

New Thermodynamics: Inelastic Collisions and Cosmology

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ABSTRACT

The sciences have evolved around elastic collisions although most collisions are inelastic. Elastic collisions allow for simpler mathematical modelling, that may not be particularly suitable for cosmology.

Inelastic collisions create photons. This has led to consideration of an ensemble of inelastic collisions producing CMB. This will further lead to brief discussions concerning the nature of dark matter, and dark energy. This will then be followed by a simpler analogy concerning the creation of Hawking's radiation.

A consequence of collisions being inelastic is that as a mathematical contrivance, entropy may only be an approximation when applied to the real world. And this fits well with this author's "New Thermodynamics".

Keywords: Cosmic Microwave Background Radiation, Cosmology, Dark Matter, Inelastic Collisions.

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I. INTRODUCTION

An example of an elastic collision is Newton's cradle, in which a series of balls hanging by equal lengths of string collide with one another through their centers of mass. In Newton's cradle each ball and string act as an independent pendulum, which when lifted passes all of both its momentum and kinetic energy onto the ball with which it collides.

Collisions in the cosmos are often treated as elastic, although the majority of collisions are clearly inelastic. Based upon Newton's cradle, the criteria of an elastic collision seems to be solid spheres of equal mass colliding through the centers of their masses. Herein, energy is only lost when the ball in motion experiences drag (friction) with the surrounding atmosphere. Is the drag a result of elastic, or inelastic collisions between the moving ball and surrounding atmospheric molecules? No matter how one chooses to view such drag, the inherent result is that it results in an infinitesimal heating of our atmosphere.

It becomes troublesome that cosmic collisions are so often treated as being elastic, although the vast majority of collisions are clearly inelastic [1]. This author's improved kinetic theory challenges the notion of elastic collisions at the molecular scale [2]-[4].

The illusion of elastic collisions occurs often in experimental apparatus/system, wherein relatively massive walls impose their kinematics onto an ensemble of enclosed gas molecules. And the fact is that these very walls adsorb and then radiate back into the system any thermal energy generated by inelastic collisions, thus completing the illusion

[1], [4], [5]. It can equally occur in experimental systems connected to a heat bath (or heat sink), which imposes the isothermal condition. Note that our atmosphere can act as such a heat bath/sink [4].

The above illusion has incorrectly enshrined the application of entropy to many realms of the sciences, including cosmology [6]-[8]. And this has extended to the application of Shannon's information theory [9]. As Ben-Naim [10] has pointed out Shannon was perplexed as to what to call his function, with the thought of "information" being the correct term. However, Shannon ended adhering to von Neumann's advice of calling it "entropy" for two reasons; "In the first place your uncertainty function has been used in statistical mechanics under that name, so it already has a name. In the second place, and more important, nobody knows what entropy really is, so in a debate you will always have the advantage." [10], [11]

As a mathematical contrivance entropy's exact relevance [4], [12]-[18] remains questionable. Accepting this then challenges our comprehension of the second law [4], [15]-[20] but not the second laws origins as described in Lord Kelvin's statement: "It is impossible to transform an amount of heat completely into work in a cyclic process in the absence of other effects" [4], [21].

In order to comprehend this author has stated that as expressed by changes to the mechanical parameters (P, V), the work done by expanding systems ($W=PdV$) is actually irreversible work done onto the surrounding atmosphere [$W=(PdV)_{atm}$] [4], [13]-[16], [19]. And as irreversible work this explains Lord Kelvin's comprehension of the second law

without entering the generally accepted dogmatic entropy-based arguments.

If the majority of collisions are inelastic, then one must question the relevance of any statistical thermodynamics-based theory whose fundamental conscript is enshrined in ensembles of elastic collisions. Understandably, the conceptualization of an ensemble of molecules undergoing elastic collisions simplifies one's mathematical analysis. Rendering one's analysis to the molecule's kinematics, hence ignores all those photons produced during inelastic collisions [1], [4], [16], [22]. Seemingly, to many this not only simplifies the math, it simplifies the theory.

