Black holes have 'Cold Energy'

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Abstract:
I propose that bodies have hot and cold states, the temperature of the cold bodies being below 0K. Temperature- wavelength relation for a cold state is suggested as $\lambda = b^2T$ (where b is the Wien's constant), and the wavelength for absolute zero is derived. It is proposed that black holes have cold energy, their interiors resembling hot stars. Black holes and stars represent symmetrically opposite potential states created by 'a pulsating universe' that oscillates between hot and cold states.

Key words: Cold state, Wien's displacement law, Absolute zero, Black holes, Pulsating universe

1. Introduction:

Newton's law of gravitation, a mathematical law, gives the impression that force can be increased without limit by decreasing the distance. Or, the law predicts gravitational collapse. General relativity, another mathematical theory, predicts a gravitational collapse that leads to the formation black holes. However, a body collapsing due to its own gravity is something that goes against our commonsense. But that is the general nature of physical concepts derived from mathematical laws [1], and is a drawback to be rectified.

Here, I propose that there is cold energy just like heat energy. Cold bodies resemble black holes, and so it is proposed that black holes have cold energy. So the concept of gravitational collapse can be discarded. The proposal is based on the classical view that bodies made up of matter move in absolute space, and interact with each other using forces; the explanations based on quantum mechanics and relativity theories of Einstein are completely ignored.

2. Hot and cold states:

It is a known fact that an increase in internal energy leads to an increase in temperature. This can be viewed as follows: when internal energy increases, the body tries to expand; but the attractive forces prevent the body from expanding in proportion, and this makes the atoms vibrate, and we say it is hot. This is a high-entropy state [2]. If internal energy is decreased, the body contracts and reaches a normal-entropy state, where the vibrations are normal. If internal energy is decreased further, the repulsive forces prevent further contraction, and the vibrations increase again and thus the body reaches a low-entropy state. We can call this a cold state. The proposed concepts regarding hot and cold states are given below:

Hot and cold states are potential states of 'a mass of atoms' (like earth, moon, sun etc.). The ratio between internal energy and speed decides the state. In a hot state, the internal energy is high and in a cold state, the speed is high. A part of *internal energy remains as heat/cold energy in the respective states. The same temperature indicates the same intensity for both hot and cold states.*

The above proposal implies that atoms do not have hot or cold states. A ‘mass’ is not a mere collection of atoms; it has its own emergent properties. Cooling of a ‘mass’ is a process of internal energy changing into speed, and a consequent increase in density. The ‘mass’ has to attain a critical density to pass on to the cold state. The more the speed, the more will be the force towards the centre of the ‘mass’, and this causes atomic fusion if the elements are light, and ultimately creates the cold state. However, this requires that G increases with speed [3].

Taking temperature as a measure of the intensity of hotness, the temperature of a cold body can be taken as below 0K. Both the intensity and the critical density depend on the energy possessed. Light elements can reach only low potential states, whereas dense elements can reach high potential states. So, ‘masses’ having high energy will contain mainly dense elements. Bodies cannot be infinitely hot or cold because speed has an upper limit. However, the speed limit based on Einstein’s relativity theory is not considered here. So an alternate explanation is required for explaining the speed limit [3].

For a certain speed- internal energy ratio, the entropy is normal, and the ‘mass’ is neither hot nor cold, or it will be at absolute zero. For normal entropy, a ‘mass’ of light elements require higher internal energy, and a ‘mass’ of dense elements require higher speed. Though cooling below 0K is possible, the bodies on a hot ‘mass’ have to be hot, and so the limit of cooling on a hot mass like Earth will be 0K. Because of the high internal energy, a hot ‘mass’ will be emitting radiations. A cold ‘mass’ will, however, be absorbing all the radiations falling on it. Or, literally all cold bodies will be black, and so I propose that black holes have cold energy.

3. Temperature- wavelength relation:

The temperature- wavelength relation for hot bodies is given by Wien’s displacement law as, $T = b/\lambda$. By symmetry, the relation for cold bodies should be $T = \lambda/b_c$. So, for any given temperature, there will be two wavelengths, one for hot state and the other for cold state; and the geometric mean of the two will give the wavelength for absolute zero. For T=1, the values of λ are b and b_c, respectively. The graphs for the above two equations will intersect at $\lambda = (bb_c)^{1/2}$, which represents absolute zero. Joining the graphs by a smooth curve passing through the point of intersection, we get the graph representing a smooth change from hot state to cold state.

To transform the function ‘$y = 1/x$’ to ‘$y = x$’, we have to multiply by x^2. So any constant in the former will have to be squared in the latter to represent continuity. So the value of b_c, the constant for cold bodies should be b^2 (however, the unit should be so chosen that $b > 1$). So the wavelengths in millimeters for the following temperatures will be as follows: for 1K, $\lambda = b = 2.898$ mm; for -1K, $\lambda = b_c = b^2 = 8.398$ mm; and for 0K, $\lambda = (bb_c)^{1/2} = 4.933$ mm.

