Arguments by A.C. Sturt submitted by him as the inventor through Reddie and Grose in response to the rejection of United States Patent Application No. 12/312902 Process for Destroying Radioactive Materials of Alan Charles Sturt

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United States Patent Application No. 12/312902
Process for Destroying Radioactive Materials of Alan Charles Sturt

I have read through your letter of 19 September 2011 with the examiner's report and the cited document, of which I received only one.

Since the development of the current physical basis is quoted in the cited book, I have described it and added to it in detail, in order to highlight its inherent assumptions and contradictions. I show how my new paradigm, which he rightly says is central to the invention, addresses them and incorporates the new thinking into the invention. I illustrate my model of the atom with a Figure. I then turn to his individual objections.

The essential theme of the examiner's objections is that he rejects my model of the nucleus. His cited document is an extract of a book on Theoretical Nuclear Physics (Blatt and Weisskopf, Springer Verlag 1979). The problem with this approach is that it presents its analysis as fact and does not allow for any changes or advances of paradigm. A paradigm is after all only the best model of the observed natural phenomenon currently available. But there are no ultimate paradigms, and my new model fits all the characteristics of nuclear physics which he lists for the conventional model.

My model takes account of a much wider range of measurements than particle physicists usually encompass. I know this from discussions with a senior physicist from CERN who insisted quite indignantly that the decay of a neutron as observed in the laboratory was 'a fact of nature', when I pointed out that neutrons were not fundamental particles. In fact they formed only in stars, and were frozen temporarily in nuclei, though perhaps for an astronomical time. Thus there is no laboratory

apparatus for making neutrons. For research purposes these have to be provided by suitable radioactive materials. When a neutron is ejected from a nucleus, it decomposes into a proton and an electron by a process which has a half-life of about 10 minutes at normal temperature and pressure. Radioactivity is the state in which the components of a nucleus are frozen into a configuration that is unstable. Radioactive decay occurs when this instability corrects itself on a stochastic atomic basis by rearrangement and ejection of the 'surplus' particle from its nucleus.

The textbook quoted delves into the history of nuclear physics, but it does not give the whole story, particularly the assumptions and deficiencies. To understand the conventional model and my new paradigm, we need to get the facts straight. The existence of atoms was fully accepted only at the end of the 19th century. One of the last doubters was Einstein, until he proved it for himself (Brownian motion). Since atoms were neutral by definition, the discovery of negative particles inside them i.e. electrons indicated that they must also contain positive elements. The question was: how were such charges distributed? The first model was called a 'plum pudding', with electrons dotted around in a neutralising positive matrix.

This model ran into trouble when Rutherford fired alpha particles at a target material. Most simply passed through or were deflected, but sometimes, though very rarely, one rebounded as if it had hit a brick wall. This showed that the particle had in fact hit something very small and positively charged i.e. a nucleus. Hence a new model of the atom with the positively charged nucleus at the centre and the electrons orbiting separately from it.

What is significant for my paradigm was that Rutherford did not say, and no one seems to have asked since then, why the electrons in his model did not just settle down on the surface of the nucleus as a result of electrostatic attraction, not so much plum pudding as icing on a cake. There are theories which describe the disposition of the electrons in orbits around the nucleus which are considered to be 'allowed' e.g. the Bohr model, but none gives a physical reason why they are 'allowed' and why the electrons stay in orbit at all rather than sticking to the nucleus, since you might expect negatives to be attracted to positives. It was not only Rutherford who did not say why orbital electrons did not settle on the nucleus. Neither did Einstein, nor Heisenberg, nor any of the other eminent physicists who are quoted by the examiner. The problem was not recognised or simply ignored. In this respect their analyses were defective.

The next indication that the structure of the atom might be even more complex was when atomic masses were found not to match the electrostatic charges on the nucleus. Different nuclear masses could have the same charge, now known as isotopes.

The discovery of the neutron by Chadwick in 1932 provided an explanation of how these apparent anomalies could be accounted for. The nucleus must contain neutrons as well as protons. Neutrons had almost the same mass as protons, but they were electrically neutral, and so they would increase the atomic mass without increasing the charge. The model of the atom then became a nucleus composed of protons and neutrons surrounded at a considerable distance (in nuclear terms) by orbiting electrons. This is the model which is still current today. As the extract from the book describes it, the nucleus is very small compared with atomic dimensions, it is charged and it is very heavy compared with electrons. The number of electrons in this model

exactly matched the number of the charges of the protons in the nucleus to make the atom neutral.

However, the argument in the supplied textbook also contains the assumption which highlights the difference between the conventional model and mine. On page 2 it states that: “The forces which hold a nucleus together cannot be ordinary electrostatic forces, since the (electrically neutral) neutrons are bound in the nucleus.” In other words, neutrons are bound into the nucleus even though they have no electrostatic charge to attract them to other, charged particles. This phenomenon could apparently not be explained by the electrostatic forces of “classical physics”, and so the conclusion was that there must be some immense force of a different kind, origin unknown and effective only at short range, which bound the nucleus together. Hence binding energy, quantum states etc.

