Ministry of higher education

Scientific Research

Salahaddin University

College of Administration and Economics

Department of General Science

The miracle of relation between spectrum and temperature from the perspective of science and prophetic hadith

ARESEARCH

Submitted to the council of college university of salahaddin _Erbil department of (General science) in partial fulfilment of the requirements for the degree of B.A or BSC. in (physic)

Prepared by

Nawal Taha Hussein

Amina Arif mohammad

Supervisor by

Dr. Abbas Hussein Rostam

2022-2023

أُوقِدَ عَلَى النَّارِ أَلْفَ سَنَةٍ حَتَّى احْمَرَّتْ ثُمَّ أُوقِدَ عَلَيْهَا أَلْفَ سَنَةٍ حَتَّى ابْيَضَّتْ ثُمَّ أُوقِدَ عَلَيْهَا أَلْفَ سَنَةٍ
حَتَّى اسْوَدَّتْ فَهِيَ سَوْدَاءُ مُظْلِمَةٌ)

Chapter one
History of spectrum

Introduction

This research contain of thew three chapters, chapter one is describe the historical of the black body radiation and chapter two consist of the Spectrum and blackbody radiation compare between modern physics and the classical physics and chapter three contain the Secrets of scientific miracles

Historical aspects1-1

Until the middle of the nineteenth century a great volume of diverse experimental data on the radiation of heated bodies was accumulated. The time had come to comprehend the data theoretically. And it was Kirchhoff who took two important steps in this direction. At the first step Kirchhoff, together with Bunsen, established the fact that a quite specific spectrum (the set of wavelengths, or frequencies) of the light emitted and absorbed by a substance corresponds to that particular substance. This discovery served as a basis for the spectral analysis of substances. The second step consisted in finding the conditions, under which the radiation spectrum of heated bodies depends only on their temperature and does not depend on the chemical composition of the emitting substance. Kirchhoff considered theoretically the radiation inside a closed cavity in a rigid body, whose walls possess some particular temperature. In such a cavity the walls emit as much energy as they absorb. It was found that under these conditions the energy distribution in the radiation spectrum does not depend on the material the walls are made of. Such a radiation was called 'absolutely (or ideally) black'. For a long time, however, black-body radiation was, so to speak, a "thing- in-itself". Only 35 years later, in 1895, W. Wien and O. Lumber suggested the development of a test model of an ideal black body to verify Kirchhoff's theory experimentally. This model was the bole diameter being small as a hollow sphere with internal reflecting walls and a narrow hole the compared to the sphere diameter. The authors proposed to investigate the spectrum of radiation issuing through this hole . Any light beam undergoes multiple reflections inside cavity and, actually, cannot exit through the hole. At the same time, if the walls are at a high temperature the hole will brightly shine (if the process occurs in the optical band) owing to the electromagnetic radiation issuing from inside the cavity [2].

