# Theoretical and Experimental Research on Elements in Nuclear Synthesis Chemistry

**Authors:** Wen, Dr. Wen Bingxiong, Wen, Dr. Wen Bingxiong

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## Abstract

Research Background: This paper addresses four major experiments and theories in modern physics: cosmic abundance; the binding energies of various fundamental energies required for nucleosynthesis elements; the infinite asymmetry of energy required for various elements; quarks' requirements for sufficient gluons and pressure, as well as atomic saturation state theory. Previously, these five key points were each accomplished through separate individual experiments. Now, I have merged these four experiments to form innovative experimental and theoretical frameworks. The most significant feature of this paper is the simulation of the special environment within the interior space of stars in the universe. The main research objectives of this paper are fourfold: experimental methods for achieving stable physical properties under heavy element saturation states, experimental methods for synthesizing heavy elements and new elements, experimental methods for providing substantial energy in continuous chemical reactions, and experimental methods for determining the binding energies of hadrons, leptons, mesons, and higher quantum nuclei. Furthermore, magnetic confinement fusion experiments combine various energies and quantum confinement methods within finite spaces, along with rp-process and $\gamma$-process combination experiments. The energy generated by hydrogen recycling nuclear reactions can replace the energy from traditional heavy element nuclear fission and can be applied to nuclear reactor technology. Moreover, the energy conversion efficiency is high, and the energy can be widely utilized across various fields.

## Full Text

## Abstract

This paper presents theoretical and experimental research on nuclear synthesis chemistry, integrating four fundamental aspects of modern physics: cosmic abundance patterns, the binding energy requirements for nucleosynthesis, the infinite energy asymmetry needed for various elements, and the necessity of sufficient gluons and pressure for quark interactions, along with atomic saturation state theory. Previously investigated separately, these elements have now been combined into an innovative experimental framework. The distinguishing feature of this research is the simulation of extreme stellar interior conditions to achieve four primary objectives: developing experimental methods for stabilizing physical properties under heavy element saturation states, establishing techniques for synthesizing heavy and novel elements, creating continuous chemical reaction systems that provide substantial energy, and investigating binding energies for hadrons, leptons, mesons, and higher quantum nuclei. The approach combines magnetic confinement fusion experiments with finite-space quantum confinement methods and integrated Rp-process and $\gamma$-process experiments. The energy generated through cyclic hydrogen nuclear reactions can potentially replace conventional heavy element nuclear fission energy in reactor applications, offering high conversion efficiency and broad utility across multiple fields.

**Keywords:** chemical elements; synchrotron radiation; hadron; hydrogen; magnet

## 1. Cosmological Foundations

The formation of the first stars in the universe provides the theoretical basis for these experiments, wherein hydrogen clouds underwent nuclear fusion to create diverse elements, eventually forming solid planets and in some cases collapsing into black holes. Cosmic rays and particles represent the energy of nuclear excited state radiation, and various radiation types constitute crucial technologies for investigating artificial heavy elements, containing proof of different energy hierarchies. When heavy elements absorb radiation energy and particles to reach saturation, their physical properties become stable. Modern physics experiments confirm that heavy elements can absorb both radiation energy and gluons. This paper explores the physical connections underlying various aspects of nucleosynthesis element formation.

## 2. Principles of Simulated Celestial Body Experiments

The experimental design simulates stellar formation principles by recreating extreme physical conditions and special environments within stars. The fundamental approach involves reproducing all environmental conditions of stellar nuclear fusion in a laboratory setting. Modern nuclear reaction experiments emit numerous radiation types—including alpha, beta, gamma, infrared, ultraviolet, X-rays, and high-energy particles—whose fusion products form various radioactive chemical elements, confirming the high success rate of experimental synthesis.

Despite this capability, the cosmic origin of chemical elements remains incompletely explained. This research designs experiments to replicate extreme universal physical conditions, recognizing that chemical element formation is a product of stellar fusion where infrared, gamma, X-ray, and ultraviolet radiation play vital roles in chemical reactions. These radiations represent both nuclear physical properties and atomic radiation, demonstrating intimate connection to atomic structure.