However, the above also limits one's conceptualization of temperature (T) to the kinematic motions of molecules, when clearly temperature is more than that. If thermal photons (i.e. infrared photons) are adsorbed by condensed matter and/or polyatomic gases, they become incorporated into their vibrational modes/energies. Then those photons are also part of a system's thermal energy as defined by its relationship to temperature [4].

The traditional notion of a vacuum is that it has no temperature, all because there are no molecules in incessant motion within that vacuum. And yet if a thermometer is placed into a vacuum containing thermal radiation, the thermometer obtains a temperature reading. Often a reading is solely due to the exchange of thermal energy with that very thermal radiation. Specifically, the molecules within the thermometer eventually attain thermal equilibrium with the surrounding thermal radiation, although no molecular kinetic energy resided within the vacuum until the thermometer was placed inside.

Traditionalists argue that by putting a thermometer into the vacuum, there is now a temperature associated with the thermometer but not with the surrounding vacuum. Is the thermometer not actually measuring the vacuum's temperature? For example, consider that a thermometer is put into an immense vacuum that is full of thermal radiation. Although the energy associated with thermal radiation is often minute when compared to the energy of molecular kinematics, the fact that the vacuum's volume is immense means that the eventual thermometer's temperature reading will be that of the vacuum. Furthermore, because the speed of light is vast, a significant quantity of heat can be exchanged within a vacuum even when the thermal radiation density in that vacuum remains diminutive in comparison to thermal energy contained within most condensed matter [4].

Is the above simply a metaphysical argument that should be ignored or is it one with applicable relevance, i.e., to outer space? Certainly, we talk about the dark side of the moon being cold and the bright side of the moon rendering warmth. Accepting that the warmth is due to our Sun's blackbody radiation, it becomes paramount that one accepts that part of our Sun's radiation constitutes thermal energy that can be associated with temperature, as the following Stefan-Boltzmann law seemingly states:

$$Power = A\varepsilon\sigma T^4 \quad (1)$$

where ε =emissivity. Note that: $\varepsilon=1$ for blackbody, while $\varepsilon < 1$ for graybody.

$$\sigma = 2\pi^5 k^4 / 15h^3 c^2 = 5.67 \times 10^{-8} \text{ W/m}^2\text{K}^4 \text{ (J/sm}^2\text{K}^4\text{)}.$$

A = surface area. [4], [23].

The peak frequency of a blackbody spectrum as given by the Stefan-Boltzmann law, is determined by Wein's law [$\lambda_{max}\alpha(\frac{1}{T})$], which in terms of constant b can be written:

$$\lambda_{max} = \left(\frac{b}{T}\right) \quad (2)$$

where $b=2.898 \times 10^{-3} \text{ m}\cdot\text{K}$.

This author has discussed the likelihood that blackbody radiation as defined by eq 1 may simply be a radiation resulting from an ensemble of inelastic molecular (inter and/or intra) collisions, i.e. blackbody radiation from our Sun [1], [4], [22].

Maintaining the simplicity of thought, this author will not enter the quagmires associated with entropy, statistical mechanics, and/or quantum mechanics, whose exact applicability to cosmology is now open to question [1], [4]. A humbler route will be discussed, one that contemplates what CMB and dark matter may actually be in simpler terms than has been accepted.

II. TRADITIONAL BLACKBODY RADIATION

As has been discussed by this author [1], the traditional conclusions concerning blackbody radiation, as described by eq 1, has been a radiation residing within a cavity surrounded by condensed crystalline matter.

Our Sun's radiation was accepted as being blackbody with the notion that it takes a prolonged time for newly created energy to migrate from our Sun's core to its outer atmosphere. And this prolonged time acts as if the generated radiation is encapsulated in some cavity. This argument remains weak and it does not explain how a gaseous star can be associated with the crystalline requirement.

Accepting that blackbody radiation is a result of inelastic molecular collisions, removes the need for a cavity with the encapsulating matter being crystalline [1]. The realization that molecular (inter and intra) collisions are inelastic, and blackbody radiation being a result of such collisions, should change how one views cosmology. This includes CMB, dark matter and even Hawking's radiation.

