**European Journal of Applied Sciences – Vol. 13, No. 06**
**Publication Date:** December 20, 2025
**DOI:**10.14738/aivp.1306.19746.
Herndon, J. M. (2025). Origin of the Elements Constituting the Universe and Thermonuclear Ignition of Dark Galaxies. *European Journal of Applied Sciences, Vol - 13(06).* 218-235.

# Origin of the Elements Constituting the Universe and Thermonuclear Ignition of Dark Galaxies

**J. Marvin Herndon, Ph.D.**
Transdyne Corporation, Dewees Island, SC USA

## ABSTRACT

**Galaxies are prominent features as deep into the universe as astronomers can observe. Among the vast number of galaxies, there are only a few prominent morphologies, suggesting a commonality of formative conditions. Galaxies and the origin of elements heavier than hydrogen and helium are inexplicable within the current foundations of astrophysics which are based upon stellar ignition by gravitational collapse, galaxy formation from luminous stars, and abrogation of scientific standards. Here I present evidence for a fundamentally different understanding that began with the realization that thermonuclear reactions in stars, as in hydrogen bombs/devices, are ignited by nuclear fission chain reactions, and ultimately that dark stars in dark galaxies are ignited by nuclear matter jetted out from the galactic center. The luminous stars of galaxies are evidence of the paths of galactic jets that contacted and seeded dark stars with fissionable elements that ignited their thermonuclear fusion reactions. The nuclear matter of the galactic jets, I posited, is the principal origin and source of elements heavier than hydrogen and helium. The spherical assemblage of un-ignited dark stars maintains the dynamical stability of the pattern of luminous stars as required by the velocity dispersions and rotation curves evidenced by Vera C. Rubin.**

## INTRODUCTION

Theodore W. Richards received the 1914 Nobel Prize in Chemistry for making precise measurements of atomic weights [1]. Joseph John Thompson discovered that the atomic weight of an element is really an expression of the weighted average of the weights of its individual components, later called isotopes [2]. Francis William Aston followed, inventing the mass spectrograph and with it eventually identified about 70% of the 244 naturally occurring stable isotopes now known to exist [3]. Scientists throughout the world measured isotopic compositions of elements from the Earth and from meteorites, and found each element to be identical, except in a few very special circumstances. In other words, the Earth and the meteorites (and, found later, the Moon) formed from well-mixed matter of common origin.

Understanding the nature of the solar spectrum was developed during the early part of the nineteenth century, which made it possible to detect the presence of elements in the photosphere of the sun. By 1893, forty one elements were claimed to have been identified in the sun by the absorption lines in the solar spectrum [4].

In the 1920s, astronomers began to tackle the extremely difficult problem of determining the relative amounts of the elements identified through their absorption lines in the atmosphere of the sun [5]. Almost immediately, the relative abundances of elements in the sun and in chondritic meteorites were realized to be quite similar [6]. Yet decades elapsed before a ten-fold discrepancy in the abundance of iron was resolved [7].

The oxygen-rich Orgueil carbonaceous chondrite and the oxygen-poor Abee enstatite chondrite were found to have quite similar corresponding elemental abundance ratios to those of the sun, at least for the less-volatile elements, as shown in Figure 1 [8-13]. Moreover, the abundances of the elements were discovered to be related, although in a complex way, to nuclear properties [14].

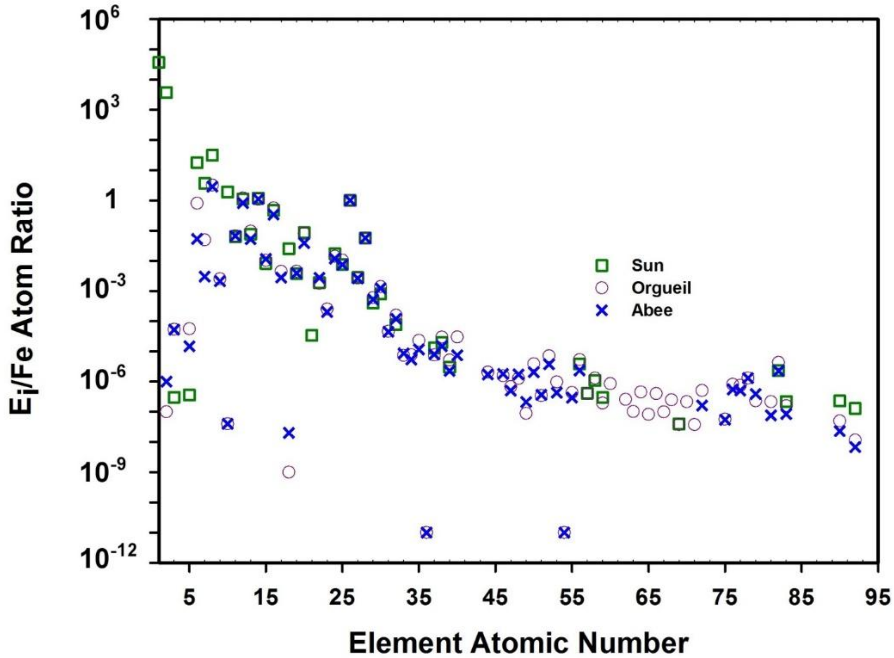


**Figure 1: Comparison of relative element atom-abundances, normalized to iron, in the sun and in the Orgueil carbonaceous chondrite and in the Abee enstatite chondrite. From [15].**

The sun is an ordinary star in an ordinary galaxy so one might expect a commonality of processes involved in the origin of the elements universe-wide.

