# White Holes and Black Holes

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## Abstract

Physicists have theories about white holes: cosmic monsters that overlap the line between tall tale and actuality. Yet to be seen in the space, white holes might be only mathematical giants. But according to recent research, if a speculative theory known as loop quantum gravity is true, white holes could be not just only real but we might have already observed them. A white whole is, somewhat, the reverse of a black hole. [10]

That's what some physicists have argued for years: That black holes are the ultimate vaults, entities that suck in information and then evaporate without leaving behind any clues as to what they once contained. But new research shows that this perspective may not be correct. [9]

Considering the positive logarithmic values as the measure of entropy and the negative logarithmic values as the measure of information we get the Information – Entropy Theory of Physics, used first as the model of the computer chess program built in the Hungarian Academy of Sciences.

Applying this model to physics we have an understanding of the perturbation theory of the QED and QCD as the Information measure of Physics. We have an insight to the current research of Quantum Information Science. The generalization of the Weak Interaction shows the arrow of time in the associate research fields of the biophysics and others. We discuss also the event horizon of the Black Holes, closing the information inside.

## Are White Holes Real?

According to Caltech physicist Sean Carroll, a black hole is a region of space where you can enter but you can never escape due to its powerful gravitational pull; a white hole is a region where you choice of leaving but you can never go back. Otherwise both share precisely the similar mathematics, precisely the same geometry. That boils down to some vital features: a singularity, where mass is pressed into a point of infinite density, and have an event horizon, the unseen "point of no return" first defined mathematically by the German physicist Karl Schwarzschild in 1916. For a black hole, the event horizon symbolizes a one-way entry; for a white hole, it's exit-only scenario.

There is definite proof that black holes truly exist, and astrophysicists have a strong understanding of what it requires to make one. Visualize a white Hole is hard.
One prospect comprises a spinning black hole. According to Einstein's general theory of relativity, the rotation smudges the singularity into a circle, creating it imaginable in theory to travel through the spinning black hole without being crushed. General relativity's equations propose that someone dropping into such a black hole might go through a tunnel in space-time called a wormhole and appear from a white hole that its matters into a different areas of space or even period of time.

Although mathematical answers to those equations exist for white holes, Andrew Hamilton, an astrophysicist at the University of Colorado at Boulder say "they're does not exist in reality," .That is because they define universes that comprise only black holes, white holes and wormholes—no matter, radiation or even energy.
Certainly, earlier research, counting Hamilton's, proposes that anything that falls into a rotating black hole will basically plug up the wormhole, avoiding the creation of a channel to a white hole.

Einstein's General Relativity, from which Hamilton draws his calculations, breaks down at a singularity of a black hole. Stephen Hsu, a physicist at Michigan State University in East Lansing, says "The energy density and the curvature become so large that classical gravity is not a good description of what's happening there.

Maybe a more comprehensive model of gravity—one that works as well on the quantum level as it does on bulky ones—would disprove the variability and allow for white holes."