The temperature- wavelength relations will be valid for temperatures sufficiently away from 0K. As it approaches 0K, there will be a slight variation, and between 1K and -1K, the relations are completely invalid. The actual wavelength for 1K will be slightly less than *b*. So instead of the above mentioned values, slightly modified values as given below are proposed:

Wavelength for absolute zero, $\lambda_0 = 4.82 \text{ x}10^{-3}\text{m}$
Constant for cold bodies, $b_c = 8 \text{ x}10^{-3}$

However, suggesting that a particular wavelength represents absolute zero requires explanation why it is so particular [4].

4. Stars and Black holes:

Stars and black holes are 'masses' having high potential states, hot and cold respectively. The change from stars to black holes happens in the expanding phase of the universe, where its entropy increases with time [2]. Assuming that the galaxy-clusters are moving faster than the galaxies, and the galaxies are moving faster than the stars, the masses, if any, at the centers of the galaxy-clusters will be the first to become black holes, followed by the masses at the galactic centers, and then by the stars. It is most probable that the masses at intergalactic centers and the galactic centers contain dense elements and so the density is always above critical density; so, fusion reactions will not be taking place in them.

The clouds of hydrogen are degenerated masses having low speeds and hence a low G and a low temperature (near 0K). In the expanding phase, the clouds easily contract, their internal energies changing into speed. The increase in speed increases the G, and the atoms come closer resulting in heating. If the energy is enough to create the required temperature, fusion reactions are kindled. Otherwise, the 'mass' passes on to a low-intensity cold state.

A star having a small dense core may not attain critical density with hydrogen fusion alone. So the next stage reaction from helium to denser elements takes place, causing an explosion. But a large dense core stops the reaction even before the hydrogen fuel is exhausted – a red giant. If the size of the core is in between the two, the star reaches an intermediate stage. However, ultimately all stars become black holes. 'Masses' which were less hot will simply pass on to a low-intensity cold state. In the contracting phase, the reverse process (including atomic fission) takes place. So the following physical model of a black hole is proposed:

A black hole is a cold mass with temperature far below 0K. Its entropy is low; that is, its internal energy is low compared to speed. It contains dense elements, and the atoms in it vibrate similar to that in hot masses. It bends light, but does not hold back light. It absorbs all radiations falling on it, and that makes it black.

The new concept thus denies gravitational collapse and singularity. Amount of matter is not a crucial factor that decides the formation of black holes, but speed is a factor. It is possible that G depends on speed and so the gravity of a black hole is high, but not infinite. It is the cold state, and not gravity that makes it black.

5. Pulsating universe:

In the previous paper [2], I have argued that entropy-changes in an independent system keep it in a dynamic equilibrium, where it oscillates between low and high entropy states. Here, I have proposed hot and cold states to represent the high and low entropy states of 'masses'. A decrease in the entropy of the 'masses' causes an increase in the entropy of the universe. So I conclude that the universe oscillates between super-hot and super-cold states. The universe always remains as system of masses in dynamic equilibrium, the potential states deciding the limits. Just before expansion, the universe may be white hot, the temperature of 'masses' varying from 0K to the upper limit. The expansion starts with maximum acceleration, and at halfway, acceleration becomes zero and the average temperature becomes 0K. The CMBR represents the present temperature (2.7K) of the universe, and so the expansion has reached nearly halfway. If the present calculations are correct, the universe will then continue expanding for another 13 billion years [5] before it starts contracting.

6. Conclusion:

I have explained how 'masses' attain hot and cold states, an emergent property. The proposed temperature-wavelength relation for cold state and wavelength for 0K do not go against logic or commonsense. The attributed properties of black holes are in agreement with the proposed properties of cold bodies. The accelerating expansion of the universe can be explained based on hot/cold states (without invoking dark energy). These indicate the possibility that black holes are indeed cold 'masses' having cold energy. However, for theoretical consistency the following explanations are required: Why should G depend on speed?[3] What explanation other than relativity is possible for a speed limit?[3] Why is the wavelength for absolute zero so peculiar?[4] What is the geometry of the pulsating universe?[5]

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[1]. Jose P Koshy, *Physical Reality and the Mathematical laws – a new philosophical approach,* **viXra: 1311.0118** (history and philosophy of physics)

[2]. Jose P Koshy, *Redefining 'system' and 'entropy' in physical terms,* **viXra: 1312.0002** (thermodynamics and energy)

[3]. A paper titled "*The inherent relation between motion and force*" suggesting that motion at speed 'c' is a fundamental property of matter and that gravity depends on speed, will be published in **viXra**, as the next paper in this series.

[4]. A paper suggesting that a '*quantum occupies a finite length'* and the *'wavelength for absolute zero depends on quantum length'* will be published in **viXra** subsequently.

[5]. A paper suggesting the geometry of 'a *pulsating universe with a period of 51.4 billion years*' will be published in **viXra** subsequently.