The experiments employ high-density hydrogen, deuterium, or tritium to simulate primordial hydrogen clouds. Nuclear fusion radiation is represented by alpha rays, X-rays, infrared, ultraviolet, beta rays, gamma rays, neutron flux, proton flux, electron flux, and high-energy particles. A reference reaction involves the 2.22 MeV energy released when neutrons and protons combine in deuterium, emitted as gamma radiation. The reverse process occurs when tritium or deuterium nuclei are bombarded by gamma rays, dissociating into neutrons and protons. Such radiation and inverse radiation processes can provide both nuclear energy and the high binding energy demands required for nucleosynthesis through nuclear reaction mechanisms.

The experimental configuration includes neutron flow, proton flow, beta rays (high-speed electron flow), and magnetic field effects that induce circular electron motion, controlling radiation energy within the apparatus while increasing ion particle density. Since quantum science identifies neutrons, protons, and electrons as atomic main components, appropriate physical conditions can achieve heavy element nuclear binding in a reactor. Post-operation waste and radioactive substances demonstrate that particle and radiation collisions can form chemical elements. The simulation principle relies on magnetic confinement fusion, where collisions between fast neutrons and protons, as well as thermal neutrons and protons, require less binding energy than conventional proton-neutron reactions. Although this process doesn' t meet actual fusion temperature requirements and represents a magnetic confinement fusion subtype, it can create weak confinement spaces where free negative electrons (beta rays) combine with positive protons and neutrons within limited volumes. Deuterium and tritium in the apparatus undergo cyclic nuclear reactions rather than fusion itself.

This reaction produces nuclear energy—high-grade energy closest to the nuclear core level and fundamentally different from chemical reaction energy—serving as the primary binding energy for nucleosynthesis chemical elements. The experimental apparatus enables gamma ray bombardment of deuterium to dissociate protons and neutrons, their recombination into deuterium and tritium, hydrogen-neutron combination forming deuterium or tritium, gamma bombardment of tritium causing dissociation, and proton-beta ray reactions with free electrons forming hydrogen. These cyclic nuclear reactions release substantial high-grade energy. Initially, gamma rays bombard deuterium and tritium to release fast neutrons and protons along with nuclear energy. Upon reaching specific temperature and pressure conditions, fast neutrons and protons collide to form hydrogen, deuterium, and tritium, releasing abundant nuclear binding energy sufficient for further combinations. Since nuclear energy released during atomic dissociation and binding far exceeds the binding energy itself, an energy absorption-release differential emerges. Accumulated residual nuclear energy gradually increases temperature, reaching higher nuclear binding energy requirements. This cyclic chemical nuclear reaction continuously releases numerous hadrons, leptons, mesons, higher nuclear binding energies, various gluons required for quark reactions, and minimal gamma rays as reactor drivers. Only small gamma ray quantities are needed for efficient future energy output, substantially reducing radiation cost and technical difficulty. Magnetic confinement fusion devices confine these hadrons, leptons, and ions in finite space, where X-rays, gamma rays, neutron currents, proton currents, and other particles collide, causing energy and pressure collapse that increases compression density. The experimental space contains various fast neutrons, fast protons, electron currents, and quanta, facilitating atomic nucleus capture and new element formation. This ray and high-energy particle collision process provides necessary conditions for quarks with asymmetric energy, achieving quark effects and weak electric phase transition effects analogous to cosmic phenomena.