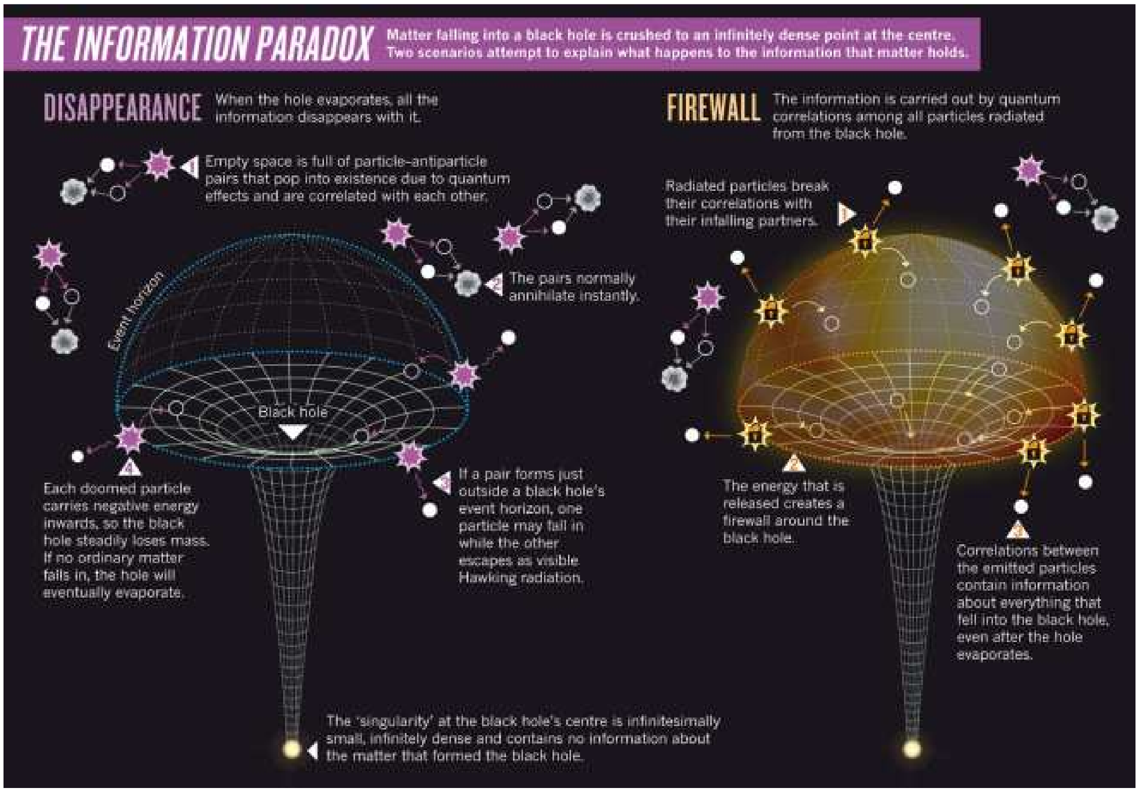
Certainly, a unified theory that combines gravity and quantum mechanics is one of the holy grails of modern physics. Applying one such theory to black holes, theorists Hal Haggard and Carlo Rovelli of Aix-Marseille University in France have presented that black holes could transform into white holes via a quantum procedure. In July last year, they issued their work online.

Loop quantum gravity suggests that space-time is fabricated of fundamental construction blocks formed like loops. According to Haggard and Rovelli, the loops' limited size stops a dying star from collapsing all the way down into a point of endless bulk, and the shrinking object recoils into a white hole instead.

The black-to-white transformation could resolve a nettlesome puzzle known as the black hole information paradox. The idea that information can be destroyed is abomination in physics, and general relativity states that anything, counting information, that drops into a black hole can never escape. It does not mean that s black holes only act as protected safes for any information they slurp up, but Stephen Hawking presented 40 years ago that black holes essentially evaporate with time.

That directed to the alarming prospect that the information confined within black hole could be lost too, generating a discussion that rages to this day. [10]

## Proposed Resolution For the Black Hole Information Paradox




"According to our work, information isn't lost once it enters a black hole," says Dejan Stojkovic, PhD, associate professor of physics at the University at Buffalo. "It doesn't just disappear."

Stojkovic's new study, "Radiation from a Collapsing Object is Manifestly Unitary," appeared on March 17 in Physical Review Letters, with UB PhD student Anshul Saini as co-author.

The paper outlines how interactions between particles emitted by a black hole can reveal information about what lies within, such as characteristics of the object that formed the black hole to begin with, and characteristics of the matter and energy drawn inside.

This is an important discovery, Stojkovic says, because even physicists who believed information was not lost in black holes have struggled to show, mathematically, how this happens. His new paper presents explicit calculations demonstrating how information is preserved, he says.

The research marks a significant step toward solving the "information loss paradox," a problem that has plagued physics for almost 40 years, since Stephen Hawking first proposed that black holes could radiate energy and evaporate over time. This posed a huge problem for the field of physics because it meant that information inside a black hole could be permanently lost when the black hole disappeared—a violation of quantum mechanics, which states that information must be conserved.

### Information Hidden in Particle Interactions:

In the 1970s, Hawking proposed that black holes were capable of radiating particles, and that the energy lost through this process would cause the black holes to shrink and eventually disappear. Hawking further concluded that the particles emitted by a black hole would provide no clues about what lay inside, meaning that any information held within a black hole would be completely lost once the entity evaporated.