III. COSMIC MICROWAVE BACKGROUND RADIATION (CMB)

In 1964, American astronomers Robert Wilson and Arno Penzias [24] discovered (arguably by accident) blackbody radiation whose peak was centered in the microwave part of the spectrum. Not only did this fundamentally isotropic radiation permeate throughout our horizons, it also fit with the application of entropy-based concepts to the cosmology. Note: CMB's existence was predicted in 1948 by Ralph Alpherin [25].

The big bang is based upon the theory that our young universe was a very dense uniformly glowing hydrogen plasma, which over the last 13.7 billion years has expanded into the cosmos that we currently witness [25]. Soon after its discovery, this cosmic microwave background radiation (CMB, a.k.a. CMBR) became known as the remnant relic of

the big bang, with a current associated temperature of near 2.7 K.

The current cosmological model predicts that the radiation from the early primordial universe would have redshifted into the CMB that is witnessed today. Polarization of CMB is accepted as an imprint of the separation of radiation and matter, hence telling us the nature of our early universe [25], [26]. CMB is believed to provide a view of our universe 380,000 years after the big bang [27].

Interestingly, the Planck Collaboration has recently measured CMBR with precision that the COBE (early 1990's) and WMAP (early 21st century) could not achieve. Note that the numerous Planck Collaboration papers can be found on the internet [28], [29].

The inference being that CMB has survived without any of it interacting with any matter over its 13.7 billion year lifetime. This seems astonishing, verging upon unrealistic. Even if one thinks that these photons associated with CMB travelled as the fabric of space time expands, it remains troublesome to claim no interaction with matter over such an enormous period of time.

Interestingly, the age of the universe is based upon the measured observation of the distant infant state of our universe. Seemingly, CMB confirms this. However, this author cannot help but feel that there may be a circular argument if one derives the age of the universe from CMB and then states that CMB confirms the age of the universe. Or if one ascertains the temperature of the young universe based upon the current CMB and then uses 13.7 billion years of redshift to prove the point.

Beyond the possibility of a circular argument there remains a plausible simpler answer that this author shall now explore.

IV. THERMAL EQUILIBRIUM

Thermal equilibrium does not mean that matter radiates all the energy at all the exact frequencies that it has adsorbed [1]. The notion that it does may incorrectly be inferred from our 19th, 20th and beginning of the 21st century notions concerning blackbody radiation and that a perfect adsorber also being a perfect emitter. Perhaps the term "perfect" has been misleading, as thermal equilibrium simply means that it radiates the same total amount of energy, as it adsorbs [1], [4], [22]. In other words, nothing is perfect, if perfect means that all of the identical frequencies, as well as the power at those frequencies, are emitted as are adsorbed.

In order to better understand, think of a piece of carbon black basking in the sunlight. When in thermal equilibrium it radiates the same total amount of energy as it adsorbs, but not necessarily at all the identical frequencies, e.g., it adsorbs visible light but does not radiate visible light, i.e., when at $T=300$ K carbon black emits a blackbody spectrum whose peak is centered in the infrared.

Unlike carbon black our moon is not a perfect blackbody. Its bright side adsorbs our Sun's rays and then radiates its thermal energy as a blackbody spectrum centered at a peak frequency (in the near infrared range as defined by eq 2 for $T=400$ K), that is significantly lower than the peak frequency (in the visible range as defined by eq 2 for $T=5,800$ K) that our Sun emits. The dark side of the moon being much colder

must emit a blackbody spectrum centered around an even lower peak frequency, e.g., in the far infrared range as defined by eq 2 for $T=140$ K.

V. BLACKBODY AND DARK MATTER

Dark matter is argued to make up as much as 80% of the universe's mass. Furthermore, the claim is often made that dark matter does not interact with light, rendering many to assert that it is not made of baryonic matter.

