959	Hogg	3.1±2.0	Excess microwaves	[16]
1961	Ohm	3.3±2.7	Excess microwaves	[17]
1963	Jakes	2.5±1.5	Excess microwaves	[18]
1965	Penzias+Wilson	3.5±1.0	Possible CMB	[1]

### III. THE TERMINATION SHOCK MEASURED BY VOYAGER 1 AND VOYAGER 2

The termination shock is the boundary marking one of the outer limits of the Solar System. In this boundary the solar wind particles slows down so that the wind particles are travelling slower than the speed of sound. Our actual knowledge about the termination shock comes from data made by Voyager 1 and Voyager [19]. The average distance of the termination shock from the Sun can be extracted from those data in Table II.

TABLE II: THE GEOMETRY OF THE TERMINATION SHOCK MEASURED BY VOYAGERS

Spacecraft	Entrance of TS [au]	Exit of TS [au]
Voyager 1	94.0	121.6
Voyager 2	83.7	119
Average distance of the termination shock from the Sun $R = (104.6 \pm 4.0)$ au		

In this first approach, we will assume that the termination shock is a spherical shell with solar wind particles reflecting the Solar radiant heat back inside of the Solar System. The reflected Solar radiant heat obeys the Stefan-Boltzmann law. The average thickness if this shell is about  $(31.4 \pm 4.0)$  au. The characteristic distance for the reflection of the Solar radiant heat  $R = 104.6 \pm 4.0$  au can be compared with the “fitted” reflection distance  $R_{TS} = 102.3$  au.

The termination shock is composed of solar wind particles that locally create structures with various densities and different velocities. This might influence slightly the reflection of the Solar radiant heat and in the thermal telescope, we should observe some characteristic fluctuations in the microwave background, e.g. [20], [21].

On the other side we can observe some anomalies in fluctuations of the microwave background known as the Hawking spots [22]–[24]. The reason for these Hawking points could be interpreted as the passage of some big objects flying inside or outside of the Solar System through the termination shock. The gravitation fields of these big objects might modify the density of the Solar wind particles. The damaged termination shock might change locally the density of solar wind particles and their reflective properties with the Solar radiant heat.

Figure 1 shows schematically the travel of the Solar radiant heat towards the termination shock and the reflection of the Solar radiant heat back into the Solar system.

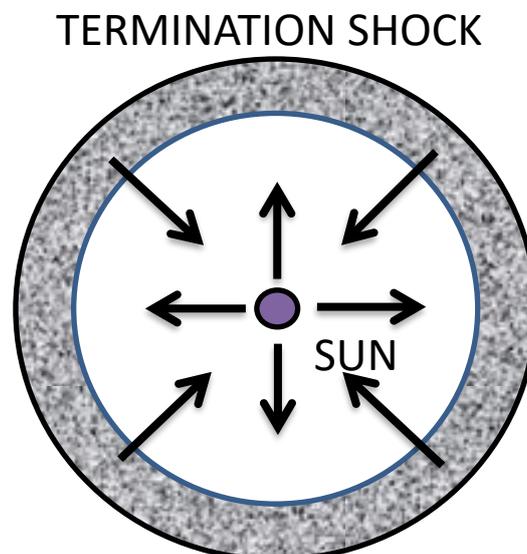


Fig. 1. The Solar radiant heat reflected from the termination shock.

#### IV. THE FORGOTTEN WAVE THEORY OF HEAT (BASED ON STEPHEN G. BRUSH [25])

Stephen G. Brush in his excellent review [25] on the forgotten wave theory of heat collected many important experimental papers published in the period 1830–1850 where the radiant heat shares all qualitative properties of light: reflection, refraction, diffraction, polarization, interference, etc. There was a severe discussion if the radiant heat is identical to the infrared photons. After the year 1850, it was generally accepted that radiant heat is identical to electromagnetic radiation.

However, what if the radiant heat differs in some properties from the electromagnetic radiation? What if the radiant heat is the agent creating the black body radiation of heated bodies:

radiant heat → heated telescope → formation of the black body radiation

We propose one hypothesis that temperature of radiant heat obeys the Stefan-Boltzmann law:

$$\frac{T_2^4}{T_1^4} = \frac{R_1^2}{R_2^2} \Rightarrow T_2 = T_1 \left( \frac{R_1}{R_2} \right)^{0.5} \Rightarrow T_2 = 278.84 \left( \frac{1}{R_2} \right)^{0.5} \quad (1)$$

If we know temperature  $T_1$  at the distance from the Sun at  $R_1 = 1$  au (astronomical unit), then we can easily calculate the temperature  $T_2$  at any distance  $R_2$  toward the termination shock. The effective temperature of the Earth  $T_1 = 278.84$  K can be calculated using the Stefan-Boltzmann law [26].