In a 1957 scientific article, entitled "*Synthesis of the Elements in Stars*," Burbidge, Burbidge, Fowler, and Hoyle [16] proposed that chemical elements are synthesized in stars by a number of processes. Heavy elements, however, were assumed to be solely produced by "rapid neutron capture" during supernova explosions. These ideas are still widely believed [17]. Subsequent observations [18], I posited, led to a fundamentally different understanding of the origin of the elements [19] (Figure 2), which I describe briefly here and extend.

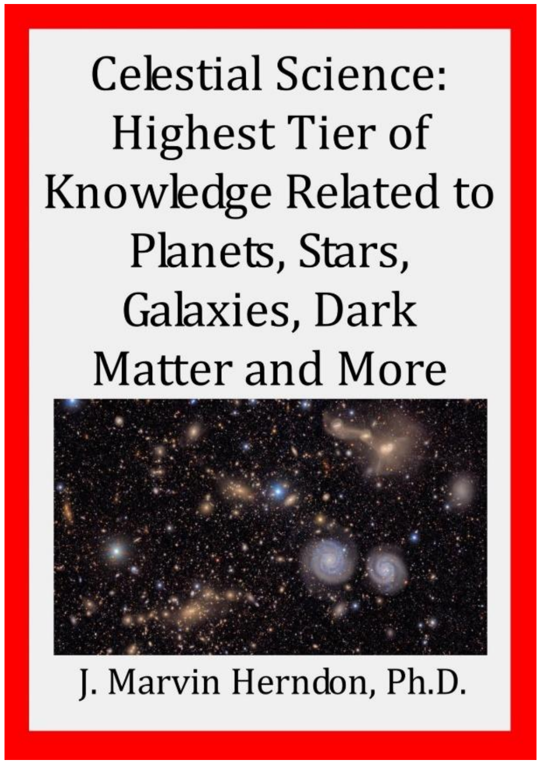


**Figure 2: [19].**

## BACKGROUND

At the beginning of the 20th century, understanding the nature of the energy source that powers the sun and other stars was one of the most important unsolved problems in the physical sciences. Initially, it was thought that during formation, when dust and gas coalesce and collapse by gravitational attraction, great amounts of heat would be produced. But calculations showed that the energy release would be insufficient to power the sun for as long as life has existed on Earth. Following the discovery of radioactivity by Becquerel in 1896 [20], numerous experiments began to reveal the nature of radioactivity, the atomic nucleus, and nuclear reactions [21]. In 1934, Oliphant, Harteck, and Rutherford [22] discovered thermonuclear fusion reactions. Thermonuclear fusion reactions are called thermonuclear because temperatures of more than 1,000,000°C are required for the nuclei to achieve the very high velocities needed to overcome the electric charge repulsion and get close enough for the nuclei to react. When the fusion reaction takes place, a great quantity of energy is released.

Thermonuclear fusion reactions seemed to be the unknown source of energy that powers the sun and other stars, which contain copious amounts of hydrogen and helium. The scientific development of solar thermonuclear reactions was undertaken by nuclear physicists such as Edward Teller [23] and Hans Bethe [24], whose names would later be associated with the development of nuclear weapons.

By 1938, theoretical investigations on the thermonuclear reactions thought to power the sun and other stars had sufficiently progressed that there seemed to be no longer any question as to the sun's energy source. In 1938, there was no energy source known that could produce the million degree temperatures necessary to ignite thermonuclear fusion reactions. So, it was just assumed that such temperatures would be produced during star formation when dust and gas coalesce and collapse by gravitational attraction.

In 1965, Hayashi and Nakano [25] first showed that gravitational collapse of dust and gas during star formation would not yield the requisite million degree temperatures for igniting thermonuclear fusion reactions. The reason is obvious. Heating a forming star by gravitational collapse of dust and gas is offset by heat radiated from its surface, which is a function of the fourth power of temperature. In other words, TxTxTxT represents a huge loss factor when T ≥ 1,000,000°C. But instead of asking "What is wrong with this picture?", astrophysicists just made *ad hoc* assumptions, such as a shock-wave induced flare up, or they tweaked model-parameters in attempts to attain the requisite temperatures [26, 27].

The sun is like a hydrogen bomb held together by gravity. Both are powered by thermonuclear fusion reactions, and both require temperatures on the order of a million degrees Celsius for ignition. Yet a thorough search of the scientific literature revealed that no one before me had thought of the idea that thermonuclear fusion reactions in stars [23, 24, 28-30] are ignited by nuclear fission reactions, which I published in 1994 in the *Proceedings of the Royal Society of London* [18].