Applying our understanding of thermal equilibrium, it becomes preposterous to claim that cold dark matter does not interact with EM waves, simply based upon the fact that we cannot see it. If dark matter reflects an indiscernible amount of incident light then it would not be readily witnessed. Examples of such dark matter may even include matter residing in our solar system's outer reaches, e.g., Kuiper belt and/or Oort cloud.

Interestingly, the temperatures associated with our Kuiper belt is around 50 K, while the more distant Oort cloud's temperature is thought to be between absolute zero and 4 K, putting it in the realm of temperatures associated with CBM ($T=2.7$ K). We know very little about either the Kuiper belt or the Oort cloud, all because of their low temperatures, which is simply a result of their existence being so remote from our Sun.

Perhaps dark matter acts as a perfect adsorber, adsorbing all of the incident light, in which case such matter would truly be dark. Being in thermal equilibrium it must emit a blackbody radiation spectrum that is indicative of its actual temperature (or, if one prefers the energetics of its molecular inelastic collisions).

Whether such dark matter is or is not a perfect adsorber of visible light remains secondary to the fact that it is located so far from its nearest star. Therefore, it receives very little thermal energy. As such it must radiate a blackbody spectrum whose peak frequency is significantly lower, with the total emitted spectrum's energy being insignificant when compared to what one considers as matter at everyday temperatures, i.e., $T=300$ K.

Accepting that CBM permeates the whole universe, then one may contemplate that any perfect adsorber must first absorb and then subsequently emit this radiation. This assumes that dark matter is baryonic in nature. In which case, dark matter could not actually attain a temperature of absolute zero, i.e., its lowest plausible temperature may be 2.7 K. Renaming such baryonic matter "cold-dark matter" could add clarity by distinguishing it from theoretical non-baryonic dark matter.

Does all baryonic matter with vibrational modes (condensed matter and/or polyatomic gases) adsorb and then radiate blackbody radiation whose peak is centered in the microwave, e.g. associated with $T=2.7$ K?

To what extent dark matter interacts with visible light is not known. If the cold-dark matter's temperature is above absolute zero, e.g., $T=2.7$ K, and if it is baryonic, then its molecules are vibrating and their molecular inelastic collisions must result in the emission of energy, e.g., blackbody radiation. And if this emitted radiation is neither part of, nor representative for all of the measured CMB, one

must then become concerned of the whereabouts of the cold-dark matter's blackbody radiation. Of course, all this is avoided by the traditional assertion that dark matter is not baryonic matter.

No matter one's conclusion, the Oort cloud (and even the Kuiper belt) remains a great analogy for cold-dark matter. Cosmologically speaking they reside in our backyard but in the grand scheme of things, we know less about them than many aspects of hotter locals in our universe located thousands of light years away, with the primary reason being that its temperature approaches absolute zero.

Why can there not be other large quantities of cold-dark matter in regions of space located far from their nearest stars. Or not too far from a burnt-out star?

Does CMB mean that the temperature of the far reaches of outer space is 2.7 K? Does this apply to any locale where neither a star's rays nor gravitational induced heating (P - T relationships) influences the location's temperature?

The above remain fundamental unanswered questions. Consider that some or even all of the CMB radiation spectrum is locally produced, e.g., from the outer reaches of our solar system, and/or galaxy. Further questions arise, such as: Does this help explain the "axis of evil"? That being an anomaly in the measured CMB that provides both the plane of the solar system and Earth with a greater significance than would be expected (as described by WMAP [30]-[32]).

Based upon CMB anomalies, Lior Shamir [33] believes that the asymmetry in an isotropic universe shows that our universe did not expand as Edwin Hubble had predicted, i.e., Hubble expansion predicts no preferred sense of direction. The prospect that a new understanding of CMB may explain such anomalies becomes an interesting narrative that may remove the prospect of an expanding universe possessing a preferred sense of direction.

It must be stated that questioning CMB's relevance as the definitive primordial universe's relic does not dismiss nor support any vision of an expanding universe. Furthermore, there are still inherent issues with Hubble's vision [34], as well as disagreements concerning the actual speed of our universe's expansion [35].