It was this particular test model of a black body on which the experimental investigations to verify thermal radiation laws were carried out, and, first of all, the fundamental spectral dependence of black-body radiation on frequency and temperature (the Planck formula) was established quant tentatively. The success of these experimental (and, a little bit later, theoretical) quantum-approach-based investigations was so significant that for a long time, up until now, this famous renctamnle. And, thus, some cavity has been considered lack physics textbooks as a unique black body exclusiveness with respect to natural objects arises. In reality, however (as we well know both from the radio-astronomical and remote sensing data, and from the data of physical (laboratory) experiments), the natural world around us, is virtually saturated with physical objects which are very close to black-body models in their characteristics. First of all, we should mention here the cosmic microwave background (CMB) of the universe the fluctuation electromagnetic radiation that fills the part of the universe known to us. The radiation possesses nearly isotropic spatial-angular field with an intensity that can be characterized by the radio brightness temperature of 2.73 K. The microwave background is, in essence, some kind of 'absolute ether at rest that physicists intensively sought at the beginning of the twentieth century. A small dipole component in the spatial-angular field of the microwave background allowed the researchers to determine, to a surprising accuracy, the direction and velocity of motion of the solar system. The contribution of the microwave back-ground as a re-reflected radiation should certainly be taken into account in performing fine investigations of the emissive characteristics of terrestrial surfaces from spacecraft. The second (but not less important) source of black-body radiation is the star nearest to the Earth the Sun . The direct radar experiments, performed in the 1950s and 1960s, have indicated a complete absence of a radio echo (within the limits of the receiving equipment capability) within the wide wavelength band - in centimetre, millimetre and decimetre ranges. Detailed spectral studies of solar radiation in the optical and IR bands have indicated the presence of thermal black-body radiation with a brightness temperature of 5800K at the Sun. In other bands of the electromagnetic field the situation is essentially more comply catted - along with black-body radiation there exist powerful, non-stationary quasi-noise radiations (flares, storms), which are described, nevertheless, in thermal radiation terms. The third space object is our home planet,- the Earth, which possesses radiation close to black-body radiation with a thermodynamic temperature of 287 K. The basic radiation energy is concentrated in the 8-12 micrometre band, in which almost all terrestrial surfaces possess black-body radiation properties. Just that small portion of radiation energy which falls in the radio-frequency band is of interest for microwave sensing. The detailed characteristics of radiation from terrestrial surfaces in this band have shown serious distinctions of many terrestrial media from the black-body model. In experimental measurements of the radiation properties of real physical bodies it is necessary to have an ideally black surface or a black emitter as a standard. Since ideal black sources do not exist, some special technological approaches are applied to develop a realistic black-body model. So, in optics these models represent hollow metal cylinders having a small oriice and cone at the end, which are immersed in a thermostat with fixed (or reconstructed) temperature (Siegel and Howell, 1972). In the radio-frequency band segments of waveguides or coaxial lines, filled with absorbing substance (such as carbon-containing fillers), are applied. Multilayer absorbing covers, which are widely used in the military-technological area (for instance, Stealth technology), are applied as standard black surfaces in this band. It is clear, that objects covered with such an absorbing coat are strong emitters of the fluctuation electromagnetic field. It is important also to note that in the radio- frequency band a closed space with well-absorbing walls (such as a concrete w ith various fillers) represents a black-body cavity to a good approximation. For these reasons the performance of fine radiothermal investigations in closed rooms (indoors) makes no sense. (Of interest is the fact that it was in a closed laboratory room that in 1888 Hertz managed to measure for the first time the wavelength of electromagnetic radiation [2,3] .

Chapter Two

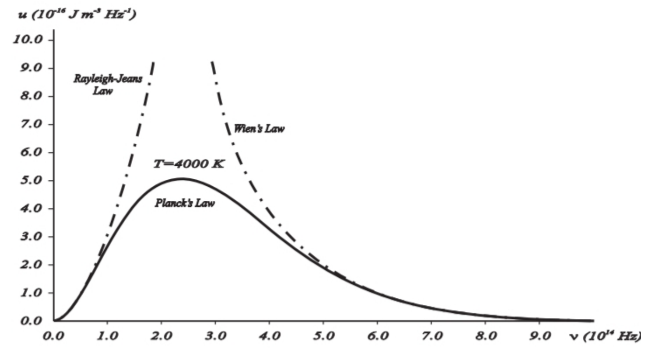
Spectrum and blackbody radiation

2-1: Blackbody Radiation

At issue here is how radiation interacts with matter. When heated, a solid object glows and emits thermal radiation. As the temperature increases, the object becomes red, then yellow, then white. The thermal radiation emitted by glowing solid objects consists of a continuous distribution of frequencies ranging from infrared to ultraviolet. The continuous pattern of the distribution spectrum is in sharp contrast to the radiation emitted by heated gases; the radiation emitted by gases has a discrete distribution spectrum: a few sharp (narrow), coloured lines with no light (i.e., darkness) in between. Understanding the continuous character of the radiation emitted by a glowing solid object constituted one of the major unsolved problems during the second half of the nineteenth century. All attempts to explain this phenomenon by means of the available theories of classical physics (statistical thermodynamics and classical electromagnetic theory) ended up in miserable failure. This problem consisted in essence of specifying the proper theory of thermodynamics that describes how energy gets exchanged between radiation and matter. When radiation falls on an object, some of it might be absorbed and some reflected. An idealized "blackbody" is a material object that absorbs all of the radiation falling on it, and hence appears as black under reflection when illuminated from outside. When an object is heated, it radiates electromagnetic energy as a result of the thermal agitation of the electrons in its surface [4,5].

