



Breakthrough Experiment Reveals Neutron's Internal Structure

Description

A long experiment finally showed us the inside of particles called neutrons, helping us understand more about the smallest parts of matter. The data from the Central Neutron Detector at TJNAF is helping us learn more about how neutrons work. Neutrons are made up of even smaller particles called quarks and gluons. Quarks and gluons are always moving and changing in a chaotic way.

Physicists shoot tiny bullets at particles to see how they move. This helps us understand partons, which are units of quarks and gluons. We have learned a lot about protons, but neutrons are still a mystery. A new detector at TJNAF is helping us gather more information about neutrons. We are studying how quarks in neutrons are different from quarks in protons.

Understanding the insides of atoms will give us new knowledge about quantum mechanics. This research is in a journal called Physical Review Letters.

Vocabulary List:

1. **Particles** /'pɑ: r.tɪ.kəlz/ (noun): Small localized bits of matter.
2. **Neutrons** /'nju: trɒn/ (noun): Subatomic particles that have no electric charge and are found in the nucleus of an atom.
3. **Quarks** /kwɔ: rk/ (noun): Elementary particles and fundamental constituents of matter.
4. **Gluons** /'glu: ðn/ (noun): Elementary particles that act as the exchange particles for the strong force between quarks.
5. **Physicists** /'fɪz.ɪ.sɪsts/ (noun): Scientists who study the properties and interactions of matter and energy.
6. **Quantum** /'kwɒn.təm/ (adjective): Relating to the smallest possible discrete unit of any physical property.

Comprehension Questions

Multiple Choice

1. What is the name of the detector helping study neutrons at TJNAF?
Option: Central Electron Detector
Option: Central Neutrino Detector
Option: Central Neutron Detector



Option: Central Particle Detector

2. Which particles are neutrons made up of?

- Option: Quarks and Electrons
- Option: Quarks and Gluons
- Option: Protons and Electrons
- Option: Protons and Neutrinos

3. What are units of quarks and gluons called?

- Option: Particles
- Option: Neutrons
- Option: Atoms
- Option: Partons

4. What are physicists shooting at particles to understand their movement?

- Option: Lasers
- Option: Bullets
- Option: Electrons
- Option: Neutrons

5. Which journal is the research on neutron particles published in?

- Option: Nature
- Option: Science
- Option: Physical Review Letters
- Option: Cell

6. What gives new knowledge about quantum mechanics according to the content?

- Option: Understanding particles
- Option: Studying protons
- Option: Studying neutrons
- Option: Understanding the insides of atoms

True-False

7. Neutrons are larger particles compared to protons.

8. Quarks and gluons are stable and stationary particles.



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9. The new detector at TJNAF is providing additional information about protons.
 10. Studying neutron particles will not contribute to understanding quantum mechanics.
 11. Partons are combinations of quarks and gluons.
 12. Physicists study the movement of particles using microscopic cameras.

Gap-Fill

13. Neutrons are made up of even smaller particles called _____ and gluons.
14. Physicists use tiny _____ to study the movement of particles.
15. A new detector at TJNAF is helping gather more information about _____.
16. Understanding the insides of _____ will give us new knowledge about quantum mechanics.
17. Quarks in neutrons are different from quarks in _____.
18. The data from the Central Neutron Detector is helping us learn more about how _____ work.

Answer

Multiple Choice: 1. Central Neutron Detector 2. Quarks and Gluons 3. Partons 4. Bullets 5. Physical Review Letters 6. Understanding the insides of atoms

True-False: 7. False 8. False 9. False 10. False 11. True 12. False

Gap-Fill: 13. quarks 14. bullets 15. neutrons 16. atoms 17. protons

Vocabulary quizzes

Multiple Choice (Select the Correct answer for each question.)



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1. What drives progress in various fields and industries?
 - Option: Dormancy
 - Option: Advancements
 - Option: Technology
 - Option: Ancestors

 2. Who studies the properties and interactions of matter and energy?
 - Option: Memory
 - Option: Researchers
 - Option: Physicists
 - Option: Particles

 3. Which disease affects the central nervous system and can cause tremors and difficulty with movement?
 - Option: Resist
 - Option: Dementia
 - Option: Parkinson
 - Option: Inflammation

 4. What are the elementary particles that combine to form protons and neutrons?
 - Option: Gluons
 - Option: Quarks
 - Option: Neutrons
 - Option: Particles

 5. What branch of physics deals with the behavior of very small particles like photons and electrons?
 - Option: Visceral
 - Option: Active
 - Option: Quantum
 - Option: Subcutaneous

 6. Which B vitamin is essential for converting food into energy?
 - Option: Toxins
 - Option: Biotin
 - Option: Riboflavin
 - Option: Memory

 7. In what way do different species live together without causing harm to each other?
 - Option: Resilient
 - Option: Survive
 - Option: Resist
 - Option: Coexist



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8. Who conducts systematic investigations to establish facts or reach new conclusions?
Option: Memory
Option: Active
Option: Quantum
Option: Researchers
9. What term is used to describe finding or learning something previously unknown or unseen?
Option: Similar
Option: Discovery
Option: Planned
Option: Ancestors
10. What is the ability of an organism to adjust to its environment for survival?
Option: Adapt
Option: Particles
Option: Gluons
Option: Quarks

Gap-Fill (Fill in the blanks with the correct word from the vocabulary list.)

11. In biology organisms that share _____ characteristics are often classified together.
12. Alzheimer's disease is associated with a decline in cognitive function and _____ loss.
13. Genetic traits are passed down from our _____ and can influence our physical appearance.
14. Organisms with advantageous traits are more likely to _____ and reproduce in a given environment.
15. Regular physical exercise helps to keep the body _____ and healthy.
16. Exposure to environmental pollutants and harmful substances can lead to the accumulation of _____ in the body.
17. Chronic _____ in the body can contribute to the development of various diseases.



18. Older adults may experience cognitive decline and memory loss as a result of _____.
19. The construction of a new city is a complex project that requires careful _____
and execution.
20. Antibiotics are used to help the body _____ bacterial infections.

Matching Sentences (Match each definition to the correct word from the vocabulary list.)

21. Subatomic particles found in the nucleus of an atom along with protons.
22. Fundamental units of matter that make up the universe and interact through forces.
23. Quantum particles that mediate the strong force which holds quarks together.
24. The ability to recover from difficulties and maintain stability and adaptability.
25. Located or placed just beneath the skin such as a subcutaneous injection.
26. Connect or associate one thing with another due to a relationship or connection.
27. A B vitamin that plays a key role in metabolism and energy production.
28. A state of minimal activity or reduced metabolic rate often to survive harsh conditions.
29. Technological and scientific progress leading to new innovations and discoveries.
30. Past generations from which individuals or species are descended.

Answer

Multiple Choice: 1. Advancements 2. Physicists 3. Parkinson 4. Quarks 5. Quantum 6. Riboflavin 7. Coexist
8. Researchers 9. Discovery 10. Adapt

Gap-Fill: 11. Similar 12. Memory 13. Ancestors 14. Survive 15. Active 16. Toxins 17. Inflammation 18.
Dementia 19. Planned 20. Resist

Matching sentence: 1. Neutrons 2. Particles 3. Gluons 4. Resilient 5. Subcutaneous 6. Linked 7. Biotin
8. Dormancy 9. Advancements 10. Ancestors

CATEGORY

1. Health - LEVEL2



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