But in fact there was an alternative explanation, which is that the neutron model is wrong. This raises howls of protest from particle physicists who have observed neutrons, measured them etc. However, as we have stated above, neutrons are made only in stars i.e. at immense temperatures and pressures. It is quite possible therefore, that under stellar conditions electrons are forced into orbit around protons at a close proximity which is impossible to obtain with particles of stochastic origin at the temperatures, pressures and densities available in the walled vessels of the laboratory. The closer the electron, the faster it will orbit, which is why stellar conditions are needed to keep it close. Under laboratory conditions the electrons orbit much further away, and much more slowly. This is the basis of interactions between atoms rather than nuclei, what we call chemistry. It is misleading to use these laboratory relationships to describe nucleus formation in stars, because they have been developed and apply only in the laboratory. Stellar conditions change the processes of interaction.

The alternative process is as follows. An electron is forced into close orbit around a proton to form a ‘stable’ neutral complex, or ‘neutron’. From there it is possible, though less probable, that close orbits would be formed around more than one proton to form stable complexes in which the electrons are in close orbit around both protons. Then as fast as the protons try to separate by the mutual repulsion of their positive charges, the electrons intervene to pull them together again, because they move much more rapidly since they have a much smaller mass,. Similarly the electrons would like to leave the complex to avoid each other, but the protons pull them back again by electrostatic attraction. The best that the electrons can do is to avoid each other as far as possible by keeping at diametrically opposite ends of their common orbits. If such a complex attains a configuration which is stable in energy terms, both electrons and protons are then bound together in a structure which it is very difficult for them to leave. If a proton is ejected from the nucleus of a radioactive material in the laboratory, it may take an electron with it in close orbit, which is what we see as a neutral particle or neutron. This is an unstable relationship, and when the neutron collides with another particle or the wall of the vessel or the surface of a detector, the orbit of the electron gradually unwinds. This process varies from neutron to neutron depending on its particular environment and it takes time, which is the reason for a half-life. The result is one separated proton plus one separated electron.

There may be a variant on this process in outer space. Such neutrons are ejected by stars, and if they escape into deep space, they will be travelling slowly in parallel lines with no other particles or walls to collide with; there are no more than half a dozen particles of any sort per cubic metre. There is no reason why they should not survive as neutrons almost indefinitely, detectable only by the gravitational attraction which they exert. This is almost a definition of dark matter of which there is thought to be six times as much as the visible matter which can be detected through the electromagnetic radiation emitted and seen through telescopes. Such particles would eventually degrade into protons, then atomic hydrogen and finally molecular hydrogen, so that it could be seen as clouds of gas. I have already published this mechanism. Such clouds of gas are actually visible.

What has been described for the star is the beginning of the cosmic process of building the nuclei of metallic elements, with the probability of attaining stability decreasing at each stage of complexity. Such a process could continue by interactions of more electrons and protons with the stable complexes which have already formed, or by interactions between such complexes themselves. These are the sort of processes which give rise to the observed abundances of the elements of the Periodic Table across the whole Universe, which astrophysicists measure. Each increase in the complexity of nuclear structures would by definition be less and less likely to occur, but over astronomical times the range of elements observed in the whole Universe would be built.

When such nuclear complexes are released form their stellar conditions, they emerge into a cooler, low pressure environment in which they freeze. These are in effect the positively charged nuclei of the elements of the Periodic Table, which need only to pick up loose electrons to become the neutral metallic atoms of which the Earth and ourselves are composed. Most nuclei would be in a stable configuration, but others would be ejected and frozen in a configuration which is less stable than the optimum because protons and electrons had not had time to find their positions of maximum stability. These would be the nuclei of radioactive elements, which would spend the rest of time pursuing stability by rearranging and losing particles to get rid of their neutron-like structures at a rate which depended on the stability of the complex.

It may be objected that there is an observed difference between the mass of a nucleus and the sum of the masses of the particles of which it is composed. This difference is thought to be related to the equation between mass and energy according to Einstein’s equation. However, it should be noted that we have moved from atomic masses which can be weighed by the gram on a balance in the laboratory, to nuclear masses which have to be measured by a different technique, mass spectrometry. This measures the deflection of particles which are travelling in a straight line by a known imposed magnetic field i.e. inertia rather than gravitational attraction to Earth. This is converted into mass by calculation, using a theoretical equation. Although these two ways of estimating mass may seem to be equivalent, because the nucleus is by far the heaviest part of an atom, mass numbers obtained in this way depend on electromagnetic parameters, and they are essentially relative. If the electrostatic characteristics of nuclei do not conform to those of the conventional hypothesis, which is suggested in my model, this difference of technique could account for the discrepancy between the masses of nuclei and the sum of the masses of the nucleons of which they consist without dragging relativity into it. In fact it seems likely that the

interaction of nuclei with electrical and magnetic fields would be affected in the same way that intranuclear electrons interact with i.e. repel the atom's orbital electrons and prevent them from landing on the nucleus. This is the answer to the question which Rutherford and later Einstein, Heisenberg et al. may not have asked: why do orbital electrons remain in orbit?