If dark matter is simply cold-dark matter located in places distant from their nearest star's influence, then what does this mean for dark energy?

VI. DARK ENERGY

While observing distant supernova in 1998, Michael Turner [36] led a group of astronomers who determined that the light emitted by the supernova travelled a greater distance than theory predicted. This and other such discoveries led to the conclusion that our universe's expansion is accelerating. There must be a simpler explanation for the apparent acceleration of our universe's expansion than that most mysterious, yet accepted exotic notion of dark energy.

Assuming that the acceleration of expansion is correct, this author cannot help but ponder the existence of significant masses of cold-dark matter located in the far reaches of our universe. If located far from what we can possibly witness, their gravitational forces could pull us along at an accelerating rate. This may require a rethink of how we

envison Hubble's expansion and/or our universe, but it does alleviate the necessity of exotic dark energy.

If the cold-dark matter is above absolute zero, then it must emit blackbody radiation. If it emits blackbody radiation whose peak is centered in the microwave part of the spectrum, then it too may comprise at the very least part of the witnessed CMB.

Again, nothing has been proven, however a plausible simpler narrative is provided here.

VII. INELASTIC COLLISIONS AND COSMOLOGY

Apparently the gross oversight concerning inelastic collisions has led to overcomplications in cosmology. It may even provide an alternative narrative to the more complicated quantum effects explanations, e.g., Hawking's radiation.

Hawking's radiation is based upon virtual particles and antiparticles within the vacuum of space forming photons pairs near the black hole's event horizon, with one photon being pulled into the black hole, while the other photon escapes into the cosmos' vastness [37].

Other views exist. Some ponder that vacuum fluctuations cause a particle and antiparticle to form. The antiparticle (signifying a negative energy) is then dragged into the blackhole while the particle escapes and is seen as blackbody radiation emanating from the black hole [37].

Applying inelastic collisions to black holes provides the following less exotic plausible explanation. Contemplating that crushing inelastic collisions of matter occur on this side of the event horizon, lends itself to the creation of the blackbody radiation emanating from the black holes. The fact that parts of this radiation are X-ray bursts would indicate temperatures that are hotter than those associated with stars. This would be based upon Stefan-Boltzmann's law.

X-ray bursts from blackholes indicate that the production of radiation is not a continuous process. This fits well with the notion of it being from the crushing effects of matter. Specifically, the net flow of matter into a black hole would be a sporadic, rather than some continuous process.

Furthermore, does what we witness here on Earth even apply to locations experiencing extreme pressures and temperatures, e.g., black holes? At pressures and temperatures felt here on Earth, only relatively dense matter, e.g., lead, of sufficient thickness, will stop an X-ray. Hence, associating X-rays with thermal energy may feel troublesome, at least from our Earthly perspective.

Consider high energy electrons impacting an anode inside of an X-ray tube, with a by-product being the creation of X-rays. The accepted analysis is that the spectrum is Bremsstrahlung radiation due to the electron slowing down in the anode's internal EM field, i.e., a braking radiation rather than collisional spectrum.

It remains conceivable that part of the Bremsstrahlung spectrum is a product of inelastic collisions between the high energy electrons and the X-ray tube's anode (generally tungsten). Thinking in terms of inelastic collisions causing the spectrum (whole, or in part) may warrant future comparisons with blackbody radiation.

Whether one chooses to think in terms of Bremsstrahlung or blackbody radiation, the inefficiencies of X-ray production

in X-ray tubes is due to the array of frequencies being produced, with X-rays only being a small component of the spectrum, e.g., X-ray frequency ranging from 3×10^{16} to 3×10^{19} Hz.

Considering a blackhole as an isometric horizon [38] into which matter is crushed and then lost may imply that a firewall exists inside of a blackhole. Even so at this point, any thought of a wall of fire inside of a blackhole remains speculative.