## 3. Analysis and Discussion

Previous researchers such as Hoyle failed in creating nuclear fusion elements because they overemphasized nuclear binding energy while neglecting cosmic element abundance and lacking sufficient gluon supply for quark reactions. Achieving nucleosynthesis abundance doesn' t necessarily require thermal energy or negative temperature; quantum energy exists in diverse forms that can be harnessed through special quantum energy and novel nuclear reactors to achieve cosmic abundance. Magnetic confinement fusion devices can both simulate nuclear fusion environments and constrain various energies and quanta in limited space, providing necessary gluons and binding energies for nucleosynthesis. The energy and plasma within the device exhibit infinite asymmetry, while continuous cyclic hydrogen nuclear reactions release abundant hadrons, mesons, and leptons that induce gluon binding into nucleons, thereby generating atoms. Hydrogen undergoes nuclear reactions in gaseous state, which doesn' t meet fusion density critical requirements and thus prevents explosion, ensuring stable, safe synthesis of superheavy atomic nuclei containing hundreds of protons, neutrons, and electrons in single nuclei. This experiment investigates four critical aspects: cosmic abundance, nucleosynthesis binding energy requirements, infinite energy asymmetry facilitating nucleon recombination, and quark requirements for sufficient gluons and pressure—satisfying every nucleosynthesis necessity. Modern artificial element experiments fail because they lack these four essential factors. Energy pressure causes intense collisions and collapse, creating shortages of hadrons, quanta, and energy in chemical nuclear reaction space while simultaneously replenishing basic particles and energy lacking in symmetry, achieving an infinitely unsaturated, asymmetric interface in the nuclear reaction process. When saturation reaches a certain threshold, new elements emerge—this constitutes the experimental design principle, with the apparatus functioning as a star simulator.

## 4. Experimental Equipment and Theoretical Design

This research designs an artificial chemical element experimental apparatus based on the following configuration:

A spherical vessel approximately 1-2 meters in diameter forms the core structure. The outer shell consists of lead metal with an inner polymer layer to prevent heat loss. A circular ring magnet at the sphere' s center generates extremely strong magnetic fields, tightly fixing a lead rod at the magnet' s center. This rod, serving as radiation-reflective material, is subjected to voltage exceeding 0.5 volts. Five circular coils (8 cm diameter, though scalable) are added to the magnet' s exterior with applied voltages ranging from 1 to 220 volts. The coils utilize mixtures of dozens of metal elements, potentially incorporating radioactive heavy and lanthanide elements while avoiding neutron-fission-prone metals to prevent nuclear fission. The coils must be constructed from heavy metals, as chemical reactions between heavy metal elements are minimal, allowing these radioactive elements to become saturated.

Radiation emitters for ultraviolet, infrared, alpha, X-ray, beta, and gamma radiation are installed at the sphere' s equator—two sets per radiation type. Additional neutron current emitters, proton current emitters, and neutron emitters are mounted at the sphere's top. The neutron emitter produces neutron streams through alpha particle bombardment of beryllium plates; when these neutron streams bombard paraffin, they generate proton streams. The apparatus includes alpha emitters, beta rays, gamma radiation emitters, plutonium elements in lead boxes, enhanced external magnetic and electric fields, and electrodes above the lead boxes emitting three-directional radiation beams. The sphere interior maintains vacuum conditions while filled with high-density hydrogen gas and tritium-deuterium mixtures. Hydrogen is crucial because stellar formation originates from hydrogen clouds, the universe' s most abundant gas comprising 76% of its elemental composition. Hydrogen nuclear reactions represent the simplest, most primitive, lowest technical difficulty, most effective, stable, and economical nuclear reaction technology, requiring only minimal gamma rays and low binding energy for efficient output while producing abundant hadrons, leptons, mesons, and gluons.

Gamma ray bombardment of deuterium dissociates protons and neutrons, with their recombination energy representing the most important and highest-level energy in element synthesis—fundamentally different from other chemical reaction energies. The entire process enables collisions between rays, between rays and magnets/coils, between fast neutrons and fast protons, between neutrons/protons and rays, and between nucleons, forming few-body systems. External current supplies produce numerous leptons and mesons, which are crucial for atomic nucleus formation.

**Component Functions:**

**Magnet:** Magnetic confinement of plasma increases particle density, while collisions release gamma rays from plutonium-containing lead boxes. This energy source bombards deuterium and tritium to dissociate protons and neutrons, providing essential energy and conditions for gamma processes.