The intensity of this radiation depends on its frequency and on the temperature: the light it emits ranges over the entire spectrum. An object in thermal equilibrium with its surroundings radiates as much energy as it absorbs. It thus follows that a blackbody is a perfect absorber as well as a perfect emitter of radiation. A practical blackbody can be constructed by taking a hollow cavity whose internal walls perfectly reflect electromagnetic radiation (e.g., metallic walls) and which has a very small hole on its surface. Radiation that enters through the hole will be trapped inside the cavity and gets completely absorbed after successive reflections on the inner surfaces of the cavity. The hole thus absorbs radiation like a black body. On the other hand, when this cavity is heated to a temperature T, the radiation that leaves the hole is blackbody radiation, for the hole behaves as a perfect emitter; as the temperature increases, the hole will eventually begin to glow. To understand the radiation inside the cavity, one needs simply to analyse the spectral distribution of the radiation coming out of the hole. In what follows, the term blackbody radiation will then refer to the radiation leaving the hole of a heated hollow cavity: the radiation emitted by a blackbody when hot is called blackbody radiation. By the mid-1800, a wealth of experimental data about blackbody radiation was obtained for various objects. All these results show that, at equilibrium, the radiation emitted has a well defined, continuous energy distribution: to each frequency there corresponds an energy density which depends neither on the chemical composition of the object nor on its shape, but only on the temperature of the cavity's walls. The energy density shows a pronounced maximum at a given frequency, which increases with temperature; that is, the peak of the radiation spectrum occurs at a frequency that is proportional to the temperature (6) . .

This is the underlying reason behind the change in colour of a heated object as its temperature increases, notably from red to yellow to white. It turned out that the explanation of the blackbody spectrum was not so easy. A number of attempts aimed at explaining the origin of the continuous character of this radiation were carried out. The most serious among such attempts, and which made use of classical physics, were due to Wilhelm Wien in 1889 and Rayleigh in 1900. In 1879 J. Stefan found experimentally that the total intensity (or the total power per unit surface area) radiated by a glowing object of temperature T is given by $P = a\boldsymbol{\sigma}T^4$, (2.1) which is known as the Stefan-Boltzmann law, where is the Stefan-Boltzmann constant, and a is a coefficient which is less than or equal to 1: in the case of a blackbody a = 1. Then in 1884 Boltzmann provided a theoretical derivation for Stefan's experimental law by combining thermodynamics and Maxwell's theory of electromagnetism [7] .



Figure(2-1) Comparison of various spectral densities: while the Planck and experimental distributions match perfectly (solid curve), the Rayleigh-Jeans and the Wien distributions (dotted curves) agree only partially with the experimental distribution.

2-2: Wien's energy density distribution

Using thermodynamic arguments, Wien took the Stefan -Boltzmann law and in 1894 he extended it to obtain the energy density per unit frequency of the emitted blackbody radiation: u(v, T) = Av^3e^-βv/T (2.3)

where A and ß are empirically defined parameters (they can be adjusted to fit the experimental data). Note: u(v, T) has the dimensions of an energy per unit volume per unit frequency; its SI

units are Jm^-3 Hz^-1. Although Wien's formula fits the high-frequency data remarkably well,

it fails badly at low frequencies. [8,9] (2.4)

$$\lambda_{max} = \frac{hc}{4.9663k}\frac{1}{T} = \frac{2898.9 \times 10^{-6}\ \text{m K}}{T}.$$