Fig. 2 shows the decrease of the radiant heat temperature towards the termination shock at the distance  $R_{TS} = 102.3$  au.

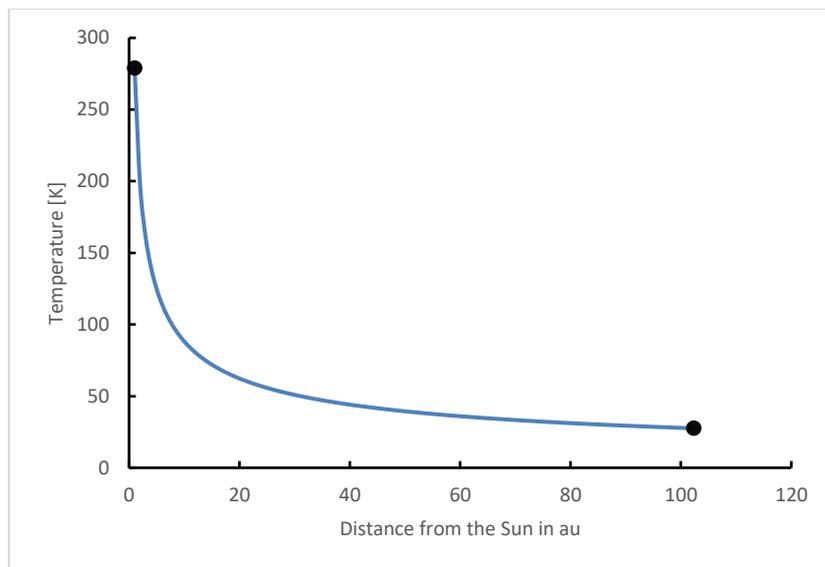


Fig. 2. The decreasing temperature of the Solar radiant heat between the Earth and the termination shock.

The value of temperature of the termination shock at the distance  $R_{TS} = 102.3$  au equals  $T_{TS} = 27.568$  K and was fitted in order to get the microwave background monopole temperature at the distance  $R_1 = 1$  au  $T_{MB} = 2.7255$  K.

The Solar radiant heat reflected on the termination shock with its temperature  $T_3$  might create the observed black body radiation in thermal telescopes with the same temperature  $T_3$ :

$$T_3 = 27.568 \left( \frac{1}{R_3} \right)^{0.5} \quad (2)$$

where  $R_3$  is the distance from the termination shock towards the Earth. This is a new experimental prediction of the microwave background monopole temperature at various distances between the Earth and the termination shock – see Fig. 3. This experiment can easily falsify this proposed model with the existing technology.

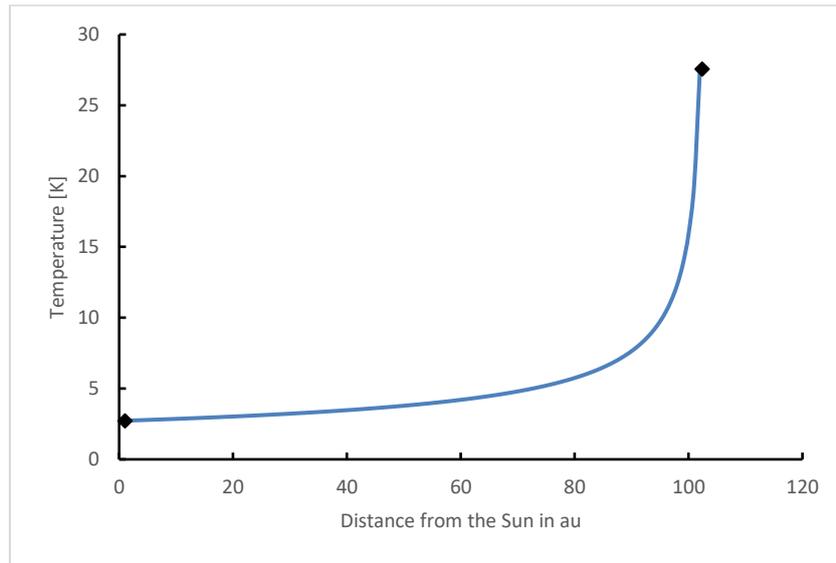


Fig. 3. The predicted temperature of the microwave background monopole between the Earth and the termination shock.