The prospect of associating a black hole's blackbody spectrum with inelastic collisions at extreme temperatures and pressures should be more palatable to those seeking simpler explanations than the currently accepted speculations, e.g., Hawking's. No matter one's particular theoretical preference, so much concerning black holes remains unknown, as does both dark matter and dark energy.

Amazingly, as a mathematical contrivance, entropy is deemed very important to the science of cosmology. As previously stated, entropy's fundamentals lay in an ensemble of elastic collisions reinforced by the illusions of elastic collisions found in many experimental systems [1]-[5].

Applying thermodynamic entropy to black holes can be troubling, requiring what are arguably superficial explanations. As for entropy in Shannon's information, nothing is resolved concerning whether information is, or is not lost, when one starts thinking in terms of inelastic collisions both near and inside of black holes.

Accepting that real cosmology involves inelastic collisions changes our interpretations. This raises the question: How often in cosmology do collisions occur between perfectly hard spheres of equal mass and size, with the direction of the collision along a line through all of the interacting particles' center of masses?

Other mathematical descriptions of the requirements for elastic collisions exist [4], [39], [40]. However, such mathematical conscripts are not particularly practical. They often involve one mass passing all of its energy onto another, or some small mass colliding with a comparatively massive immovable object, e.g., a gas molecule impacting a wall [40]. Even the latter being elastic is actually limited to the previously discussed illusions.

The consideration of inelastic collisions will mean that one can no longer freely interchange momentum change with kinetic energy change in their mathematical analysis. Rather conservation of momentum may have to now be mathematically separated from conservation of energy when considering the mathematics of molecular kinematics. Barring dissipative forces, the differences between the energetics of an ensemble of colliding matter and the resultant matter's energetics will be the radiation produced by the inelastic collisions. And this may add complexity to one's mathematical analysis, e.g., alter how one writes the Lagrangian that defines a system's mechanics.

VIII. A RATIONAL ARGUMENT

"Thermal energy" is energy that is in (phonons), or will result in (photons), molecular (both inter and intra) vibrations when adsorbed by condensed matter and/or polyatomic gases

[4]. This means that not all energy is necessarily thermal, and thermal energy may actually depend upon the exact nature of the matter in question, as well as the surrounding pressure and/or temperature.

It means that surrounding photons and even thermal photons within a vacuum can signify thermal energy. The latter challenges the traditional atrocity of claiming that a vacuum does not have a temperature, until one actually places a thermometer inside of it.

In terms of blackbody radiation, it also implies that not every photon at every frequency within a given spectrum is necessarily thermal energy. However, a blackbody's association with temperature is clearly given in Stefan-Boltzmann's equation, and this may require some thought. Can one replace temperature with thermal energy density? That too may be problematic, as the thermal energy density at a given temperature depends upon the types of matter that are within a given system.

Whatever the outcome, our reality remains that blackbody radiation is related to the system's temperature, and temperature is associated with a system's thermal energy (or if one prefers the thermal energy density within different substances).

Moreover, thermal energy in the form of thermal photons, when adsorbed by condensed matter and/or polyatomic gases, will become thermal phonons within that matter. These thermal phonons are then associated with that matter's molecular vibrations. Therefore, a vacuum must have a temperature so long as it has thermal photons within it.

As previously stated, the above argument goes against traditional thermodynamics theory, wherein those solely embracing statistical mechanics claim that temperature is limited to the kinetic motions of molecules. This author's argument accepts that often the total amount of energy associated with all the thermal photons inside of vacuum is generally miniscule, especially when compared to an equal volume system containing matter. One then realizes that matter, which adsorbs thermal energy tends to store and concentrate that energy.

When contemplating cosmology, the thermal energy associated within its vastness can be similarly vast, even when the actual thermal energy density within its vacuum remains miniscule.

IX. GLOBAL WARMING

The realization that collisions are inelastic not only changes the way one views cosmology it alters the way one contemplates most scientific realms.

At the risk of unwarranted repetition, this author has to emphasize that it changes how one views global warming. Greenhouse gases are a secondary cause for the unnatural rise in Earth's temperature, i.e., our atmosphere as a whole is Earth's thermal blanket [4], [41].