Thus it is intranuclear electrons which hold the nucleus together according to my model. The number of electrons in the nucleus is equal to the number of neutrons in the nucleus. Larger nuclei contain more neutrons, which shows that they need more binding together, but they are rarer because the probability of their formation by the process described above is much lower. The rest of the electrons of which the atom is composed orbit the nucleus at a distance i.e. they are extranuclear. It is these orbital electrons that take part in interaction between atoms, which we know as chemistry.

The nucleus has been speculatively been portrayed as a hard kernel or a sort of jelly. My picture of the nucleus is as a sort of plasma in which the electrons move in fast close orbits around protons which are determined by the forces of electrostatic attraction and repulsion. A plasma has been defined by Artsimovich as a gas in which the proportion of atoms ionised is sufficiently large for the motions of the resulting electrons and positive ions to be dominated by their collective electromagnetic interactions. The nucleus is hardly at the atomic level, but it may be considered as the same sort of concept, formed in the heat and pressure of stars at the next state of matter down towards fundamental particles. In fact the nucleus, as I have drawn it, is the parallel of the structure of the atom at the next layer down (see attached Figure).

So contrary to what the examiner states, there are electrons present in the nucleus, and this is why the orbital electrons do not settle on the nucleus (unless someone can suggest another reason, which has not happened yet). Orbital electrons are attracted by the positive charge of the protons, but are constantly met and repelled by the intranuclear electrons travelling fast and close around the protons. It is these electrons in the nucleus that are the source of the immense, short distance forces which hold it together. The reason why they are so immense is that the separation between charges is much smaller than we experience in chemical bonding, almost approaching zero.

The orbitals of electrons in the conventional model can be explained by the balance between the electrostatic forces of attraction to the nucleus, the electrostatic forces of repulsion by the electrons bound within the nucleus, and the electrostatic forces of repulsion by orbital electrons of each other.

Against this background we can answer the specific points made by the examiner:

1. All the above is about interpretation of the nature of the nucleus. By definition, a theoretical interpretation of structure cannot affect the physical behaviour of the same nuclei while they are intact. Thus any statistical analysis which applies to the behaviour of nuclei in the conventional model, whether Bose-Einstein or Fermi-Dirac, whichever is relevant, must apply equally to my model, because the mathematics cannot tell the difference.

2. The process of the invention certainly can be carried out by those skilled in the art, because the collision of heavy ions in accelerators is known from reported

experiments with gold, silver, and lead nuclei at CERN and in the Fermilab Tevatron.

3. Statistical parameters relating to the probability of collision in these experiments are the same for the invention. There is no reason why the statistics should be any different for nuclei just because of the theoretical interpretation of their internal structures.

4. The invention has to be described at the particle level, because it is the particles which are affected, but as is well known the technique is to use opposing streams of billions of nuclei to produce millions of collisions. Such a process is clearly known to those skilled in the art.

5. The process of the invention is much less critical than that which the researchers needed, because the velocities are much lower. Their purpose was to reduce the nuclei to fundamental particles at the next lower level than envisaged in my invention, e.g. quarks and bosons, in order to validate the Standard Model of physics. This requires an energy of collision much higher than in my invention.

6. Their apparatus is complicated by the need for sophisticated detectors to trap and identify such particles as soon as they are formed by collision, because they are extremely short-lived. These detectors are very large and placed very close to the collision zone to reduce the interval between formation and detection to the absolute minimum, which may be only one ten millionth of a second for particles which are moving at such high speeds.

7. By contrast such detectors are superfluous in my invention, which needs only to measure the radioactivity in the flow. The products would take much longer to evacuate from the collision zone and collect for separation, and so there would be much longer for neutrons to decompose into protons and electrons, which is the aim of the process.

8. Moreover reduction to such fundamental particles in my invention would be a problem, because there is no way of preventing them from reforming into amongst other things neutrons and unstable structures.

9. Since the aim is to reduce the radioactivity of a material, the atomic number of nuclei which may survive collision is irrelevant, as long as they are not radioactive.

10. Nuclei which do not lose their radioactivity are simply recycled.

11. The energy required to deactivate radioactive nuclei depends on their stability, and so velocities may be controlled to provide the minimum energy of collision to achieve this.