Splitting the uranium nucleus releases an enormous amount of energy and liberates neutrons. These newly released neutrons could split other uranium nuclei, which could split others, and so forth in a chain reaction that is the basis for the atomic (nuclear fission) bomb [31, 32]. In every thermonuclear hydrogen bomb (or device) detonation, the requisite temperatures are obtained through use of an associated nuclear fission trigger.

## THERMONUCLEAR IGNITION OF STARS AND THE NATURE OF DARK MATTER

The nature of dark matter represents an outstanding problem in astrophysics. In the old, flawed paradigm, stars (except tiny brown dwarfs) are always thought to ignite by gravitational collapse during formation. In my new paradigm [18], however, stellar ignition requires the presence of very heavy elements, such as uranium or plutonium, to undergo nuclear fission chain reactions. As I noted in 1994, the corollary to thermonuclear ignition is non-ignition, which might result from the absence of fissionable elements, and which would lead to dark stars [18]. A dark star the mass of the sun after cooling would have a diameter similar to that of Earth [33]. The idea that stars are ignited by nuclear fission opens the possibility of stellar non-ignition, a concept which has fundamental implications bearing on the nature of dark matter and, as I suggested [19, 34] and discuss below, on the thermonuclear ignition of dark galaxies, on the distribution of luminous stars in galaxies universe-wide, and on the principal origin of elements heavier than hydrogen and helium.

Vera C. Rubin's observational evidence [35], primarily based on velocity dispersions and rotation curves, suggests that spiral galaxies have associated with them massive, spheroidal, dark matter components, thought to reside in their galactic halos.

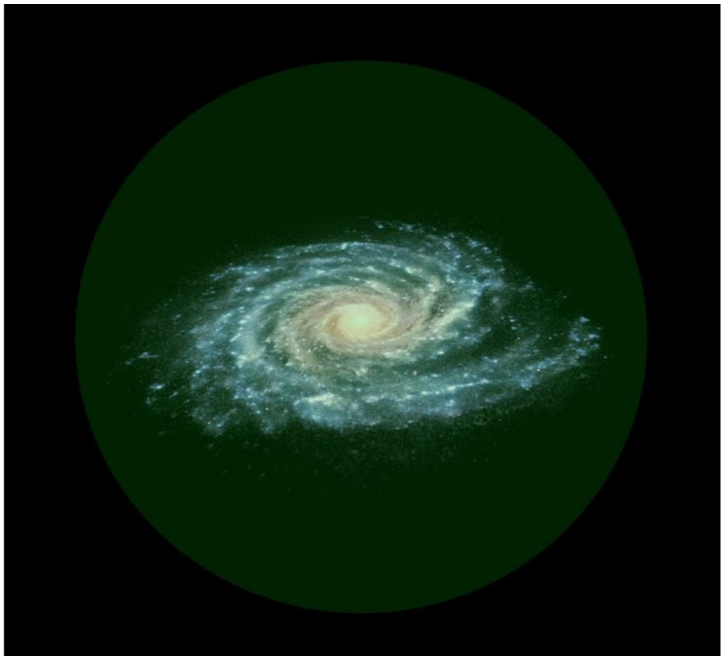

**Figure 3: Typical spiral galaxy. The hypothetical green halo shows the region where dark matter is thought to reside, imparting dynamic stability to the luminous configuration of stars [35].**

Interestingly, the luminous disc stars of spiral galaxies belong to the heavy-element-rich Population I; the luminous spheroidal stars of spiral galaxies belong to the heavy-element-poor Population II. In spiral galaxies, the dark matter components are thought to be associated in some manner with the spheroidal heavy-element-poor Population II stars [36, 37]. The association of dark matter with heavy-element-poor Population II stars is inferred to exist elsewhere, for example, surrounding elliptical galaxies [38, 39]. Because of the apparent association of dark matter with heavy-metal-poor Population II stars, I suggested the possibility that these dark matter components are composed of what might be called Population III stars, zero metallicity stars or stars at least devoid of fissionable elements, and, consequently, unable to sustain the nuclear fission chain reactions necessary for the ignition of thermonuclear fusion reactions [18].

**Figure 4: Vera C. Rubin Observatory image showing a small section of the Virgo galaxy cluster. Visible are two prominent spiral galaxies (lower right), three merging galaxies (upper right), several groups of distant galaxies, many stars in the Milky Way galaxy, and more.**

Figure 4 is a Vera C. Rubin Observatory image showing numerous galaxies. Two features stand out and beg for explanation. First, among this vast number of galaxies, there are only a few prominent morphologies, suggesting a commonality of formative conditions. Second, a vast proportion of the observable luminous galaxies are flat, not spherical. Although dark matter is thought to be more than an order of magnitude more abundant than luminous matter in the universe, there has yet to be an unambiguous identification of a wholly dark, galactic-scale structure. There is, however, increasing evidence that VIRGOHI 21, a mysterious hydrogen cloud in the Virgo Cluster, discovered by Davies et al. [40] may be a dark galaxy. Minchin et al. [41] suggested that possibility on the basis of its broad line width unaccompanied by any responsible visible massive object. Subsequently, Minchin et al. [42] found an indubitable interaction with NGC 4254 which they took as additional evidence of the massive nature of VIRGOHI 21. If indeed VIRGOHI 21 turns out to be composed of dark stars having approximately the mass of stars found in luminous galaxies, it would lend strong additional support to my concept of stellar thermonuclear ignition by nuclear fission [18].

