An Intuitive Hypothesis on the Atomic-Scale Behavior of Matter Nearing a Singularity

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Introduction

Since my childhood, I have always been curious about black holes. Perhaps their mystery has drawn me in. As I gradually became more deeply interested in physics and space, this curiosity transformed into another question: What happens to matter that falls into a singularity?

Starting from this question, I began to develop my own thoughts. Although I do not yet possess advanced knowledge of mathematics and physics, I tried to form a hypothesis based on my intuitions. In this study, I will propose an idea about what might happen within the internal structure of atoms under the strong gravitational pull of black holes.

Of course, this idea may contradict some known laws of physics at certain points. However, the aim is not to provide a definitive answer, but rather to open an intuitive window into the unknown.

I must strongly emphasize that: I am currently 15 years old and do not possess advanced knowledge of physics. This hypothesis may contain errors or contradictions with some physical laws or principles. I have noticed some of these and included them in this study. I am putting forward this hypothesis based solely on my physical intuitions. I kindly ask that your criticisms be constructive and developmental, helping me to improve myself. My work is very new and open to development. I plan to develop it further with the knowledge I acquire over time.

Declaration of Conformity with Ethical Principles

I declare that during the writing process of this study, I acted in accordance with scientific and ethical principles, cited all sources I used in compliance with citation rules, and that all ideas and expressions in other parts of this text belong to me.

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General Considerations and Hypothesis

We know that the vast majority of atoms consist of empty space. It is said that a hydrogen atom is 99.9999999999996% empty space. I wanted to establish a connection between black holes and these empty spaces.

The topic of what happens to matter that falls into a black hole is a very deep and complex one. My hypothesis is as follows:

"As matter approaches the center of a black hole, the empty spaces within each atom gradually decrease. Electrons increasingly approach the atom's nucleus and eventually stick to or nearly stick to the nucleus. In this state, matter continues to exist within the singularity; it does not vanish. Thus, one cannot speak of matter disappearing in singularity."

I formed this hypothesis based solely on my own intuitions and thoughts, and it is very likely to contain errors. The concept of "the center of a black hole" in the hypothesis may vary depending on different ideas. However, I do not believe this would change the hypothesis.

When we examine neutron stars, we can actually find things that may support the hypothesis. During the formation of neutron stars, electrons are compressed, approaching the atomic nucleus and becoming denser. This shows similarity to what is mentioned in the hypothesis. When even the nuclear pressure of a neutron star's neutrons cannot resist gravitational pull, it collapses further to become a black hole. In the hypothesis, a similar event is proposed to occur to matter falling into a black hole. The electrons within the atoms of matter approach the nucleus considerably, and the volume of the matter shrinks. It continues to shrink as it approaches the center of the black hole. Thus, in the singularity, it is stored with other matter in a very small volume.

Weak Points of the Hypothesis and Contradictory Principles

The first weak point that comes to mind is what happens to light falling into a black hole. Since light photons are not made of atoms, the hypothesis falls short at this point. I do not have much information about light or photons, so I do not want to comment too much. You can help in the development of the hypothesis and my self-improvement by sharing your opinions and thoughts.

The hypothesis put forward in this study assumes that inter-atomic voids can completely disappear, causing matter to be compressed into a much smaller volume. However, this approach directly contradicts the Pauli Exclusion Principle, a fundamental principle in quantum mechanics. The Pauli Exclusion Principle states that no two fermions (e.g., two electrons) can occupy the same quantum state simultaneously in the same place. This principle ensures that atomic and nuclear structures maintain a defined arrangement and volume, preventing matter from being compressed into infinite density. While the hypothesis assumes that the voids within the atom must completely close, the necessity of preserving the quantum states of fermions may physically hinder this process. Therefore, even if this hypothesis were theoretically possible, it might lose its practical applicability when considering the Pauli Exclusion Principle. However, this contradiction can be addressed differently with the development of quantum gravity theories. For example, quantum gravity could redefine how the Pauli Principle operates at extreme sub-Planck scales. In this context, this contradiction is proposed as a subject for discussion and research in future studies.

The hypothesis is in direct tension with the Heisenberg Uncertainty Principle, one of the fundamental principles of quantum mechanics. The Heisenberg Uncertainty Principle states that it is impossible to simultaneously know a particle's position and momentum with absolute certainty. In other words, the more precisely a particle's position is measured, the greater the uncertainty in its momentum – and vice versa. The hypothesis assumes that subatomic particles can be gathered together within a nearly zero volume. However, determining a particle's position with such precision would lead to enormous uncertainties in its momentum, meaning that the particles could not remain fixed in place, i.e., they could not be "compressed". The uncertainty principle, in this sense, theoretically limits the idea of gathering matter to a point of infinite density. If the hypothesis's fundamental assumption ignores this principle, it may be invalid at the quantum level. However, this contradiction can be re-examined within the scope of quantum gravity models that go beyond the limits of classical physics. Especially in the singularity of black holes, the structure of spacetime and particle behavior are not yet fully understood. In this context, the question of how the uncertainty principle operates in a singularity environment is also open to scientific discussion.

The content in this section (Weak Points of the Hypothesis and Contradictory Principles) was developed by the author based on text obtained from OpenAI's ChatGPT-4 model. It may also contradict other principles, scientific laws, etc.

Expectation from the Reader

This work is very new and describes a hypothesis that is currently in draft form. It does not reach any definitive conclusions in any way. The hypothesis presented in the study is a hypothesis formed solely based on the author's views and thoughts. It is not based on mathematical or physical foundations and may be erroneous.

The reader is kindly requested to read, evaluate, and criticize the study while being aware of the points written above.

All your comments, evaluations, developments, and criticisms about the study are very valuable to me.

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Translation and Original Work

This article has been translated from its original Turkish version by Gemini, an AI large language model. The author acknowledges that minor discrepancies may exist in the translation. The author's original article in Turkish can be accessed at