Theory of the "Compression Horizon"

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Intro:

In the core of every star, hydrogen is the dominant element — not merely prevalent, but the primary constituent. Yet, all stars form from the same cosmic materials as planets: interstellar gas and stellar dust. These materials also contain large amounts of heavy elements. Over time, the accretion of cosmic dust, meteors, and other heavy matter should logically increase the concentration of heavy elements in a star. Despite this, hydrogen remains the dominant element in stellar cores. This seems illogical at first glance — why haven't heavier elements displaced hydrogen from the core?

Contemporary science acknowledges the presence of hydrogen in the core but does not provide a clear explanation for how this hydrogen remains concentrated in the center, nor why heavier elements have not overtaken its position.

This is where the proposed theory comes in — the "Compression Horizon" (also referred to as the "Mirror inversion threshold" or the "Equilibrium Zone"). Each term describes a different facet of the same underlying phenomenon and may be used interchangeably depending on context — particularly when referring to different aspects of stellar physics within this zone.

Hydrogen is the lightest element, but it is also the most compressible. It has the least resistance to compression of all known elements. After passing the Compression Horizon, hydrogen's density increases so drastically that its mass per unit volume surpasses that of heavier elements. This leads hydrogen to sink toward the very center, displacing all other elements from the core.

Within the Equilibrium Zone, all elements equalize in effective weight due to differing compressibility and increasing density. Beyond this threshold, heavier elements are displaced outward, while compressed hydrogen becomes effectively heavier and sinks inward, forming a "mirror" distribution of elements on both sides of the zone. Thus, newly synthesized elements in the stellar core are instantly pushed upward, due to the greater density and mass of hydrogen below.

The Mirror inversion threshold also acts as a natural barrier. Surface hydrogen is unable to pass back through this boundary, being blocked by heavier elements in the outer layers. This establishes a one-way barrier: only highly compressed hydrogen can remain in the core, while surface hydrogen — less dense and uncompressed — cannot penetrate downward through the threshold

The Equilibrium Zone becomes the region where the heaviest elements accumulate, while the core beneath is dominated by ultra-compressed hydrogen. This structure provides a new explanation for elemental stratification within stars.

First Generation Stars

At the dawn of the universe, the first stars (Population III) were formed from nearly pure hydrogen and helium, with an absence of heavier elements. In such an environment, the behavior of internal mass distribution was governed solely by the extreme compressibility of hydrogen. Though no true Compression Horizon existed initially — due to the lack of heavier nuclei to sharply define its boundary — the effect was already latent. Hydrogen, being the lightest and most compressible element, naturally tended to concentrate toward the center under gravitational pressure.

However, as helium accumulated — either from primordial abundance (up to 25%) or early fusion processes — its significantly lower compressibility compared to hydrogen began to influence mass stratification. Even in the absence of heavier elements like carbon or oxygen, helium's relatively low compressibility compared to hydrogen could give rise to a subtle, early-stage version of the Compression Horizon. This early barrier was not yet sharply defined, but it already created mild resistance to the free downward flow of hydrogen. The higher the helium concentration, the stronger this initial barrier became.

As stellar fusion continued and heavier elements such as carbon, oxygen, and beyond were synthesized in the core, this barrier evolved into a sharply defined Mirror Inversion Threshold. The true Compression Horizon was born, fully separating the ultra-compressed hydrogen core from the surrounding stratified layers. From this point onward, the structure of these stars began to resemble the layered elemental architecture of later-generation stars, governed by the same fundamental inversion dynamics.

The formation of the Compression Horizon meant that only the hydrogen within the core could be burned. The outer layers — though rich in hydrogen — typically never participate in fusion due to the presence of structural compression barriers

After a supernova explosion, most of the material ejected into space is still hydrogen. This is because the explosion tears the star apart along the boundary of the Equilibrium Zone, ejecting the outer hydrogen layers while the heavy elements from the zone are partially scattered and partially collapse into the stellar remnant and become white dwarf, neutron star, pulsar or black hole

This mechanism explains the persistent presence of hydrogen in the remnants of stars and the interstellar medium — even after stars exhaust their fuel and explode. It supports the theory that hydrogen was not burned throughout the entire volume of the star, but only below the Compression Horizon.

Explanation of the meaning of terms:

🔷 Compression Horizon

The Compression Horizon is the inner region directly beneath the Equilibrium Zone, where hydrogen atoms become denser and heavier (per unit volume) than heavier elements due to their exceptional compressibility. This causes hydrogen to sink further inward, displacing heavier nuclei upward despite their atomic weight, while compressed hydrogen continues to sink deeper toward the star's core.. The horizon marks the start of gravitational inversion, where the lightest element gains dominance in depth due to density-driven mass behavior.

The greater the stellar mass and the more rapidly internal pressure builds up, the sooner the compression horizon is reached, allowing a larger fraction of the star's hydrogen—potentially a significantly higher percentage of its total hydrogen content—to be incorporated into the core.

🔷 Mirror Inversion Threshold

The Mirror Inversion Threshold encompasses the Equilibrium Zone and creates a transitional layer where the typical mass stratification of elements is reversed. It consists of two sides:

Upside of inversion: Traditional stratification — heavier elements are located beneath lighter ones.

Downside of inversion: Mass order is inverted — compressed hydrogen dominates, displacing heavier elements upward.

This threshold acts like a mirror — not in perfect symmetry, but in oppositional structure. Elements below the threshold are highly compressed and fixed in place, while those above remain more mobile and diffuse. The mirror effect refers not to identical positioning, but to a reversal in behavior: above the zone, elements are free to rise or fall, below it they are stabilized and confined by pressure and density. Surface hydrogen, due to obstruction by denser layers above the threshold, cannot easily penetrate downward, creating a natural barrier.

◆ Equilibrium Zone

The Equilibrium Zone is a razor-thin layer within the stellar core where all elements—regardless of atomic weight—exhibit equal mass per volume due to extreme compression. This zone is infinitesimally narrow, like the edge of a blade at stellar scale. It marks the center point of mass inversion dynamics and acts as the anchor of structural balance within the star.

Despite its stability, internal stellar motion—such as convection or turbulence—can occasionally cause elements to cross this threshold in both directions. Normally, this has minimal impact. However, in very rare cases for example of great inner explosion or powerful movements, hydrogen from upper layers may cross that line of equilibrium and descend into the core, supplying additional fusion fuel, or the opposite can occur, with hydrogen escaping upward—depleting the core and altering the star's evolutionary path. However, the thicker and denser the barrier layers become, the lower the probability that hydrogen will successfully cross this threshold.