The existence of a dark galaxy composed of non-brown-dwarf, solar-massive dark stars would certainly call into question the long-standing idea of gravitational collapse as the sole source of heat for inevitable stellar thermonuclear ignition, which after all has no laboratory support, unlike my idea of a nuclear fission trigger [18], which has been demonstrated experimentally with each hydrogen bomb/device detonation.

## THERMONUCLEAR IGNITION OF DARK GALAXIES

The conditions and circumstances at galactic centers appear to harbor the necessary pressures for producing highly dense nuclear matter and the means to jet that nuclear matter out into the galaxy where, as suggested here, the jet seeds dark stars which it encounters with fissionable elements, turning dark stars into luminous stars. Galactic jets, either single or bi-directional, are observed originating from galactic centers, although little is currently known of their nature. Figure 5 is a Hubble Space Telescope image of three galactic jets, one 4,000 light-years long, one 10,000 light-years long, and one which was observed to have a length of 865,000 light-years.

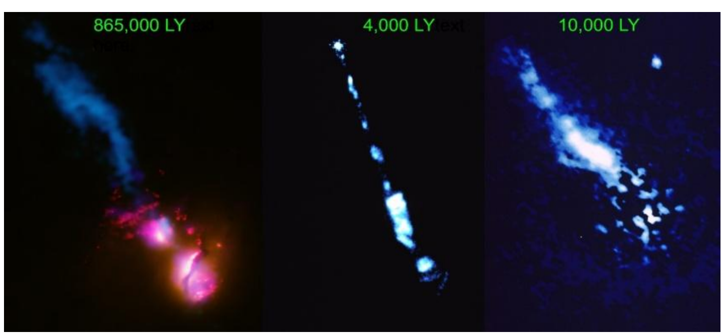


**Figure 5: Hubble Space Telescope images of galactic jets with their lengths indicated in light years.**

Although little is known of the physical processes occurring deep within the massive galactic center, some geophysical evidence suggests a possible means for galactic jets shooting from the galactic center and typically shooting out into the galactic rotation plane. Earth's behavior is described by *Whole-Earth Decompression Dynamics* [43-47], which is the basis for virtually all surface geology and geodynamics. Primordial condensation at high pressures, high temperatures from within a giant gaseous protoplanet resulted in oxygen-starved elemental matter raining out to form Earth's interior, including uranium concentrating at Earth's center and functioning as a nuclear fission breeder reactor [18, 48-57].

Earth's complete primordial condensation and aggregation resulted in the formation of a gas giant planet whose rocky interior was surrounded by 300 Earth-masses of ices and gases, a planet similar in mass to Jupiter. At the center, the rocky planetary interior with its fluid core was compressed to about two-thirds Earth's present diameter by the weight of overlying ices and gases. T-Tauri solar winds, presumably associated with thermonuclear ignition of the sun, stripped away the overlying ices and gases leaving a compressed Earth fully surrounded by a shell of continental rock.

**Figure 6: Former diamond mine in the Far Eastern Federal Distric, Russia. Courtesy of Staselnik.**

As pressures built within the Earth, occasionally there would be a "blow out". Pressure would force a column of matter from a depth of about 150 km to puncture a narrow hole a few meters in diameter through all of the overlying rock and explode at the surface in a funnel shape as wide as 200 meters (Figure 6) [58]. The eruptions of these diamond-bearing kimberlite pipes, however, were just sporadic events. Major catastrophic geological violence would occur again and again, as whole-Earth decompression split the continental crust, created new ocean basins, produced mountain ranges characterized by folding, and caused widespread species extinction [59].

**Figure 7: Hubble Space Telescope image of NGC 4676 showing the beginning formation of a spiral or barred spiral galaxy as the first jet is sent out from the galactic center and seeds the dark stars it encounters with fissionable matter, thus igniting the dark stars along its path.**

**Figure 8: Hubble Space Telescope image of NGC 10214 showing the beginning formation of a luminous spiral or barred spiral galaxy as the initial jets sent out from the galactic center contact the dark stars along their paths, seeding the dark stars with fissionable matter, thus igniting those contacted dark stars. The luminous stars are records of the paths of previous galactic jets.**

**Figure 9: Group of galaxies known as Stephan's Quintet. Note the young galaxies just beginning to send out galactic jets of nuclear matter which ignite the thermonuclear reactions in the dark stars they encounter, turning dark stars into luminous stars.**

By analogy one might expect highly compressed nuclear matter to erupt from deep within the galactic core in a pipe-like manner producing the jets that seed the galaxy of dark stars with fissionable matter, turning dark stars it encounters into luminous stars. The centrifugal force due to galactic rotation biases and constrains the eruptions to the galactic plane. Consider a more-or-less spherical, gravitationally bound assemblage of dark (Population III) stars, a not-yet-ignited dark galaxy. Now, consider the galactic nucleus as it becomes massive and shoots its first jet of nuclear matter into the galaxy of dark stars, seeding and igniting those stars which it contacts. How might such a galaxy at that point appear? I suggest it would appear quite similar to NGC 4676 (Figure 7), to NGC 10214 (Figure 8), and to some of the group of galaxies known as Stephan's Quintet (Figure 9).