The process depends on the rate at which neutron structures decay after the collision process. The likelihood is that the sort of ‘plasma’ structure of the nucleus described above would disintegrate as soon as intranuclear electrons were released and left the

scene at high velocities, because of their small size and mutual repulsion. They would be followed by the protons which are heavier and so slower, and later there would be recombination to form hydrogen atoms. If, however, neutron-like associations of a proton with an electron emerged from the collision, it would decompose into a separated proton and a separated electron, and an electron antineutrino would be emitted. The electron antineutrino is quite harmless, because it has zero charge and zero rest mass, and it travels at the speed of light through matter with virtually no interaction. Nor is it radioactive, and so it does not affect the goal of reducing radioactivity.

The reasons why neutron-like structures should unwind rapidly at the locus of collision are that:

1. There are many particles with which to collide.
2. The particles have a very high energy, equivalent to very high temperatures.
3. The pressure inside the apparatus is very low, which facilitates separation and inhibits recombination.

In addition the residence time in the collision chamber and the extraction apparatus can be controlled and increased to facilitate the process of unwinding. If a carrier gas is also introduced, as in the claims, the unwinding process could certainly be achieved. There is also the possibility of continuous operation.

None of these features are described in the literature and patents, and so their combined contribution to the process is new.

I have had a look through the modified claims which were accepted by the GB examiner, and I think they should cover it.

A.C.Sturt

Attachment: Figure

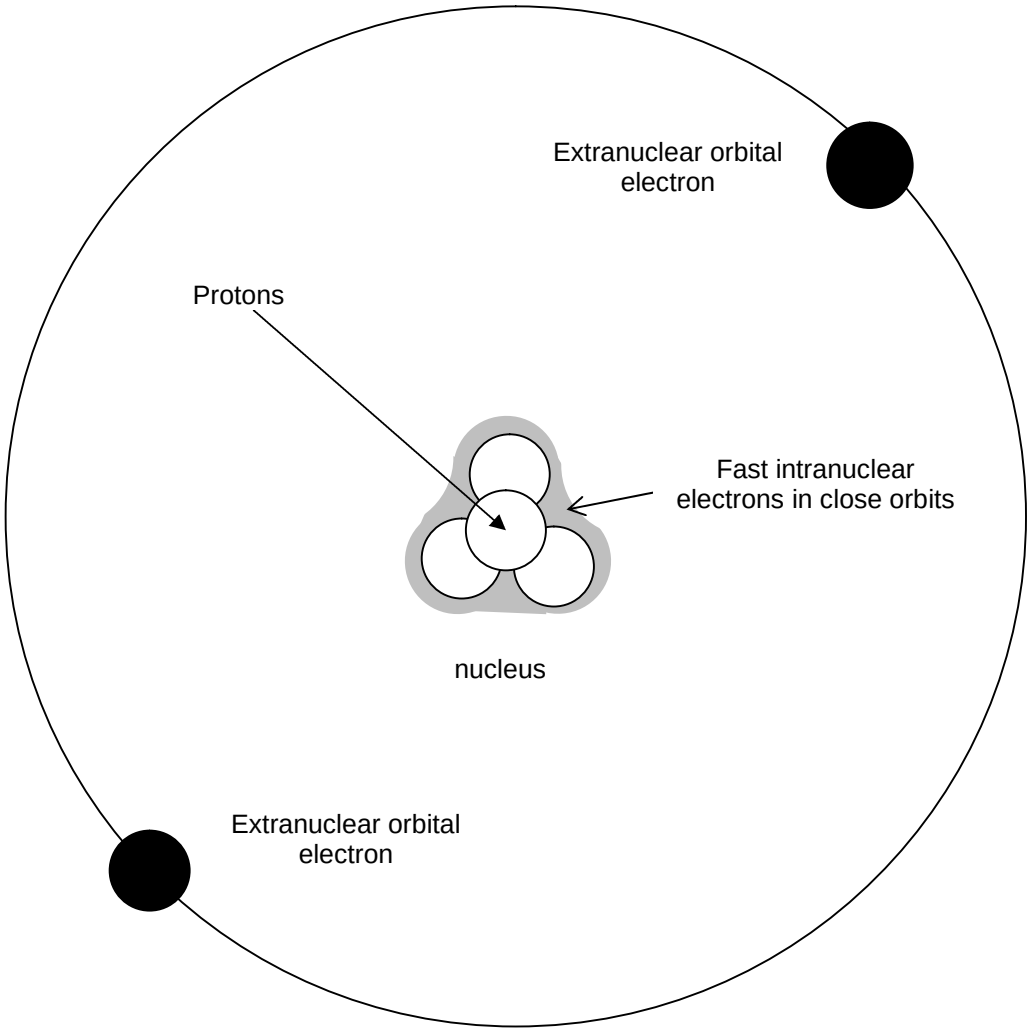

Figure. New Model of the Atom (Helium) with Distributed Negative Charge