**Beta rays:** Required for heavy element synthesis as they provide positive and negative electron sources.

**Alpha rays:** Used to bombard plutonium plates, producing neutron beam sources and high-energy fast neutrons. Alpha rays also generate high-energy neutrons that bombard paraffin to create proton streams—high-energy fast protons. This design effectively utilizes lead box alpha rays while increasing fast proton and neutron mass/density, enhancing collision opportunities for heavy element synthesis under Rp-process physical conditions.

**Heavy metal circle:** Radioactive elements become saturated, stabilizing physical properties and providing raw material for heavier element nucleosynthesis.

**Hydrogen nuclear reaction:** Provides sufficient nuclear binding energy. Continuous hydrogen atom decomposition and synthesis produce high-energy fast protons and neutrons whose collisions directly or indirectly generate hadrons, leptons, mesons, and gluons, as high-energy particle collisions can create new particles in extremely short timeframes.

**Possible Particle Types:**

**1. Hadrons:** Including protons, neutrons, and more complex particles such as baryons, easily generated during collisions through strong interaction forces.

**2. Leptons:** Such as electrons, muons, and their corresponding neutrinos. Leptons don' t participate in strong interactions but frequently appear alongside other particles in high-energy reactions.

**3. Mesons:** Composed of quarks and antiquarks, such as $\pi$ mesons (pions) and K mesons (kaons), occurring in hadron interactions and decay processes.

**4. High-energy particle collisions** not only produce gluons but also form quark-gluon plasmas, jets, and other phenomena through complex strong interaction processes, providing crucial experimental foundations for studying strong interactions and elementary particle properties. In extreme high-energy environments with abundant hadrons, leptons, mesons, and gluons (such as the early universe or high-energy colliders), nuclear reaction rates and mechanisms change significantly. Under high temperature and density, increased particle collision frequency, enhanced strong nuclear forces, and material state transitions may accelerate overall nuclear reaction rates, supplying basic particles, nuclear physics reaction sources, and provisions required for heavy element nucleosynthesis.

**Radiation Effects:** Gamma, beta, alpha, X-ray, ultraviolet, and infrared rays create asymmetric effects on nucleons and energy during heavy element synthesis. Radiation energy interferes with nuclear spin energy, splitting nuclear energy levels and making originally symmetrical levels asymmetric. Plasma generated during nuclear reactions also contributes to asymmetry effects. Asymmetric nuclei are unstable and readily accept nuclear recombination, with energy supplied by hydrogen nuclear reaction particle energy. Various radiation energies serve as special energy types required for nucleosynthesis, with saturated elements needing such energy inputs.

**Magnetic lead rod:** The central magnetic lead rod reflects particles and rays, increasing collision probability. By adjusting gamma ray, X-ray, and infrared radiation intensity, the time required for element formation at specific radiation proportions can be controlled, and neutron/proton flow intensity into the radiation source can be modulated to verify specific heavy elements formed under different intensities through actual experiments.

**Safety Considerations:** Extreme care must be taken to prevent plutonium element loss and radioactive leakage. Monitor sphere changes, excessive pressure, high temperature, and other physical transformations. For simple, efficient thermal energy output, metal coils may be omitted.

This experiment operates in secondary magnetic confinement fusion space, where radiation energy, quantum energy, and particles gradually increase density and energy pressure in finite space, existing in infinite asymmetry. Upon reaching certain saturation, they collapse and evolve into elements. Artificial elements are generally heavy and prone to decay through three mechanisms: alpha decay, beta decay, and gamma decay. Larger heavy element masses increase decay probability due to lacking one or more nuclear equilibrium particles. Fewer equilibrium particles make heavy element maintenance more difficult, triggering decay. Heavier elements require more nuclear equilibrium particles.

This experiment specifically addresses heavy element decay by using radiation energy emitted from heavy elements to bombard radioactive materials with radiation and quantum energy, replenishing and absorbing specific nuclear equilibrium particles and providing conditional nucleosynthesis energy and nucleons. This allows nucleosynthesis heavy element cores to reach saturation states, enabling saturated elements to increase and maintain stability before decay occurs. Whether in modern physics experiments or cosmic celestial changes, saturation typically transforms physical states into their opposites—this principle underlies new element formation. Saturated-state heavy elements exhibit stable physical properties resistant to change, yet when energy pressure is applied to saturated heavy elements, core collapse causes nuclear instability, making them more receptive to other nucleons and producing heavier mass numbers—again forming new elements.