The arms of spiral galaxies, such as M101 (Figure 10), possess morphologies which I suggest occur as a consequence of central galactic jetting of fissionable elements into the essentially spherical galaxy of dark stars, seeding the dark stars encountered with fissionable elements, thus igniting thermonuclear fusion reactions, lighting the contacted dark stars. The spherical assemblage of un-ignited dark stars comprises the "dark matter" that serves to maintain the dynamically stable configuration of the spiral pattern of luminous stars.

**Figure 10: Hubble Space Telescope image of M101, the Pinwheel Galaxy in the constellation Ursa Major, showing the paths where galactic jets have seeded dark stars in their paths, igniting thermonuclear fusion reactions in their dark stars by nuclear fission chain reactions thereby changing the estimated 1 trillion dark stars to luminous stars, leading to the commonality of luminous features that give galaxies their customary appearances.**

The structures of just about all luminous galaxies, including the examples shown in Figures 11-19, appear to possess the jet-like luminous-star features, the imprints of the galactic jets which gave rise to their thermonuclear ignition, the imprints of the distribution of fissionable, heavy element seeds. Therein is the commonality connecting the vast number of observed galactic structures with the logical and causal relationships I have described [18, 19, 34, 60, 61].

**Figure 11: Hubble Space Telescope image of NGC 2008 spiral galaxy in the constellation Pictor showing the paths where galactic jets have seeded dark stars in their paths, igniting thermonuclear fusion reactions in those dark stars by nuclear fission chain reactions, producing the luminous pattern common to the multitude of galaxies. The surrounding massive spherical assemblage of yet un-ignited dark stars maintains the dynamical stability of the pattern of luminous stars.**

**Figure 12: Hubble Space Telescope image of M51 (NGC 5194) also known as the Whirlpool Galaxy, which lies in the constellation Canes Venatici, showing paths of previous dark stars that became luminous stars when contacted by the nuclear matter jets from the galactic center. As in the case of virtually all galaxies, the pattern of luminous stars is maintained by the gravitational attraction of the massive spherical assemblage of yet un-ignited dark stars.**

**Figure 13: Hubble and James Webb Space Telescopes combined image of NGC 5468 in the constellation Virgo. Note the galactic commonality of features attributed to thermonuclear ignition of dark stars by galactic jets of nuclear matter, and where dynamical structure stability is imparted by its massive spherical halo of un-ignited dark stars.**

**Figure 14: Upper: James Webb and Hubble Space Telescopes image of colliding galaxies NGC 2207 and IC 2103, each showing paths of previous dark stars that became luminous stars when contacted by the nuclear matter jets from the galactic centers. Lower: Same photographed in mid ultraviolet light.**

**Figure 15: James Webb Space Telescope image of NGC 2090. As with virtually all galaxies, note the configuration of luminous stars that bear witness to the galactic jets of nuclear matter that seeded the spherical assemblage of dark stars enabling those contacted stars to ignite their thermonuclear fusion reactions and become luminous.**

**Figure 16: Hubble Space Telescope image of NGC 1300 barred spiral galaxy showing the paths where galactic jets seeded dark stars with fissionable matter that ignited their thermonuclear fusion reactions by nuclear fission chain reactions, changing dark stars into luminous stars.**

