# Dragrath's Hawking Radiation Equilibrium Theorem

Terry Bollinger
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https://www.youtube.com/watch?v=PJ2QsqqQSeY&lc=UgwmJhLPuqzVMAWtDwd4AaABAg.9gk5gj6fSoi9gofvcvgIox

A Comment on the YouTube Fermilab post:
*What happens when you fall into a black hole?*
https://youtu.be/PJ2QsqqQSeY?t=4m7s

@Dragrath1, your idea is interesting enough that I've attempted to write my interpretation of it below. Please let me know if anything is in error. Beyond quoting what I think may be the most relevant section of the Hawking paper, please note that I have neither done a literature search on your idea nor assessed it mathematically.
— Cheers, Terry Bollinger

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## Dragrath's Hawking Radiation Equilibrium Theorem

(As interpreted by Terry Bollinger on 2022-10-05)

Shouldn't UV obliteration work in *both* directions, that is, on both light falling in from the outside universe and light rising from black hole Hawking radiation? Additionally, since the observer is falling towards the black hole rather than away from it, shouldn't the blue-shifted version of Hawking radiation eventually dominate and create an equilibrium point that keeps particles from falling any closer to the event horizon?

As an observer approaches closely to the event horizon, the initially cold and negligible Hawking radiation of the black hole grows exponentially hotter and brighter due to time dilation and the inbound acceleration of the observer. Time dilation concentrates all light, whether from behind or in front. However, Hawking radiation gets blue-shifted more than light from the outside universe due to inbound acceleration. At some point, the radiation pressure of the outbound Hawking radiation should first reach and then exceed that of incoming light and then the gravitational pull of the black hole. At this hot equilibrium point — one well-hidden from the outside universe — the particle stops falling and thus never reaches the event horizon.

The resulting *Hawking radiation equilibrium point* thus would be akin to the radiation pressure from fusion in star cores that keeps them from entirely collapsing under gravity.

The concept of a Hawking equilibrium point makes a black hole more akin to a highly time-dilated explosion. Interestingly, the title of Hawking's definitive 1974 paper *Black hole explosions?* [1], suggests a similar view. Here is a related quote from that paper:

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[1] S. W. Hawking, *Black Hole Explosions?*, Nature **248**, 5443 (1974).

"… Part of this wave will be scattered by the curvature of the static Schwarzschild solution outside the black hole and will end up on $I^-$ with the same frequency $\omega$. This will give a $\delta(\omega - \omega')$ behaviour in $\alpha_{\omega\omega'}$. Another part of the wave will propagate backwards into the star, through the origin and out again onto $I^{+}$. These waves will have a very large blue shift and will reach $I^{-}$ with asymptotic form

$$C\omega^{-1/2} \exp\{-i\omega\kappa^{-1} \log(v_0 - v) + i\omega v\} \qquad \text{for } v < v_0$$

and zero for $v \geq v_0$, where $v_0$ is the last advanced time at which a particle can leave $I^{-}$, pass through the origin and escape to $I^{+}$."

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PDF: https://sarxiv.org/apa.2022-10-05.1704.pdf