**Advantages of Rp-Process and $\gamma$-Process Combination [10]:**

1. Collision nuclear reactions between kinetic fast neutrons and fast protons, plus thermal neutrons and thermal protons, require less binding energy than conventional proton-neutron reactions. This cyclic hydrogen nuclear reaction' s decomposition and binding releases substantially more binding energy. The new reactor' s differential between absorption and release

values represents the paper’ s primary success, potentially replacing conventional heavy element nuclear fission energy for reactor technology with high conversion efficiency and broad applicability.

2. Magnetic confinement space increases ion density and optimizes nuclear synthesis speed.
3. Abundant high-density beta ray electron flow, fast neutrons and protons, leptons, and mesons enable heavy element nucleation into heavier atoms—an advantage lacking in heavy nuclear fission and light nuclear fusion, which don’ t involve high-energy particle collisions or post-transformation lepton and meson production.
4. Increased radiation energy meets multiple nuclear binding energy levels, stabilizing artificial heavy element physical properties.
5. Nucleosynthesis nuclear arrangement proceeds orderly with balanced, ordered proton-neutron-electron combinations, greatly increasing nuclear force diameter control range and enabling synthesis of heavier, more stable heavy and new elements—an advantage over target-shooting nucleosynthesis.
6. Various radiation types not only split atomic energy levels to create core energy asymmetry but also saturate radioactive elements, stabilizing physical properties, making reactors safer and waste easier to handle. For simple, efficient thermal output, metal coils may be omitted.

[Figure 2: see original paper]

## 5. Conclusion

This experiment’s advantage lies in creating environmental conditions analogous to cosmic star element formation, making artificial element formation absolutely possible. Many artificial elements beyond atomic number 93 on the periodic table exhibit highly unstable physical properties, easily transforming into other elements. Most are obtained by bombarding materials with particle accelerators—known as shooting physics or quark physics—forming elements only briefly. This paper speculates that shooting-type and quark physics artificial element methods suffer from insufficient energy or lack one or more essential basic constituent particles and quanta, such as neutrinos, leptons, mesons, and hadrons, causing elemental physical instability. Moreover, target-shooting nucleosynthesis produces disordered heavy element nucleon arrangement, drastically reducing nuclear force control diameter and causing physical instability.

By designing simulations of nuclear fusion under extreme physical and special environmental conditions, and through sufficient time with strong collision models or natural combinations forming physically stable elements, new chemical elements can be discovered, solving technical complexities in artificial element refining and utilization difficulties from unstable physical properties. This research deeply investigates cosmic element source combinations and modern physical methods, designing experimental approaches for artificial elements. If theory and experiments succeed, physics and chemistry research will open new channels and models, disrupting modern scientific development and advancing energy, chemistry, and physics with immeasurable significance due to these enormous changes.

## 6. Data Declaration

This article uses limited data without incorporating new datasets, simply summarizing previously published scientific data to create a novel experimental approach. Old data appears in reference materials. Due to inability to retrieve recent research literature, references are limited. This article' s importance lies in its special experimental methodology—an innovative experimental type combining four aspects of artificial chemical element theory: cosmic abundance, nucleosynthesis energy, quantum energy deficiency symmetry, and gluon replenishment for quarks. While solving four main artificial element problems, this approach may produce more stable radioactive elements or new chemical elements through experimental design for cosmic chemical element formation, innovating new ideas and research methods.

Recent decades have seen no new progress in artificial chemical heavy element research, with achievements reaching a bottleneck. To further understand cosmic mysteries, research methods must change to improve modern chemical artificial heavy element studies. Since modern chemistry only undergoes certain reaction types, changing reaction methods can discover stable physical properties in new and radioactive heavy elements.

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*Note: Figure translations are in progress. See original paper for figures.*