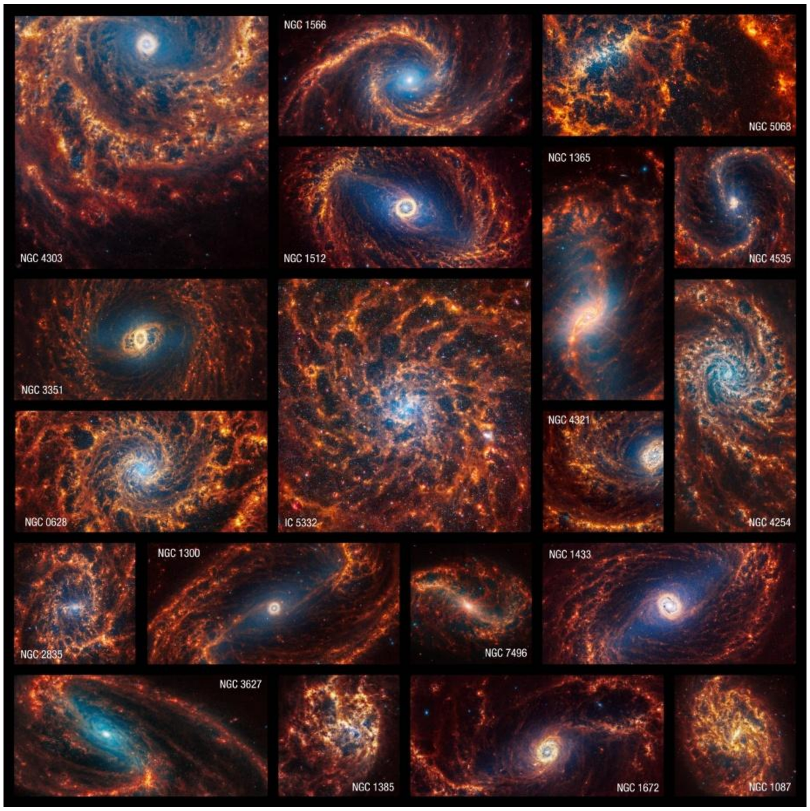


**Figure 17: James Webb Space Telescope collection of 19 galaxies observed in near- and mid-infrared light. The luminous stars in each example bear witness to the galactic jets of nuclear matter that seeded each spherical assemblage of dark stars enabling those contacted stars to ignite their thermonuclear fusion reactions and become luminous.**

**Figure 18: Hubble Space Telescope image of galactic cluster in the constellation Cetus (the whale) showing that the multitude of galaxies have luminous features common to my suggestion [18, 19, 34, 60, 61] that galactic jets of nuclear matter seed dark stars they encounter in the spherical galactic assemblage of dark stars with fissionable elements, igniting their thermonuclear fusion reactions and producing the observed patterns of luminous stars.**

**Figure 19: James Webb Space telescope ultra-deep field view showing a multitude of galaxies having the same jet-induced characteristic distributions of luminous stars.**

And what of the dark matter necessary for dynamical stability of the structures of luminous galactic stars? The dark matter is the spherical halo of un-ignited dark stars, located just where it must be to impart rotational stability to the galactic luminous structure [35].

## ORIGIN OF ELEMENTS HEAVIER THAN HYDROGEN AND HELIUM

Since the 1930s, astrophysics has been built upon the concept that thermonuclear reactions in stars are ignited automatically by heat generated by the collapse of dust and gas during star formation. Not only are there severe problems associated with that concept, because of extreme heat loss at high temperatures during formation, but the observed jet-like distributions of luminous galactic stars are wholly inexplicable within that context. In stark contrast, the quite-limited variety of morphological galactic forms, especially the prevalence of jet-like arms can be understood in a logical and causally related way from my concept of heavy-elements being formed in galactic centers and jetted into the spherical galaxy of dark stars where they seed the dark stars they encounter with fissionable elements, which in turn ignite thermonuclear fusion reactions. From that perspective, the distribution of luminous stars in a galaxy, and consequently the type of galaxy, for example, barred or spiral, may simply be a reflection of the distribution of the fissionable elements jetted from the galactic center.

Astrophysicists group stars into two categories based upon their metal content. The association of low-metal stars in the region believed populated by zero-metal stars, *i.e.*, dark stars [18], suggests to me that there exist two *primary* sources of chemical elements. One of the two *primary* sources consists solely of a mixture of hydrogen and helium (the stuff of zero-metallicity stars). The other *primary* source consists of the nuclear matter jetted out from the galactic center that yields not only the fissionable elements that ignite thermonuclear fusion reactions, but virtually all elements heavier than hydrogen and helium. *Secondarily*, over their lifetimes stars may synthesize some elements internally as well as possibly accumulating debris from previous astrophysical trauma-events.

As noted above, observational evidence, primarily based on velocity dispersions and rotation curves, indicates that spiral galaxies have associated with them massive, spheroidal, dark matter components, thought to reside in their galactic halos [35]. The disk stars of spiral galaxies, typically subjected to the most direct assault by galactic jets, consequently, belong to the heavy-element-rich Population I. The luminous spheroidal stars of spiral galaxies, typically subjected to only indirect assault by galactic jets, belong to the heavy-element-poor Population II [36, 37]. The association of dark matter with heavy-element-poor Population II stars is inferred to exist elsewhere, for example, surrounding elliptical galaxies [38, 39] and is indicative of only indirect assault by galactic jets. The apparent association of the relative degree of metallicity with the proximity to galactic jets is compelling evidence of my fundamental statement that the "other *primary* source" of elements consists of the nuclear matter jetted out from the galactic center that yields not only the fissionable elements that ignite thermonuclear fusion reactions, but virtually all elements heavier than hydrogen and helium.

## CONCLUSIONS

Galaxies are prominent features as deep into the universe as astronomers can observe. Among the vast number of galaxies, there are only a few prominent morphologies, suggesting a commonality of formative conditions. Galaxies and the origin of elements heavier than hydrogen and helium are inexplicable within the current foundations of astrophysics which are based upon stellar ignition by gravitational collapse, galaxy formation from luminous stars, and abrogation of scientific standards. I have presented evidence for a fundamentally different understanding that began with the realization that thermonuclear reactions in stars, as in hydrogen bombs/devices, are ignited by nuclear fission chain reactions, and ultimately that dark stars in dark galaxies are ignited by nuclear matter jetted out from the galactic center. The luminous stars of galaxies are evidence of the paths of galactic jets that contacted and seeded dark stars with fissionable elements that ignited their thermonuclear fusion reactions. The nuclear matter of the galactic jets, I posited, is the principal origin and source of elements heavier than hydrogen and helium. The spherical assemblage of un-ignited dark stars maintains the dynamical stability of the pattern of luminous stars as required by the velocity dispersions and rotation curves evidenced by Vera C. Rubin [35].