2-3: Rayleigh's energy density distribution

In his 1900 attempt, Rayleigh focused on understanding the nature of the electromagnetic radiation inside the cavity. He considered the radiation to consist of standing waves having a temperature T with nodes at the metallic surfaces. These standing waves, he argued, are equivalent to harmonic oscillators, for they result from the harmonic oscillations of a large number of electrical charges, electrons, that are present in the walls of the cavity. When the cavity is in thermal equilibrium, the electromagnetic energy density inside the cavity is equal to the energy density of the charged particles in the walls of the cavity: the average total energy of the radiation leaving the cavity can be obtained by multiplying the average energy of the oscillators by the number of modes (standing waves) of the radiation in the frequency interval v to v + dv: $u(\nu, T) = \frac{8\pi\nu^2}{C^3} KT$ (2.3)

where c =3x 10^8 ms^-1 is the speed of light; the quantity $(8\Pi v^2/c^3)dv$ gives the

$$u(\nu, T) = \frac{8\pi\nu^2}{c^3} kT.$$

number of modes of oscillation per unit volume in the frequency range v to v +dv. Rayleigh-Jeans formula: Except for low frequencies, this law is in complete disagreement with experimental data: u(v, T) as given by (2.5) diverges for high values of v, whereas experimentally it must be finite (Figure 2.1). Moreover, if we integrate (2.5) over all frequencies, the integral diverges. This implies that the cavity contains an infinite amount of energy. This result is absurd. Historically, this was called the ultraviolet catastrophe, for (2.5) diverges for high frequencies (i.e., in the ultraviolet range)a real catastrophically failure of classical physics indeed! The origin of this failure can be traced to the derivation of the average energy . It was founded on an erroneous premise: the energy exchange between radiation and matter is continuous; any amount of energy can be exchanged.[4]

2-4: Planck 's energy density distribution

By devising an ingenious scheme interpolation between Wien's rule and the Rayleigh-Jeans rule Planck succeeded in 1900 in avoiding the ultraviolet catastrophe and proposed an accurate description of blackbody radiation. In sharp contrast to Rayleigh's assumption that a standing wave can exchange any amount (continuum) of energy with matter, Planck considered that the energy exchange between radiation and matter must be discrete. He then postulated that the energy of the radiation (of frequency v) emitted by the oscillating charges (from the walls of the cavity) must come only in integer multiples of hv:

$$E=nh\nu \qquad n=0,1,2,3,....., \qquad (2.6)$$

where h is a universal constant and hv is the energy of a "quantum" of radiation (v represents the frequency of the oscillating charge in the cavity's walls as well as the frequency of the radiation emitted from the walls, because the frequency of the radiation emitted by an oscil-lating charged particle is equal to the frequency of oscillation of the particle itself). That is, the energy of an oscillator of natural frequency v (which corresponds to the energy of a charge oscillating with a frequency v) must be an integral multiple of hv; note that hv is not the same for all oscillators, because it depends on the frequency of each oscillator. Classical mechanics, however, puts no restrictions whatsoever on the frequency, and hence on the energy, an oscillator can have. The energy of oscillators, such as pendulums, mass-spring systems.

$$\langle E\rangle = \frac{\sum_{n=0}^{\infty} nh\nu e^{-nh\nu/kT}}{\sum_{n=0}^{\infty} e^{-nh\nu/kT}} = \frac{h\nu}{e^{h\nu/kT}-1},$$

and hence, the energy density per unit frequency of the radiation emitted from the hole of a cavity is given

This is known as Planck's distribution. It gives an exact fit to the various experimental radiation distributions, as displayed in Figure (2.1). The numerical

$$u(\nu, T) = \frac{8\pi \nu^2}{c^3} \frac{h\nu}{e^{h\nu/kT} - 1}.$$

value of h obtained by fitting (2.8) with

$$\tilde{u}(\lambda, T) = \frac{8\pi hc}{\lambda^5} \frac{1}{e^{hc/\lambda kT} - 1}.$$