There is one more experiment that might falsify this model: the value of the microwave background dipole should depend on the position of the thermal telescope in the Solar System. We know from the literature, e.g., [3], [27], that the amplitude of the CMB dipole at 1 au is around  $\Delta T = (3.3621 \pm 0.0010)$  mK while the Sun appears to be moving at  $v = (369.82 \pm 0.11)$  km s<sup>-1</sup> in the direction of galactic longitude  $l = 276 \pm 3^\circ$ ,  $b = 30^\circ \pm 3^\circ$ .

For small velocities we can write the formula for the amplitude of MB in the Solar System as:

$$\frac{\Delta T}{T_{MONOPOLE}} \approx \frac{v}{c} \cos \theta \quad (3)$$

where  $c$  is the light speed, and the cosine function determines the direction of the Sun motion. Fig. 4 shows the dependence of the value of the amplitude of the MB dipole on the position of the thermal telescope between the Earth and the termination shock.

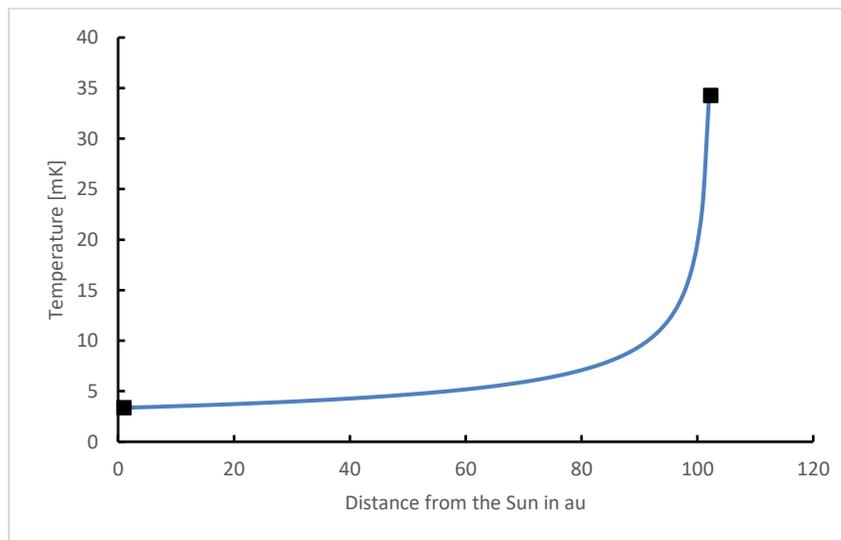


Fig. 4. The predicted amplitude of the microwave background dipole between the Earth and the termination shock.

Therefore, we propose to send several spacecrafts with thermal telescopes towards the termination shock to experimentally verify the values of temperatures of the MB monopole and the MB dipole.

On the other side, we want to re-open discussion on the properties of thermal radiation and our concept of temperature, e.g., [28]–[30].

## V. CONCLUSION

We have presented a new interpretation of the excess microwave background measured by thermal telescopes. This model can be experimentally tested with the well-known thermal telescopes taking data between the Sun and the termination shock.

The poetic conclusion: the Sun god HELIOS might collect these experimental data from gods/goddesses of planets: HERMES, APHRODITE, GAIA, ARES, ZEUS, CRONUS, URANUS, POSEIDON, HADES.

The historical conclusion from Gustav Kirchhoff published in 1860 [31]: “Wenn ein Raum von Körpern gleicher Temperatur umschlossen ist, und durch diese Körper keine Strahlen hindurchdringen können, so ist ein jedes Strahlenbündel im Innern des Raumes seiner Qualität und Intensität nach gerade so beschaffen, als ob es von einem vollkommen schwarzen Körper derselben Temperatur herkäme, ist also unabhängig von der Beschaffenheit und Gestalt der Körper und nur durch die Temperatur bedingt.” (“If a space is enclosed by bodies of the same temperature, and no rays can penetrate through these bodies, then every ray beam inside the space is of the same quality and intensity as if it came from a completely black body of the same temperature, thus it is independent of the nature and shape of the bodies and only conditioned by the temperature”).

## ACKNOWLEDGMENT

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## CONFLICT OF INTEREST

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

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