## References

1. Richards, T.W., Nobel Prize Lecture in Chemistry 1914, in Nobel Lectures, Chemistry 1901-1921. 1966, Elsevier Publishing company: Amsterdam.
2. Thomson, J.J., Rays of positive electricity. Proc. R. Soc. Lond., Ser. A, 1913. A89: p. 1-20.
3. Aston, F.W., Isotopes. 1922, London: Edward Arnold. 152.
4. Gregory, R.A. and J.C. Christie, Advanced Physiography. 1893, London: Joseph Hughes & Co. 277.
5. Russell, H.N., On the composition of the Sun's atmosphere. Astrophys. J., 1929. 70: p. 11-82.

6. Goldschmidt, V.M., Geochemische Verteilungsgestze der Elemente. IX. Die Mengenverhältnisse der Elemente und der Atom-arten. Skrifter Norske Videnskaps-Akad., Oslo I Math.-Naturv. Klasse, 1938. No. 4: p. 148.

7. Unsold, A., Abundance of iron in the photosphere. Phil. Trans. Roy. Soc. Lond., 1971. A270: p. 23-28.

8. Aller, L.H., The Abundances of the Elements. 1961, New Your: Interscience Publishers. 283.

9. Anders, E. and M. Ebihara, Solar-system abundances of the elements. Geochim. Cosmochim. Acta, 1982. 46: p. 2363-2380.

10. Anders, E. and N. Grevesse, Abundances of the elements: Meteoritic and solar. Geochim. Cosmochim. Acta, 1989. 53: p. 197-214.

11. Cameron, A.G.W., Abundances of the elements in the solar system. Space Sci. Rev., 1973. 15: p. 121-146.

12. Suess, H.E. and H.C. Urey, Abundances of the elements. Rev. Mod. Phys., 1956. 28: p. 53-74.

13. Asplund, M., et al., The chemical composition of the Sun. Annual review of astronomy and astrophysics, 2009. 47: p. 481-522.

14. Haxel, O., J.H.D. Jensen, and H.E. Suess, Concerning the interpretation of “magic” nucleon numbers in connection with the structure of atomic nuclei. Die Naturwissenschaften, 1948. 35: p. 376.

15. Herndon, J.M., Making sense of chondritic meteorites. Advances in Social Sciences Research Journal, 2022. 9(2): p. 82-102.

16. Burbidge, E.M., et al., Synthesis of the elements in stars. Rev. Mod. Phys., 1957. 29(4): p. 547-650.

17. Anders, E. and N. Grevesse, Abundances of the elements: Meteoritic and solar. Geochimica et Cosmochimica acta, 1989. 53(1): p. 197-214.

18. Herndon, J.M., Planetary and protostellar nuclear fission: Implications for planetary change, stellar ignition and dark matter. Proc. R. Soc. Lond, 1994. A455: p. 453-461.

19. Herndon, J.M., Celestial Science: Highest Tier of Knowledge Related to Planets, Stars, Galaxies, Dark Matter and More. 2025: Amacon.com https://www.amazon.com/dp/B0G4M8CT8W/

20. Bacquerel, H., Sur les radiations emises par phosphorescence. Comptes Rendus, 1896. 122: p. 501-503.

21. Malley, M.C., Radioactivity: a history of a mysterious science. 2011: Oxford University Press.

22. Oliphant, M.L., P. Harteck, and E. Rutherford, Transmutation effects observed with heavy hydrogen. Nature, 1934. 133: p. 413.

23. Gamow, G. and E. Teller, The rate of selective thermonuclear reactions. Phys. Rev., 1938. 53: p. 608-609.

24. Bethe, H.A., Energy production in stars. Phys. Rev., 1939. 55(5): p. 434-456.

25. Hayashi, C. and T. Nakano, Thermal and dynamic properties of a protostar and its contraction to the stage of quasi-static equilibrium. Prog. theor. Physics, 1965. 35: p. 754-775.

26. Larson, R.B., Gravitational torques and star formation. Mon. Not. R. astr. Soc., 1984. 206: p. 197-207.

27. Stahler, S.W., et al., The early evolution of protostellar disks. Astrophys. J., 1994. 431: p. 341-358.

28. Gamow, G., Nuclear energy sources and stellar evolution. Physical Review, 1938. 53(7): p. 595.

29. Levée, R.D., A gravitational contracting model. Astrophys. J., 1953. 117: p. 200-210.

30. Schwartzchild, M., Structure and evolution of the stars. 1958, Princeton: Princeton University Press.

31. Serber, R., The Los Alamos primer: The first lectures on how to build an atomic bomb. 1992: Univ of California Press.