Though Hawking later said he was wrong and that information could escape from black holes, the subject of whether and how it's possible to recover information from a black hole has remained a topic of debate. Stojkovic and Saini's new paper helps to clarify the story.

Instead of looking only at the particles a black hole emits, the study also takes into account the subtle interactions between the particles. By doing so, the research finds that it is possible for an observer standing outside of a black hole to recover information about what lies within.

Interactions between particles can range from gravitational attraction to the exchange of mediators like photons between particles. Such "correlations" have long been known to exist, but many scientists discounted them as unimportant in the past. [9]

## Considering the chess game as a model of physics

In the chess game there is also the same question, if the information or the material is more important factor of the game? There is also the time factor acting as the Second Law of Thermodynamics, and the arrow of time gives a growing disorder from the starting position.

When I was student of physics at the Lorand Eotvos University of Sciences, I succeeded to earn the master degree in chess, before the master degree in physics. I used my physics knowledge to see the chess game on the basis of Information – Entropy Theory and giving a presentation in the Hungarian Academy of Sciences, proposed a research of chess programming. Accepting my idea there has built the first Hungarian Chess Program "PAPA" which is participated on the 1$^{st}$ World Computer Chess Championship in Stockholm 1974. [1]

The basic theory on which one chess program can be constructed is that there exists a general characteristic of the game of chess, namely the concept of entropy.

This concept has been employed in physics for a long time. In the case of a gas, it is the logarithm of the number of those microscopic states compatible with the macroscopic parameters of the gas.

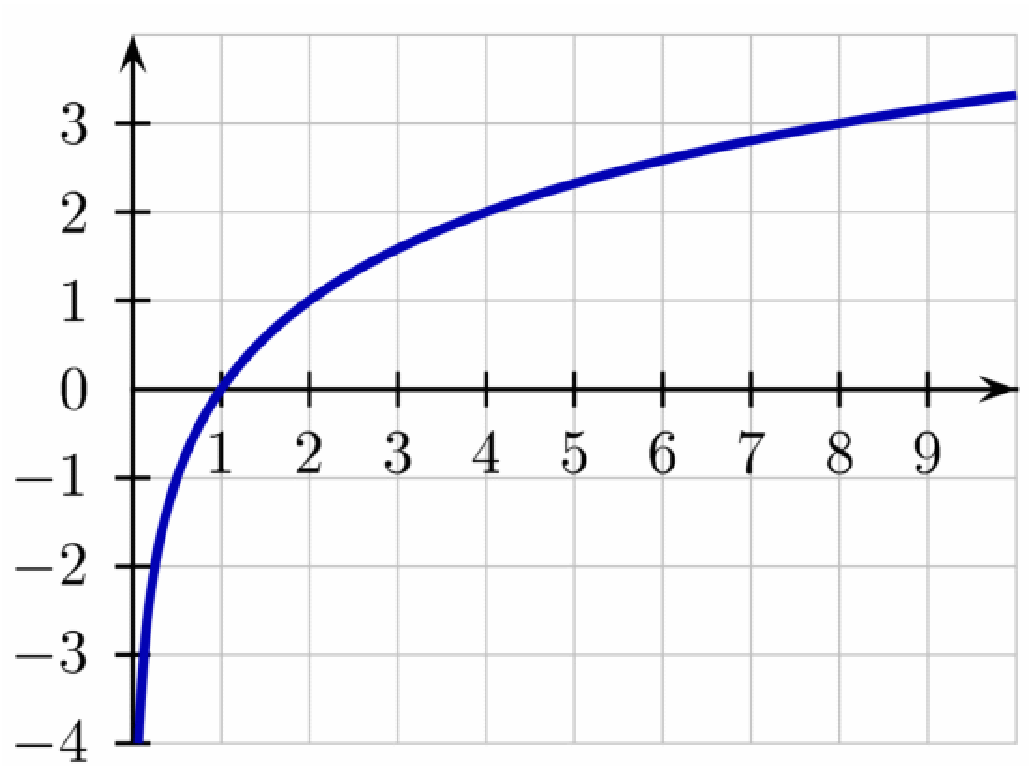
What does this mean in terms of chess? A common characteristic of every piece is that it could move to certain squares, including by capture. In any given position, therefore, the pieces by the rules of the game possess certain states, only one of which will be realized on the next move. The difference of the logarithm of the numbers of such states for Black and White respectively is the "entropy of the position". The task of the computer is then to increase this value for its own benefit.