2-5:Classical theory of thermal radiation

Before discussing the quantum theory of thermal radiation, let's see what the classical theories of electromagnetism and thermodynamics can tell us about the dependence of I on λ. The complete derivation is not given here, only a brief outline of the theory." The derivation involves first computing the amount of radiation (number of waves) at each wavelength and then finding the contribution of each wave to the total energy in the box

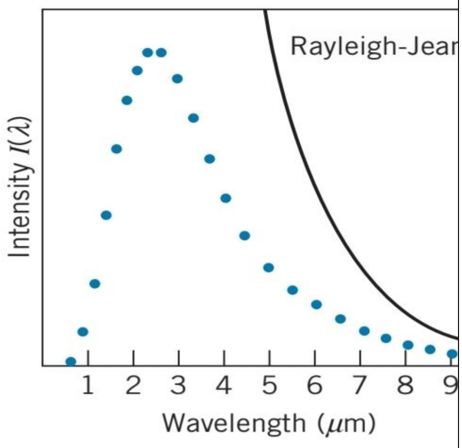
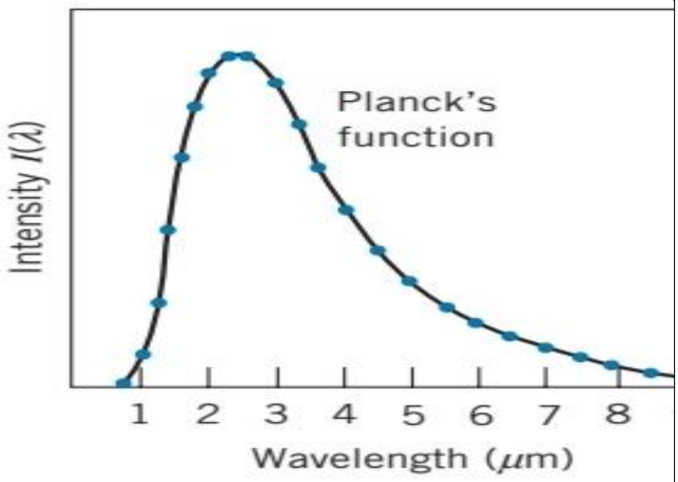
	

Figure (2-2) intensity versus wavelength clssically	Figure (-23) intensity versus wavelength modern

Figure(2.4)Planck's function fits the observed data perfectly .

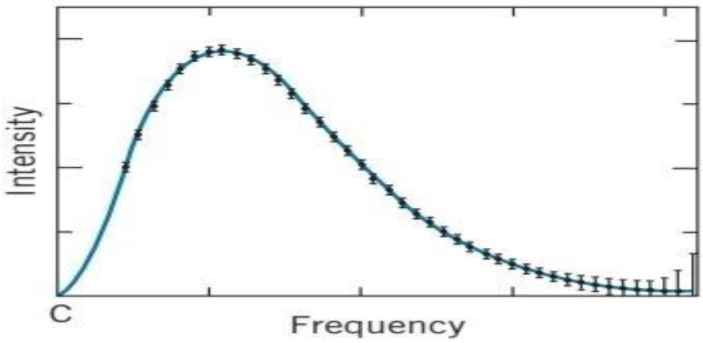


FIGURE (2-4.)Data from the COBE satellite, launched in 1989 to determine the temperature of the cosmic microwave background radiation from the early universe. The data points exactly fit the Planck function corresponding to a temperature of 2.725 K. To appreciate the remarkable precision of this experiment, note that the sizes of the error bars have been increased by a factor of 400 to make them visible! (Source: NASA Office of Space Science[5]