32. Rhodes, R., The Making of the Atomic Bomb. 1986, New York: Simon & Schuster.

33. Lynden-Bell, D. and J.P. O'Dwyer, One mass-relation for planets, white dwarfs, and neutron stars. 2008: arXiv.org/abs/astroph/0104450

34. Herndon, J.M., New concept for internal heat production in hot Jupiter exo-planets, thermonuclear ignition of dark galaxies, and the basis for galactic luminous star distributions. Curr. Sci., 2009. 96: p. 1453-1456.

35. Rubin, V.C., The rotation of spiral galaxies. Science, 1983. 220: p. 1339-1344.

36. Bacall, J.N., Star counts and galactic structure. A. Rev. Astron. Astrophys., 1986. 24: p. 577-611.

37. van der Kruit, P.C., Surface photometry of edge-on spiral galaxies. Astron. Astrophys., 1986. 157: p. 230-244.

38. Jarvis, B.J. and K.C. Freeman, A dynamical model for galactic bulges. Astrophys. J., 1985. 295: p. 314-323.

39. Levison, H.F. and D.O. Richstone, Scale-free models of highly flattened elliptical galaxies with massive halos. Astrophys. J., 1985. 295: p. 340-348.

40. Davies, J., et al., A multibeam HI survey of the Virgo Cluster - two isolated HI clouds? Mon. Not. R. astr. Soc., 2004. 349(3): p. 922.

41. Minchin, R., et al., A dark hydrogen cloud in the Virgo structure. Astrophys. J., 2005. 622: p. l21-L24.

42. Minchin, R., et al., High resolution H i imaging of VIRGOHI 21 - a dark galaxy in the Virgo Cluster. American Astronomical Society Meeting 207 #188.13, 2005.

43. Herndon, J.M., Whole-Earth decompression dynamics. Curr. Sci., 2005. 89(10): p. 1937-1941.

44. Herndon, J.M., Solar System processes underlying planetary formation, geodynamics, and the georeactor. Earth, Moon, and Planets, 2006. 99(1): p. 53-99.

45. Herndon, J.M., Energy for geodynamics: Mantle decompression thermal tsunami. Curr. Sci., 2006. 90(12): p. 1605-1606.

46. Herndon, J.M., Geodynamic Basis of Heat Transport in the Earth. Curr. Sci., 2011. 101(11): p. 1440-1450.

47. Herndon, J.M., Origin of mountains and primary initiation of submarine canyons: the consequences of Earth’s early formation as a Jupiter-like gas giant. Curr. Sci., 2012. 102(10): p. 1370-1372.

48. Herndon, J.M., Feasibility of a nuclear fission reactor at the center of the Earth as the energy source for the geomagnetic field. J. Geomag. Geoelectr., 1993. 45: p. 423-437.

49. Herndon, J.M., Sub-structure of the inner core of the earth. Proc. Nat. Acad. Sci. USA, 1996. 93: p. 646-648.

50. Herndon, J.M., Examining the overlooked implications of natural nuclear reactors. Eos, Trans. Am. Geophys. U., 1998. 79(38): p. 451,456.

51. Herndon, J.M., Nuclear georeactor origin of oceanic basalt $^3He/^4He$, evidence, and implications. Proc. Nat. Acad. Sci. USA, 2003. 100(6): p. 3047-3050.

52. Herndon, J.M., Nuclear georeactor generation of the earth's geomagnetic field. Curr. Sci., 2007. 93(11): p. 1485-1487.

53. Herndon, J.M., Terracentric nuclear fission georeactor: background, basis, feasibility, structure, evidence and geophysical implications. Curr. Sci., 2014. 106(4): p. 528-541.

54. Hollenbach, D.F. and J.M. Herndon, Deep-earth reactor: nuclear fission, helium, and the geomagnetic field. Proc. Nat. Acad. Sci. USA, 2001. 98(20): p. 11085-11090.

55. Herndon, J.M., Cataclysmic geomagnetic field collapse: Global security concerns. Journal of Geography, Environment and Earth Science International, 2020. 24(4): p. 61-79.

56. Herndon, J.M., Causes and consequences of geomagnetic field collapse. J. Geog. Environ. Earth Sci. Intn., 2020. 24(9): p. 60-76.

57. Herndon, J.M., Humanity imperiled by the geomagnetic field and human corruption. Advances in Social Sciences Research Journal, 2021. 8(1): p. 456-478.

58. Sparks, R., et al., Dynamical constraints on kimberlite volcanism. Journal of Volcanology and Geothermal Research, 2006. 155(1-2): p. 18-48.

59. Herndon, J.M., New mechanism driving major species extinction events. European Journal of Applied Sciences, 2024. 12(1): p. 517-530.

60. Herndon, J.M., Nature of the Universe: astrophysical paradigm shifts. Advances in Social Sciences Research Journal, 2021. 8(1): p. 631-645.

61. Herndon, J.M., Open letter to the Pontiff and Vatican Cardinals on pervasively corrupt Earth, planetary, and astrophysical science. Advances in Social Sciences Research Journal, 2023. 10(1): p. 440-479.