Trial Balloon

The phrase "trial balloon" refers to a preliminary idea released to assess the reaction to it. In proper scientific procedures a hypothesis is expressed with supporting evidence, but it can be refuted by falsifiability.

Within Day and Sakaduski (2011) are many quotes and cartoons. On page 103 is "No amount of experimentation can prove me right; a simple experiment may at any time prove me wrong. – Albert Einstein". An Internet search indicates a lack of proof that Einstein actually spoke or wrote those words, but their content is an expression of falsifiability.

The Big Bang hypothesis in its various forms is an attempt to explain the origin of the universe, ultimately leading to the origin of life, by purely naturalistic means. It starts with the initiation of the universe from nothing into an incredibly small but rapidly expanding size. The initial products of hydrogen, helium and a trace of lithium supposedly condense into stars and galaxies. As the stars age the heavier elements through iron are produced by fusion. Multiple supernova explosions and stellar lifetimes are needed for elements heavier than iron. Eventually such elements form the rocky matter for planetary systems. Later, planets with an atmosphere, water, and other molecules supposedly create life from non-living compounds by spontaneous generation.

However, the sequence has not just one but many flaws, whereby it is proved wrong.

The initial getting something from nothing violates the First Law of Thermodynamics. Matter and energy are interchangeable ($E = mc^2$) but their sum is a constant. The universe cannot arrive from a condition of zero.

Having the entire universe condensed into a tiny ball brings up many questions. That sounds like the definition of a black hole, from which nothing can escape. So how could it possibly expand? And if it was so small, did that crush the dimensions of atoms, changing their physical, radiational, and chemical properties, or just the space between them?

Lisle (2012, pp 80-82) reminds that matter (protons, electrons) and antimatter (their oppositely charged twins) are always produced in equal amounts. However, antimatter is almost entirely lacking in our universe. So natural processes did not produce the universe.

Considering eventual organic (carbon-based) molecules, some of them have right- and left-handed versions, mirror images of each other. Non-living processes produce equal amounts of such molecules, but living matter requires absolutely pure versions of either right- or left-handed molecules. The situation has the name racemization.

Lisle (2012, p. 36) quotes the standard Law of Gravity, $F = GMm/r^2$, where F is the force of gravity, G the gravitational constant, M and m are the masses to two objects, and r is the distance between them. Gravity is a very weak force compared to other forces that govern the universe.

Lisle (2012, p. 85) briefly describes the naturalistic model of star formation from a collapsing nebula of gas. He points out that as gas is compressed and possibly rotates faster, it heats up and causes pressures that counteract the gravitational attraction, thereby halting any stellar formation. His footnote 34 on page 120 expresses the molecular version of the Ideal Gas Law as P = nkT where P is pressure, n is the number density of particles, k is the Boltzmann constant, and T is the temperature in Kelvins.

The bulk version of the Ideal Gas Law is expressed as PV = nRT, where P is pressure, V is volume, n is the amount of gas, R is the Universal Gas Constant, and T is the temperature in Kelvins.

The equations for the Law of Gravity and the Ideal Gas Law are two of the most fundamental in physics and are expressed by relatively simple mathematics. Scientists like to deal with real numbers, so it is appropriate to insert numbers into these equations to assess the differences in the gas and gravity forces, with an eye towards cosmic conditions. However, force and pressure have different units, so some adjustments are needed for a comparison.

Figure 1. Typical helium-filled party balloons

Consider two helium balloons such as might be used for special celebrations (Figure 1). Let each be filled with one mole (4 grams) of helium. (The containing film can be considered large and thin enough to have negligible effect on pressure and gravity.) Let the environment have typical sea level conditions of 1 bar and 20º C (293º K). To let the two equations relate to each other, let the balloons touch each other over a relatively small area of 1 cm^2.

Rearranging the Ideal Gas Law, V = nRT/P. n = 1 mol. T = 293 K. P = 1 bar = 100,000 Pascal. R = 8.31472 Pascal m^3 / K mol. So V = 0.02436 m^3 = 4/3 πr^3 for radius r. Therefore r = 0.1798 m, similar to that in the illustration.

The two balloon centers are twice that distance apart, or 2r = 0.3597 m. The mass of helium in both is 4 grams = 4 E-3 kg, so m and M in the gravity equation are the same. G = 6.6742×10^{-11} m^3/kg s^2. F = $GmM/(2r)^2$ = 8.2548×10^{-15} kg m / s^2 = 8.2548×10^{-15} Newtons.