Chapter three

Secrets of scientific miracles

3-1:Colours of Fire: An Amazing Prophetic Miracle

The miracles of this noble Prophet, peace and blessings be upon him, do not studied.... end, and in this article we address a scientific fact that we have long The miracles of this noble Prophet, peace and blessings be upon him, do not end, and in this article we deal with a scientific fact that we have long studied in various references, which is related to black body radiation related to the gradient of temperatures, that is, the relationship of the colour of fire or radiation to temperature. We will see that the Prophet (peace and blessings of Allah be upon him) spoke with astonishing accuracy about this scientific fact (9,10),

which the West considers itself to be the first to speak about! Man has always been afraid of fire, until legends have been woven around it for thousands of years. Some peoples in the past even worshipped the fear of fire, and some of them prostrated themselves to the sun as a symbol of fire and heat. In the story of our master Solomon, peace be upon him, we find a mention of these infidels on the tongue of the hoopoe, who told Solomon that he saw people prostrating to the sun without God, and that the devil is the one who decorated them with these deeds, the Almighty says on the tongue of the hoopoe: (1 found a woman who owns them and I came from everything and she has a great throne I found her and her people bowing down to the sun without God and the devil decorated them with their deeds and repelled them from the way, they are not guided Do not worship God who He will come out hidden in the heavens and the earth and will know what you hide and what you declare * Allah there is no god but He is the Lord of the Great Throne) [An-Naml: 23-26]. Oh my goodness! If this simple bird has denied prostration to anyone other than Allah, and he knows that there is no god but Allah, how can he make Allah a son and a partner? How can one deny the existence of God Almighty? Isn't this person more misguided than the beasts? Beasts even understand more than him! In this research, we deal with a scientific fact that we have long studied in various references, which is related to the radiation of the "black body" in other words, related to the gradient of temperatures, that is, the relationship of the colour of fire or radiation to temperature. We will see that the Prophet (peace and blessings of Allah be upon him) spoke with astonishing accuracy about this scientific fact, which the West considers itself to be the first to speak about! We will first bring the scientific facts discovered by the scientists of the twentieth century, and then consider the words of the illiterate Prophet, peace and blessings be upon him, fourteen centuries ago, how he dealt with this fact and how he talked about it to discover the correspondence and compatibility between science and the words of the Master of the Messengers, and this proves that the Holy Prophet does not speak of passion, but every word he came with is the truth! Black body radiation Scientists confirm that the colour of the light radiated by a burning or burning object is related to the temperature of this object, and this is a fact that was not known in the past, but there are recent measurements that proved the existence of this relationship. Scientists even assert that the only factor that influences the colour of light from a heated object is temperature. Scientists therefore call this relationship

"colour temperature'

As the temperature increases, the colours move from the larger wavelength towards the shorter wavelength, i.e. from red to yellow, blue, violet, ultraviolet, and finally black. When you start heating an object, its colour starts to change from red, and then when the temperature increases, the colour becomes whiter and approaches yellow. If we know that white is a combination of the seven colours of the light spectrum, the colour that dominates during this heating is white, a combination of the seven colours of the rainbow. Finally, when the temperature rises significantly, the colours become dark or dark until they end in black, a colour that has not yet been obtained in practice, but Scientists confirm that black is the end or the thermal light spectrum (11) .

Figure (3-1): Heating any object will give light its colour red at first, and as the body temperature rises, the colour gradients towards light colours until it reaches white, and then as the temperature rises, the colour gradients towards dark colours towards dark blue.[6]

3-2:Confirmed scientific facts

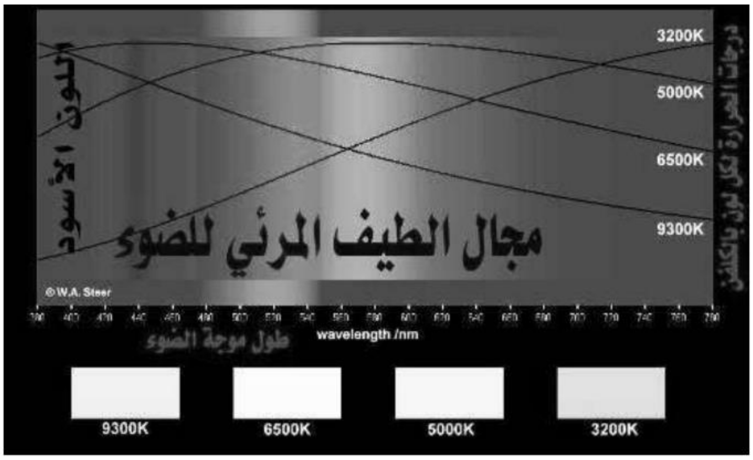
After many years of studies, scientists have developed important physical laws, the most important of which is the radiation law of the black body, and this law stipulates that the density of light energy is proportional to the wavelength of light and body temperature, that is, we can determine the colour of the light spectrum that the hot object emits only depending on its temperature. That is, there is a direct relationship between temperature and the colour of light. We find in the statements of scholars today confirmation of these facts, so that they study them in universities today, and say [3]:

As you can see, if you heat a blackbody to 1900K, it glows orange. As the temperature increases, the colour of the radiated light moves to yellow, then white, and finally to blue (11,12) .

That is, "you can see if you heat a black object to 1900 degrees Kelvin that the object glows orange, and when the heat increases, the colour produced by radiation moves towards yellow, then white, and finally blue. This speech determines the visible spectrum of light, but the very high temperatures all scientists confirm that we do not see them, because they are dark[7]

3-3:Scientists theoretically

believe that if we heat the object to infinite temperature, the wavelength of the light produced will be zero!! That is, there is no light, in other words, there is



black radiation and the fire from the combustion of this infinite- temperature object becomes dark black. This is, of course, theoretical talk, that is, it cannot be applied in practice, because we cannot raise the temperature of the body to infinity, there are limits to heat because high heat cannot be tolerated by any body

Figure (2) Wo see from the colours emitted by fire only a emitted field, the visible spectrum of light, but then, when the temperature rises too much, the visible colours disappear and we enter the dark black range, that is, the invisible field

3-4:Numbers & Colours

The wavelength of red is 700 nm, while violet has a wavelength of 400 nm.

-A star with a temperature of about 4000 K appears red.

Stars with temperatures up to 10,<> degrees Kelvin appear white.

- Stars with a temperature greater than 10,4 K appear dark blue (o], So we are facing gradation: red -white - blue, but what comes after blue?

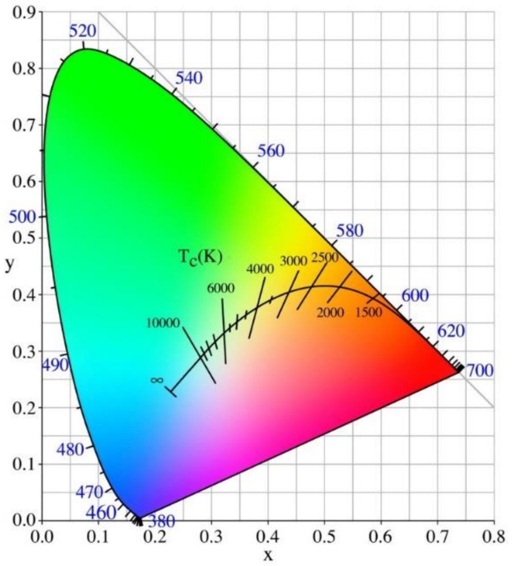


Figure (3) From this graph we can determine the temperature of any colour, as red is a colour that has a large wavelength, and therefore it is considered a cold colour! As for the dark blue colour, it has a short wavelength and therefore it is one of the hot colours, and so we can conclude that the hottest colour is black!! (13) .

3-5:Red is the first colour to appear

When we heat anything and raise its temperature, the first colour that appears as a result of the combustion of this body is red, so scientists consider that red is the coldest colour!! Contrary to what we feel.[9]

3-6:White is the central colour

Today, scientists measure colours by the temperature they express, the temperature of the red colour is about 1800 degrees Kelvin, while the yellowish white colour, which is the colour of the middle of the day when the sun is shining, this colour has a temperature of 6000 Kelvin, and finally the blue colour has a temperature of 10000 Kelvin, and from here we conclude that the red colour is colder than the blue colour!! This is a scientific fact, which scientists have only recently been able to reach with numbers and measurements [5]. Even those who deal with colours make white a central colour and coincide with a term called "white balance" [9]

3-7:Black is the last colour to appear

An object with a temperature so high and unimaginable. A black hole represents the final stage of the stars' lifespan and represents the final stage of the stars' heat, and therefore the final stage of the stars' colours. Thus, it can be said that black is the last thermal colour, so scientists called the imaginary body on which they rely in the results of their experiments the black body', and they have not yet reached this body except theoretically (12,13) .

