Is Iron-56 Just MOND in Disguise?

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Abstract:

In previous work, we have looked at the product of the 26 sporadic groups. We've observed specific distances and masses related to the observable universe at the moment of "maximum expansion". It appears that the energy released by the fusion of hydrogen (protium) into iron-56 (or the iron group) is just enough to allow the resulting nuclei to enter a "MOND-stable" orbit around the baryonic mass of the local Hubble volume, i.e. at the orbit defined by the global Hubble radius. This energy is just about half of the energy of a proton accelerated at the critical acceleration a_0 (Milgrom's constant) for the duration of Hubble time (global), with the resulting Planck-diameter channel having the volume of a proton. Links to the masses of the quarks might arise.

Body:

In previous work, we have derived two values for the Hubble radius, a local one of r = ~13.396 billion ly and a global one of r = ~14.921 billion ly and a baryonic mass of the local Hubble volume of m = ~3.68 × 10^51 kg (CODATA values) or (more likely) ~3.5887×10^51 kg (G forced slightly outside of the CODATA range in order to match the newtonian angular momentum of Hubble volume to the usually defined proton/electron mass ratio).[1]

The baryonic mass of the local Hubble radius is something of great importance for nature: the mass of this group (observable universe) + the baryonic mass = two classical electrons at Planck density. The simplest of fields is 2: all that has touched you + all that you're touching.

The Newtonian, circular orbital velocity on the orbit of r = 14.921 billion ly above a 3.58873× 10^51 kg mass is **41 192 km/s**. Our less preferred CODATA mass of ~3.68× 10^51 kg will yield ~41 712 km/s.

It is well known that the fusion of light elements produces energy up to the iron group. With iron-56 and nickel-62 standing out.

The mass of a neutral iron-56 atom is 9.2882×10^-26 kg. The binding energy of the nucleus is 7.8868×10^-11 J. [2] The 100% efficient conversion of this binding energy into a newtonian kinetic energy will result in a neutral iron-56 atom traveling at **41 209.6 km/s**, 41219.6 km/s in the case of Ni-62.

These values are OK to about 1 part in 100 – 10 000, which is sufficient for our purposes. The main source of uncertainty is ultimately the value of the gravitational constant. I'm not sure how/if to employ GR corrections in this case but the effect is/will be very minor since the Schwarzschild radius of the baryonic matter is *~26*× smaller than the orbit.

For our practical purposes, we've found out that the binding energy is the same as the one needed to achieve this orbit. This orbit can be thought of as a point where the nuclear force and the gravitational force balance out.

Of course, this is at odds with the current Lambda-CDM model – this model has a constantly changing escape velocity of all the baryonic matter that is encased inside a Hubble volume. The Hubble volume itself is always treated as a sort of black hole – with escape velocity of c. However, the baryonic matter density and its ratio to dark matter, dark energy and radiation changes *constantly. To believe this, one has to throw this model out or to believe that we live in a special time in the evolution of the observable universe (i.e. our time = Hubble time). Variable speed of light/Planck's constant is a possibility. The same applies to conventional formulations of MOND that are (also) dependent on the current size of the observable universe (the evolution of galaxies suggests stable a_0).*

Careful readers must have noticed that iron is the 26th element, i.e. that it contains 26 protons and 26 electrons – same as the number of sporadic groups and dimensions in Bosonic string theory/no-ghost theorem. In its creation, 30 electrons have been consumed to create 30 neutrons – so the whole budget is 56 electrons and 56 protons – another symmetry.

But what is the Milgrom's constant a_0? Imagine the "lattice" described by the product of the 26 sporadic groups. The creation of a new cell volume inside the lattice over the shortest cyclic time interval of 2πPlanck time yields this specific acceleration: 1.257×10^-10 m/s^2. This volume has side a = Compton's wavelength of all baryonic matter inside the observable universe (1.532e53 kg). Think about it as a sort of lattice that emerges from an infinite, wildly fluctuating background in periodic time intervals.

Let's imagine a proton accelerated at a_0 for the duration of global Hubble time (14.921 billion years). This will result in a proton traveling at 59 141.850 km/s with energy of 2.92521 × 10^-12 J or 1.82577×10^7 eV (35.7295211 electron masses). This velocity is close to the escape velocity of all the baryonic matter inside the local Hubble volume at the 14.921 Gly orbit: velocity: **58 254 km/s (2.838045 × 10^-12 J or 1.7713684×10^7 eV)**.

Note that the maximum velocities reached in core collapse supernovae (iron/nickel/fragments core) are on the order of ~70 000 km/s, i.e. the fastest layers move near the mentioned escape velocity. The matter is effectively trying to escape the Hubble volume and the velocity between it and something trying to leave the other end of the Hubble volume is ~1/2 of the speed of light.

Let's collide this with another stationary proton in order to merge it (i.e. fusion). Let's conserve momentum: this will result in two "protons" moving at half the velocity or 29 571 km/s but they carry only half the energy: 9.1289 MeV × 10^6 or 8.8568 MeV. The other half is missing. Yes, that's the binding energy per nucleon at the iron peak! Note that we can use "total binding energy" if we start with only neutrons in creating the Fe-56 nucleus – then the binding energy per nucleon jumps 9.1538 MeV so the higher - seemingly relatively imprecise value can still have some physical meaning.

But what if this stored potential energy is the real stored potential energy, i.e. not moving? Do we have something like that inside the proton/neutron? Quarks! We can use the nuclear binding energy to probe the maximal potential energy of the 3 quark system, assuming that (on average) the 3 quark positions are equal. Now, we'll remove 2 quarks, leaving just one behind to maintain at least one in the center of the nucleon (~meson...). This is the state of maximum (minimum) binding energy. Now, this gives us slightly over 13 MeV for the total mass of the 3 quarks or their respective slots. That is the 3 quarks have the same mass as about 26 electrons. This is about the bare mass of quarks inside the neutron in mainstream physics. In previous work, we've noticed that setting the mass of the up and down quark near the upper edge of experimentally determined range yields a symmetry – the 6 quarks will yield a 6×10^121 by 6×10^121 plane at the end of 6×10^121 long strings, yielding the product of the 26 sporadic groups (6×10^121)^3 – a cube with 24 rotational symmetries. Alternatively, one can say that the mass of the potential energy inside a proton/neutron (quarks) is the proton/electron ratio raised to the 12^{th} power – 1836^12 Wesson's mass = ~25 electrons worth of mass.

But what is the region between the global (our orbit) and local Hubble radius? It's the region of the Hubble tension – length of about 1.525 billion ly. A point accelerating at a_0 for the duration of the global Hubble time will cover almost the same distance. It will cover this distance if you add half the gravitational pull of the baryonic matter inside the local Hubble radius. The reason for this is not entirely clear to me. However, it seems that this is the first truly stable, defined orbit as nature intends it – as a direct orbit above the local Hubble radius would be subjected to some MOND-uncertainty. Also, this whole region might be related to nature's way of dealing with Lorenz invariance.

What's interesting is that a column 1 Planck length in diameter the length of Hubble tension (~1.525 billion ly) will have the same volume as a sphere of r = 0.89 fm, which is near the upper value for the charge radius of a proton. This obviously suggests some deep physical connection.

References:

[1]
Direct Product of Sporadic Groups as a Symmetry Group of the Observable Universe at Maximum Expansion, https://vixra.org/abs/2305.0118

[2]
The Most Tightly Bound Nuclei,
http://hyperphysics.phy-astr.gsu.edu/hbase/NucEne/nucbin2.html#c1