Every chess player knows that the more mobility his pieces have and the more constrained are his opponent's, the better his position. For example, checkmate is the best possible state for the attacker, and the chess program playing according to the above principle without the prior notion of checkmate will automatically attempt it if possible.

Entropy is a principle of statistical physics and therefore is only applicable in statistical contexts. The number of microstates of a confined gas is very large and therefore the statistical approach is valid. In chess, however, the number of pieces, a macroscopic parameter, is very small and therefore in this context the "value" of a position cannot be an exact function of entropy. For example, it is possible to checkmate with a total force of a single pawn despite the fact that the opponent has many pieces and various positions available.

Examples of sacrificial combinations further demonstrate this consideration. Therefore we also need specific information about any given position. For example, entropy could be maximized by White giving check, but if the checking piece is then taken, the move was a bad one. The logarithm of the number of variations which have been examined in this way gives the amount of information. In the endgame it is rather inaccurate. Because of the small number of pieces the above noted inadequacy of the statistical principle becomes evident and we need to compute much more information to fill the gap.

We can think about the positive logarithmic values as the measure of entropy and the negative logarithmic values as the measure of information.




Shortly speaking:

- The evaluation of any position is based on the entropy + information.
- The entropy is the logarithm of the possible legal moves of the position.

- The information is simply the depth of the search, since it is the logarithm of the exponential growing number of possible positions, $\log e^x = x$.

E = entropy

I = information

D = depth of search

M = legal moves in any position, $M_w$ for white moves and $M_b$ for black moves

$E = \log M_w - \log M_b = \log M$

And since $\log e^x = x$, $I = D$

We get information + entropy, the value V of any position in the search tree of the current chess position:

$V(D, M) = I + E = D + \log M$

This naturally gives better values for a deeper search with greater mobility. [2]

## Using this model in physics

Viewing the confined gas where the statistical entropy not needs the information addition is not the only physical system. There are for example quantum mechanical systems where the information is a very important qualification. The perturbation theory needs higher order calculations in QED or QCD giving more information on the system as in the chess games happens, where the entropy is not enough to describe the state of the matter. The variation calculation of chess is the same as the perturbation calculation of physics to gain information, where the numbers of particles are small for statistical entropy to describe the system. The role of the Feynman graphs are the same as the chess variations of a given position that is the depth of the variations tree, the Information is the same as the order of the Feynman graphs giving the Information of the micro system.

## Quantum Information Science

Quantum information science is an area of study based on the idea that information science depends on quantum effects in physics. It includes theoretical issues in computational models as well as more experimental topics in quantum physics including what can and cannot be done with quantum information.

## Quantum Computing Research

Quantum computing has been an intense research field since Richard Feynman in 1981 challenged the scientific community to build computers based on quantum mechanics. For decades, the pursuit remained firmly in the theoretical realm.

To understand the quantum world, researchers have developed lab-scale tools to manipulate microscopic objects without disturbing them. The 2012 Nobel Prize in Physics recognizes two of these quantum researchers: David Wineland, of the National Institute of Standards and Technology and the University of Colorado in Boulder, and Serge Haroche, of the Collège de France and the Ecole Normale Supérieure in Paris. Two of their papers, published in 1995 and '96 in Physical Review Letters, exemplify their contributions. The one by Wineland and collaborators showed how to use atomic states to make a quantum logic gate, the first step toward a superfast quantum computer. The other, by Haroche and his colleagues, demonstrated one of the strange predictions of quantum mechanics—that measuring a quantum system can pull the measuring device into a weird quantum state which then dissipates over time.