That attraction can be expressed as a pressure over a contact area of 1 square centimeter in this scenario, or 8.2548×10^{-15} Newtons/cm^2. The 1 bar atmospheric pressure is 10^5 Newtons/m^2 = 10 Newtons/cm^2. The ratio of the pressure and gravity forces at the contact area is therefore 1.21×10^{15}. For comparison, the U.S. National Debt, expressed in cents, is presently about 2.0×10^{12}. The number of supposed years in the secular age of the universe is about 1.4×10^{10}. So the gas pressure force is greater than gravity by a very huge factor, too large to be overcome in this simple scenario. Only in the interiors of massive existing stars do the two come into balance.

Using 1 mole of hydrogen molecules rather than helium reduces the mass in each balloon from 4 to 2 grams. The ratio thereby becomes greater by a factor of 4, making it harder for gravity to work against gas pressure.

The gentle environmental conditions of nearly sea level pressure and temperature are unlikely to represent conditions related to stellar formation. So let's see how that ratio changes for very hot (10^6 K) and very cold (10 K) conditions, holding pressure constant and letting volume vary with the temperature. As seen in Table 1, the ratios are still much too large to let gravity overcome gas pressure.

Table 1. Numerical results for balloon values

Temperature, deg K	10	293	10^6
Balloon radius, m	0.058	0.180	2.708
Ratio: gas/gravity	$1.27x10^{14}$	$1.21x10^{15}$	$2.75x10^{17}$

Some scientists think that the universe's observable mass is only several percent of the total mass and energy, invoking the unseen dark matter and dark energy. Being generous, changing each mass in the gravity equation by a factor of 100 reduces the ratios by 4 orders of magnitude. But a ratio of 10^{10} or greater still makes it impossible for gas to condense into a star by gravitational attraction. Gas is mobile, and any significantly greater concentration will immediately try to diffuse into regions of lesser concentration, as can be verified by experiment and observation.

Figure 2. Typical rawinsonde balloon.

Figure 3. Large high altitude balloon.

Greater volumes of helium (or hydrogen) are released daily around the world from hundreds of locations, carrying rawindsonde instruments (Figure 2) for documentation of upper air temperature, humidity, and winds. Occasionally a large high altitude balloon is launched (Figure 3). In all cases when the confining membrane is ruptured in the partial vacuum near the top of the atmosphere, these greater amounts of gas never condense by gravity into small volumes. Instead the gas expands quickly as it escapes. These cases are experimental verifications of the intent of the above equation manipulations.

Even so, stars composed of hydrogen and helium do exist. So it is appropriate to examine conditions by which those gasses are retained by gravity. It is possible to calculate speeds necessary to escape the gravitational hold of various stellar and planetary bodies, based on the mass of the body and the distance away from it. $V_{esc} = (2GM/R)^{0.5}$, where M is the mass of the (planet or star) body and R is the radius from which the object (gas molecules or rockets) escapes at speed V_{esc}. For the top of Earth's atmosphere, that speed is 11.2 km/s.

That escape speed can be compared to the thermal distribution of molecular speeds in a gas. However, one can simply look at the variety of planets and their satellites in our own solar system. We have 4 giant planets massive enough to retain and attract hydrogen and helium. We have small rocky planets and natural satellites that do not retain atmospheres of such light elements. In between, the Earth loses hydrogen while barely retaining some of its helium.