Man's activities generate heat through many processes especially those that involve/increase inelastic collisions, dissipative forces and lost work [4], [5], [13]-[16], [19], [41]. And it is the fact that this spawning heat resides on the interior of Earth's thermal blanket that renders man's heat-generating activities so troublesome.

X. CONCLUSIONS

Collisions at any scale are generally inelastic. The exception occurs when hard spheres of equal mass and density, collide along a line through their centers of mass. This limits the application of an ensemble of particles undergoing elastic collisions, to accepted abstract mathematics, e.g., entropy. Interestingly, such math remains applicable as an approximation for describing systems where the illusion of elastic collisions exists.

The illusion exists in systems where its walls absorb and then emit back into the system the photons generated by an ensemble of inelastic collisions, e.g., many experimental systems. The illusion can also occur when an experimental system is connected to a heat bath/sink, in what is deemed an isothermal process.

Accepting that intermolecular collisions are inelastic was previously applied by this author to the blackbody radiation from stars, e.g., our Sun [1]. Herein, it has been extended to various cosmological phenomenon. Incorrect traditional assertions concerning blackbody radiation has prevented the true of many phenomena. This author's realization that molecular (inter and intra) collisions are inelastic and the likelihood that such collisions result in blackbody radiation should actually simplify cosmology.

Starting with cosmic microwave background radiation (CMB), the notion that at no point over the billions of years of our universe's existence has any of this radiation interacted with matter, has now been questioned. Reality is that a significant amount of the radiation witnessed within our universe should have interacted with matter at some point since the big bang including what we call CMB.

By interaction, it is meant that the radiation has been absorbed and then emitted, or reflected by condensed matter and/or polyatomic gases. Thermal equilibrium means that the total energy absorbed equals the total energy emitted. It does not mean that the emission spectrum is identical to the adsorption spectrum, i.e., similar power at all the same frequencies. Any interaction involving absorption followed by subsequent emission generally involves changes in frequency. This also applies to CBM.

Moreover, a simpler explanation has been provided herein, which at the very least is that, part of the witnessed CMB spectrum is from cold-dark matter. This is not to say that it is now proven beyond any doubt that no part of the CMB radiation represents the relic radiation from the big bang. It is to acknowledge that cold-dark matter can be baryonic, hence interact with EM waves, even if we cannot witness it. And as such may cause, or just influence what we witness as CMB.

Examples of cold-dark baryonic matter are located in the far reaches of our solar system, e.g., the Oort cloud and possibly the Kuiper belt. Specifically, such cold-dark baryonic matter residing in the outer reaches of our solar system may adsorb some minute quantity of our Sun's distant rays, and then emit a blackbody radiation whose peak is centered somewhere in (or near) the microwave part of the EM spectrum.

The main point of this paper is that the realization of cosmic collisions being inelastic does remove certain

overcomplications (exotic fanciful explanations) from the sciences, whether one is considering CMB, or radiation emanating from black holes. Furthermore, matter sporadically entering a blackhole helps explains the fact that a black hole's emitted radiation occurs in bursts.

The acknowledgement of inelastic collisions may add to a mathematical description's complexity. Specifically, conservation of momentum can still be used but any analysis based upon conservation of energy will have to include any collision induced EM spectrum, e.g., blackbody radiation.

This author's new consideration of cold-dark matter may also lead to an enlightened view of dark energy, with the possibility of cold-dark baryonic matter located at cosmologically speaking far distance, using their gravity to seemingly accelerate our witnessed universe's expansion. This may require new insights in how our universe is viewed.

This paper has demonstrated that accepting that collisions are inelastic actually simplifies cosmology. This applies to CMB, dark matter, black holes and possibly even dark energy. Many may choose their abstract math-based edifices over what this author deems as common sense, which often resides in the eyes of the beholder.

Accordingly, this paper was written with the aspiration of enlightening the reader to the possibilities of new visions, whose fundamentals are based upon inelastic collisions.

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