So we're faced with three main colours: red, white, and finally black, which is invisible. Of course, between these three colours there are multiple stages, that is, the colours of the light spectrum resulting from high temperature range from red to orange and yellow, then become white, then slope towards blue and violet, then go beyond the visible colours to the dark side, that is, the invisible spectrum, and end with black.

Now we come to the words of our beloved Muhammad (peace and blessings of Allah be upon him) and see how he spoke about fire. Having seen human science and its certain facts, we come to the first teacher: is there a prophetic miracle in this area? Did he define colours for us as scientists saw them in the modern era .

3-8:The miraculous hadith of the Prophet

The Holy Prophet came at a time when the polytheists revered and worshiped fire, as it was the prevailing belief among them that fire is a god to be worshiped! How did the Holy Prophet deal with this issue, how did he talk about it, and did he correct the prevailing beliefs at the time, or did he leave people in ignorance? The Holy Prophet addressed the hadith about the colours of fire by warning him of the punishment of Allah Almighty. He used a scientific miracle to assure everyone who doubted that this fire is inevitably coming, and that telling the Holy Prophet (peace and blessings of Allah be upon him) within the framework of a scientific miracle is a confirmation of the truth of his words. The Holy Prophet (peace and blessings of Allah be upon him) said: "Kindle a thousand years on fire until it is reddened, then kindle a thousand years on it until it becomes white, then kindle a thousand years on it until it blackens, for it is dark black' [Narrated by al-Tirmidhij.

Here, the colour according to this hadith ranges from red to white to black!! And this fully corresponds to modern science. Here, the hadith confirms that the final stage is darkness, which we do not see in the world, but scientists have told us about it through their study of the black hole. The Almighty says: (Did the hadith of Al-Ghaghara come to you the faces of the day are humbled an erector worker praying a fierce fire) [AI-Ghaghara: 1-4].

The word (protector) indicates the intensity of heat, that is, it indicates a high temperature, and we find in it a reference to warm-up processes of fire, that is, continuous heating, and therefore a change in colours. This confirms the authenticity of the hadith, which some scholars considered weak [7].

We would like to point out that there are no weak or strong words of the Messenger of Allah (peace and blessings of Allah be upon him), because his words are all true and all are true, but what is meant by a weak hadith is that one of those who transmitted this hadith to us is questionable in his truthfulness, memory or behaviour.[11]

Reference

1-Thomas S. Kuhn(Historical aspects. 1894-1912 THE UNIVERSITY OF CHICAGO PRESS

2- R.B. Singh (black body radiation. Head of the Physics Department U.N. P.G. College, Padrauna

3- G. ARULDHAS(wines energy density distribution.University of Kerala 2009.

4-Junior Physics(Rayleigh's energy density distribution 2-3)

Physics DepartmentJune 4, 2001

5- J Kiefer 2006(colours of fire :an amazing prophetic miracle 3-1)

6- by Paul A. Tippler and Ralph A. Llewellyn(confirmed scientific facts 3-2)

in the United States of America. 2008

7- Arthur Beiser (scientists theoretically and number &colours3-4) Sixth Edition

8- Boston Burr Ridge, IL Dubuque, IA Madison, WI New York San Francisco (2003)

9- Nouredine Zettili; Quantum Mechanics Concepts and Applications: Second Edition, Jacksonville State University, Jacksonville, USA,2009.

10- RAYMOND A. SERWAY; Modern Physics, Third Edition: *University of North Carolina-Wilmington,2005*

11- 1Jacksonville State University, Jacksonville, USA, (2009)john