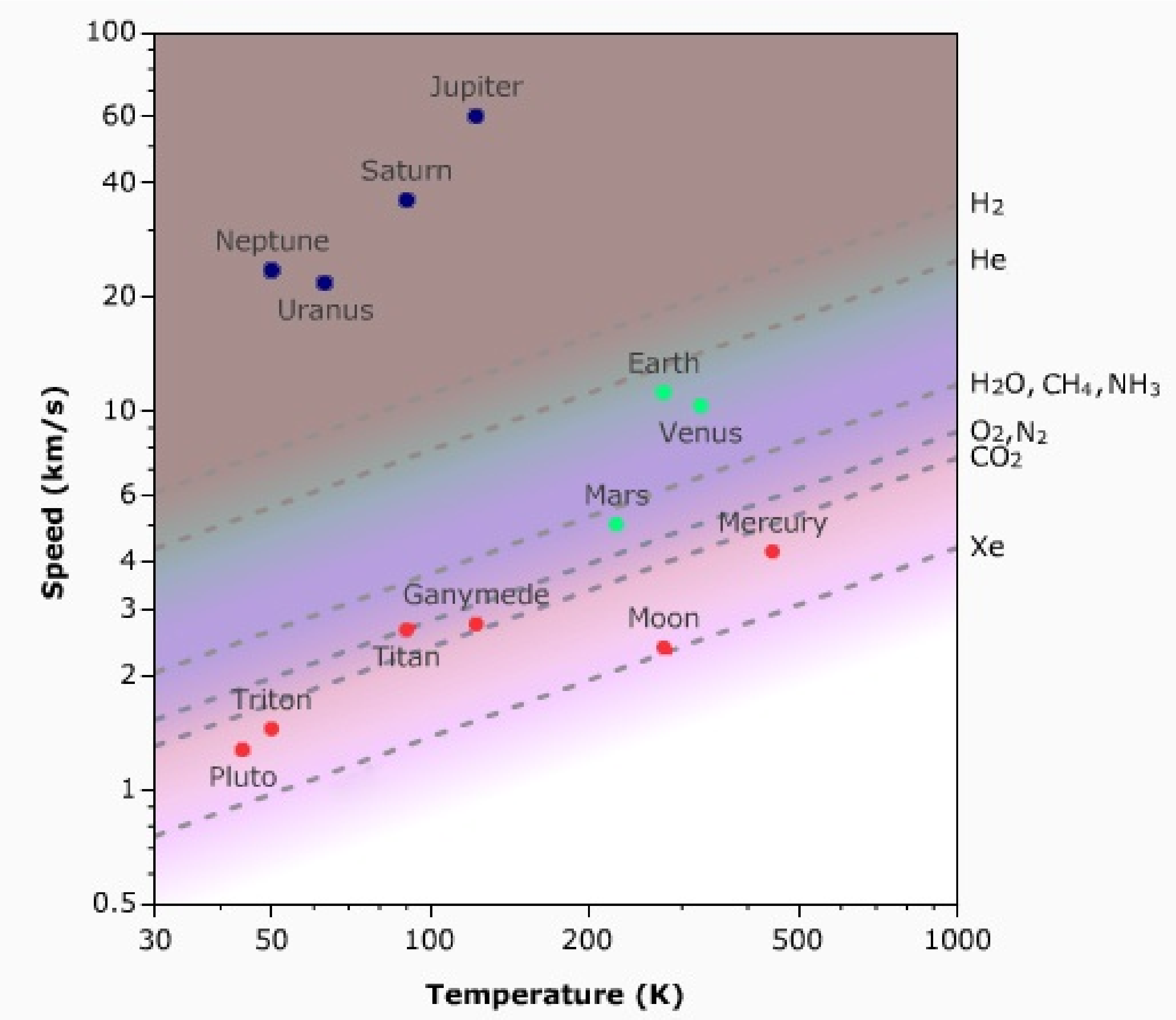

Figure 4. The relationships for gas retention for Solar System planets and lesser bodies.

There are several graphs on the Internet that show the relation between escape speed and atmospheric temperature for many solar system bodies. In one of them (Figure 4, from https://astronomy.stackexchange.com/questions/11468/why-earthian-atmosphere-is-so-thin) diagonal lines are the thresholds at which gasses are retained and show that only the four largest planets in our Solar System can retain hydrogen and helium.

Only large solid materials are rigid enough to serve as massive nuclei capable of gravitationally attracting and retaining gasses. Gasses, and liquids, are mobile and will diffuse away from high pressure regions into adjacent low pressure conditions. A rocky body much larger than the Earth is needed as a nucleus to gravitationally retain and possibly attract hydrogen and helium. And the masses of such gasses must greatly exceed that of Jupiter for a star to exist. Rocky bodies need elements of oxygen, sodium, magnesium, aluminum, silicon, potassium, calcium, iron and others for building their solid minerals. However, according to the Big Bang naturalistic scenarios, no such heavy elements existed for the first generations of stars. Therefore rocky bodies could not have existed to have been nuclei for the first stars..

These examples show by too many orders of magnitude that stars cannot form by naturalistic means from the initial gasses of hydrogen and helium. That leaves the supernatural method. On Creation Day 4 God made the greater and lesser lights (Sun and Moon) and also the stars. (Genesis 1:16)

References

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