

Temperature Of A Black Hole

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V3 By

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Abstract

A calculation is given for equilibrium temperature of a black hole revised for blue shifted cosmic background microwaves. A high temperature limit is imposed at the Planck energy level.

The result leads to a function of variant Planck constant for use in polarizable vacuum theory.

Introduction

Black hole theories were developed before the discovery of cosmic background microwaves. Theories of General Relativity have not previously reconciled with blue shifted microwaves. Previous work by Roger Penrose and Stephen Hawking laid a frame work for eventual resolution, by postulating thermal equilibrium based on quantum effects that predicted a low temperature of black holes.

In the present work a high temperature is predicted based upon the extent of gravitational blue shifting.

Temperature of a Black Hole

A calculation is given as estimate for temperature of a black hole in thermodynamic equilibrium with distant cosmic microwave background. It will differ from results of Stephen Hawking⁽¹⁾ but will use some of the

concepts originated by Roger Penrose⁽²⁾ and Stephen Hawking. The results are useful in predictions of deep space transport at high speed.⁽³⁾

- 1.1) $R = 2MG/c^2$ equivalent radius of event horizon
- 1.2) $dE = F * dr$ microwave energy in gravity field
- 1.3) $m = E/c^2$ microwave gravitational mass
- 1.4) $dE = -(EMG/r^2c^2)dr$ blue shifting of microwave in gravity

Conservation of energy in blue shifting of microwaves causes integration coefficients to become exponents in variable properties of space time. By integration E_o^2/E^2 goes to E_o^2/E_R^2 which is ideally zero in GR and very near zero in more recent work.

- 1.5) $(1/2)(1-E_o^2/E_R^2) = G_oM_o/R^2c_o^2 = (1/2)$ at event horizon
- 1.6) $(E_o^2/ E^3)dE = - (G_oM_o/r^2c_o^2)dr$ for $r > R$
- 1.7) $(E^3/ E_o^3) (E_oM_oG_o/c_o^2) = (EMG/c^2)$
- 1.8) $(E^3/ E_o^3) = (EMG/c^2)/ (E_oM_oG_o/c_o^2)$

An assumption about M must be made. Equilibrium of the black hole is evoked to make constant Temperature, not altered by a microwave approaching an event horizon, since an equal microwave departs. As Hawking predicted, the black hole has thermal equilibrium and is not completely black, but is hotter in this estimate than he calculated from QM.

- 1.9) Let $M = M_o$ microwave does not alter the black hole
- 1.10) $(E^3/ E_o^3) = (EG/ E_oG_o)/ (c^2/c_o^2)$
- 1.11) $(mG/m_oG_o) = (c^2/c_o^2)(\lambda/ \lambda_o)$ from Partition Theory⁽⁴⁾

$$1.12) \quad (EG/E_0G_0)/(c^2/c_0^2) = (c^2/c_0^2)(\lambda/\lambda_0)$$

$$1.13) \quad (E^3/E_0^3) = (c^2/c_0^2)(\lambda/\lambda_0)$$

At this point the relation of light speed to wavelength must be developed.

$$1.14) \quad c = f \lambda$$

$$1.15) \quad f/f_0 = 1/(1 - 2MG/rc^2)^{(1/2)} \quad \text{in Gravity field metric of GR}$$

$$1.16) \quad c/c_0 = (1 - 2MG/rc^2) \quad \text{from Einstein's GR (eq. 107) light speed}$$

$$1.17) \quad \lambda/\lambda_0 = (1 - 2MG/rc^2)^{(3/2)} \quad \text{wave length of cosmic microwave}$$

The relation between E and c is made.

$$1.18) \quad (E^3/E_0^3) = (c/c_0)^{(7/2)}$$

$$1.17) \quad (E/E_0)^{(6/7)} = (c/c_0)$$

$$1.18) \quad E = h f_0/(1 - 2MG/rc^2)^{(1/2)} \quad \text{microwave energy in gravity field}$$

Since GR with blue shifting predicts infinite temperature of a black hole, a quantum limit of the Planck temperature will be imposed with partition function Z of one half in flat space and zero at an event horizon.

$$(1.15) \quad h^2f^2 = (8/(1-Z)) hc^5/G \quad \text{Planck energy squared}^{(4)}$$

$$(1.16) \quad hf = kT \quad \text{using Boltzmann constant}$$

$$(1.17) \quad T = 2.7^\circ \text{K} + (8 hc^5/G)^{(1/2)} /k \quad \text{a very high temperature}$$

Then the super hot photon attempting to leave the event horizon will be red shifted to 2.7° K at far distance, and the black hole will be slightly gray as Stephen Hawking predicted, but for other reasons. It makes a thermal equilibrium without which the black hole would continue to get hotter.

To be consistent the process of equilibrium may be thought of as a temperature so high inside a black hole that the mass expands to fill the volume inside the event horizon. In this way a black hole can evaporate slowly by a different process than was predicted by Stephen Hawking.

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Conclusions

In conclusion there is prediction of high temperature in black holes limited by the Planck energy. General Relativity predicts an infinite temperature which is interpreted as a limitation of GR at high energy.

A way was found to relate Planck constant to light speed that will be helpful in other articles modifying Polarizable vacuum theory.

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Acknowledgements

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Reference Notes

- 1) Stephen Hawking; The Universe In a Nutshell, Bantam, 2001; Reference Dover, New York, 1976. Page 118.
- 2) Stephen Hawking and Roger Penrose; The Nature of Space and Time, Princeton University Press, Princeton, 1996; Reference 2000 edition. Page 25, figure (1.17)
- 3) Jerry L. Decker, Polarizable Vacuum Theory in Deep Space Transport at High Speed,

<https://www.researchgate.net/publication/285404064> Polarizable Vacuum Theory In Deep Space Transport At High Speed , 2015.

- 4) Jerry L. Decker, Vacuum Partition Theory Putting A Limit On Energy In Space, 2015, viXra:1512.0277.