IBM scientists believe they're on the cusp of building systems that will take computing to a whole new level. On Feb 28, 2012 the IBM team presented major advances in quantum computing device performance at the annual American Physical Society meeting. Using a variety of techniques in the IBM laboratories, scientists have established three new records for retaining the integrity of quantum mechanical properties in quantum bits, or qubits, and reducing errors in elementary computations. These breakthrough results are very close to the minimum requirements for a full-scale quantum computing system as determined by the world-wide research community. [3]

Quantum computing in neural networks is one of the most interesting research fields today. [4] The biological constructions of the brain are capable to memorize, associate and logically thinking by changing their quantum states. The machine learning of Artificial Intelligence will be one of the mainstreams of the Quantum Computing, when it will be available. Probably the main challenge will be to simulate the brain biologic capability to create new quantum states for logical reasoning, since we don't know nowadays how it is work exactly in the brain. [8]

# The General Weak Interaction

The Weak Interactions T-asymmetry is in conjunction with the T-asymmetry of the Second Law of Thermodynamics, meaning that locally lowering entropy (on extremely high temperature) causes for example the Hydrogen fusion. The arrow of time by the Second Law of Thermodynamics shows the increasing entropy and decreasing information by the Weak Interaction, changing the temperature dependent diffraction patterns. A good example of this is the neutron decay, creating more particles with less known information about them. [5]

The neutrino oscillation of the Weak Interaction shows that it is a general electric dipole change and it is possible to any other temperature dependent entropy and information changing diffraction pattern of atoms, molecules and even complicated biological living structures.

We can generalize the weak interaction on all of the decaying matter constructions, even on the biological too. This gives the limited lifetime for the biological constructions also by the arrow of time. There should be a new research space of the Quantum Information Science the 'general neutrino oscillation' for the greater then subatomic matter structures as an electric dipole change.

There is also connection between statistical physics and evolutionary biology, since the arrow of time is working in the biological evolution also. [6]

The Fluctuation Theorem says that there is a probability that entropy will flow in a direction opposite to that dictated by the Second Law of Thermodynamics.  In this case the Information is growing that is the matter formulas are emerging from the chaos. So the Weak Interaction has two directions, samples for one direction is the Neutron decay, and Hydrogen fusion is the opposite direction.

## Black Holes revisited

The Black Holes are the counter example, where the matter is so highly concentrated that the entropy is very low and the information is high but closed inside the event horizon.

The problem is with the Black hole that it is not a logical physical state of the matter by the diffraction theory, because we cannot find a temperature where this kind of diffraction patterns could exist. [5]

Also the accelerating charges of the electric current say that the charge distribution maintains the accelerating force and this viewpoint of the relativity does not make possible an acceleration that can cause a Black Hole. The ever growing acceleration simply resolved in the spin. [7]

The spin is one of the most generic properties of the Universe, not only the elementary particles are spinning, but also the Sun, Earth, etc. We can say that the spin is the resolution of the constantly accelerating matter solving the problem of the relativity and the accelerating Universe. The gravity is the magnetic effect of the accelerating matter, the attracting force between the same charges; working by the electromagnetic oscillations, because of this is their universal force. Since this effect is relatively weak, there is no way for the gravitation force to compress the matter to a Black Hole.

## Conclusions

It is far from clear whether loop quantum gravity is an exact explanation of reality. The only sign we get of white holes might be in only models that we create in labs and kitchen sinks. But that’s okay. Just thinking about these theoretical cosmic creatures can advance physicists’ insight, even if the actual world is confused and not like those precise conditions. That's the way in which white holes are very valuable for a physicist. [10]

"These correlations were often ignored in related calculations since they were thought to be small and not capable of making a significant difference," Stojkovic says. "Our explicit calculations show that though the correlations start off very small, they grow in time and become large enough to change the outcome." [9]

My opinion is that information and matter are two sides of the same thing in physics, because the matter is the diffraction pattern of the electromagnetic waves, giving the temperature dependent different structures of the matter, the information about them arrives by the electromagnetic waves and also the entropy or uncertainty as the measure of disorder. [7]

The Fluctuation Theory gives a probability for Information grow and Entropy decrease seemingly proportionally with the gravitational effect of the accelerating Universe, against the arrow of time by the Second Law of Thermodynamics. The information and entropy are the negative and positive sides of the logarithmic curve, describing together the state of the matter.

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