



- 4 The existence of hydrogen in this reduced energy state forms part of a theory of matter propounded by Dr Randell Mills, the proprietor of BlackLight, which he calls the “Grand Unified Theory of Classical Quantum Mechanics”. The use of both “classical” and “quantum” in the title presumably arises from the contention that the structure of atoms can be described in terms of classical attributes of the elementary particles, at least of the electron, while the energy levels of the particles in the atom, and the emission and absorption of energy obey similar quantization rules to those specified by quantum mechanics.
- 5 The examiners maintained their objections, and the matter came before me at a hearing on 26 February 2008 at which BlackLight was represented by Dr Mills and also by Ms Alexandra Tomkinson, BlackLight’s attorney in the UK and Mr Jeffrey Melcher, BlackLight’s US attorney.

#### **GB0521120.6**

- 6 The specification of GB0521120.6 describes plasma cells into which (ordinary) hydrogen and a catalyst are introduced. A source of energy is provided to start and maintain a reaction. Molecular hydrogen is dissociated into atomic hydrogen, and the catalyst is said to catalyse a reaction in which the electron in the hydrogen atom is placed into an energy state lower than the lowest energy state (the ground state) allowed by quantum mechanics. It is explained that the electron moving into a lower energy state results in the release of the equivalent amount of energy. Energy from the cell may be used to generate power or light.
- 7 The new species of hydrogen, by virtue of the electron being in a lower energy state, is also described as having a higher than normal binding energy. A hydrogen atom in this form is referred to as a “hydrino”. Dr Mills’ hydrino theory forms part of his Classical Quantum Mechanics theory which treats the physical description of the electron in the hydrogen atom, the existence of the hydrogen atom in such increased binding energy states and a wide range of other phenomena. According to the specification, hydrinos may be ionised to produce hydrino ions and combined with other materials to produce hydrino compounds.
- 8 Claim 1 reads as follows:

*A plasma reactor to generate power and novel hydrogen species and compositions of matter comprising new forms of hydrogen via the catalysis of atomic hydrogen and to generate a plasma and a source of light such as high energy light, extreme ultraviolet light and ultraviolet light, via the catalysis of atomic hydrogen, the reactor comprising*  
*a plasma forming energy cell for the catalysis of atomic hydrogen to form novel hydrogen species and compositions of matter comprising new forms of hydrogen,*  
*a source of catalyst for catalyzing the reaction of atomic hydrogen to form lower-energy hydrogen and release energy,*  
*a source of atomic hydrogen, and*  
*a source of intermittent or pulsed power to at least partially maintain the plasma.*

- 9 Considering the other independent claims: claim 81 relates to compounds produced in the reactor of claim 1 which involve increased binding energy hydrogen, and claim 242 relates to a method for producing power, lower energy hydrogen species and compounds. It corresponds broadly to the apparatus claimed in claim 1.
- 10 The invention consequently depends fundamentally on the existence in nature of the new lower-energy state hydrogen species described in the specification and proposed in the Classical Quantum Mechanics theory, but which is inconsistent with standard quantum mechanics.

### **GB0608130.1**

- 11 This specification relates to lasers based on hydrogen molecules involving the same new species of hydrogen referred to in GB0521120.6. As described, the lower energy hydrogen atoms have a smaller radius than normal hydrogen, and the distance between the nuclei in a hydrogen molecule formed from such atoms is similarly reduced. The laser involves excitation of vibrational or rotational states of the molecular bond (see for example pages 22 to 27 and pages 99 to 107 of the specification). The material is said to lase with a wavelength in the far ultra violet. It is explained that such a laser would be valuable for integrated circuit lithography, having the advantage over existing UV lasers of smaller size.
- 12 Claim 1 reads:
- A laser comprising:  
a laser medium comprising  $H_2(1/p)$  where  $p$  is an integer and  $1 < p \leq 137$ ,  
a cavity,  
and a power source to form an inverted population in an energy level of  $H_2(1/p)$ .*
- 13 Claims 25, 65 and 104 also relate to lasers based on molecular hydrogen. Claim 138 relates to the production of laser light from the reaction (described for example on page 64) in which a reduced energy state hydrogen atom combines with another hydrogen atom to form a molecule of hydrogen. Claims 66, 145 and 148 relate to light emitters which do not appear necessarily to amount to lasers though they involve emission of radiation from lower energy state hydrogen.
- 14 Claims 89, 97 and 98 refer to “disproportionation” reactions. These are explained, on page 21 for example, as the autocatalysis of hydrogen atoms into the lower energy state by hydrogen atoms already in the new state. These claims consequently relate to a separate invention. However, this invention too relies for its performance on the existence of the new species of hydrogen.
- 15 Some claims are indeterminate; for example claims 68 - 73 refer to the “compound of claim 25”, whereas claim 25 does not mention any compound, and claim 84 specifies “the catalyst of claim 1” whereas claim 1 does not refer to a catalyst. These claims do not affect the arguments or conclusion of this decision.

- 16 The inventions in this specification, like that in GB0521120.6, also depend on the existence in nature of the lower-energy state hydrogen species described in Classical Quantum Mechanics but inconsistent with standard quantum mechanics.

### **The law**

- 17 Section 1(1)(c) reads as follows:

*“A patent may be granted only for an invention in respect of which the following conditions are satisfied, that is to say-*

*...*

*(c) it is capable of industrial application;*

*...;”*

- 18 Section 4(1) provides that an invention shall be taken to be capable of industrial application if it can be made or used in any kind of industry, including agriculture. Precedent cases over a number of years have held that systems which operate in a manner which is contrary to well-established physical law are not capable of industrial application.

- 19 Section 14(3) of the Patents Act 1977 states:

*“The specification of an application shall disclose the invention in a manner which is clear enough and complete enough for the invention to be performed by a person skilled in the art.”*

### **The questions to be addressed**

- 20 I consequently need to consider whether or not the description of hydrogen in a lower energy state as set out in the BlackLight specifications and in the Classical Quantum Mechanics theory accords with reality. If such hydrogen species exist, the objections on grounds of lack of industrial applicability and sufficiency fall away. If they do not exist, the inventions can neither be applied industrially nor performed as described and the applications stand to be refused.
- 21 An initial question that presents itself is whether the lower energy state hydrogen upon which these inventions are based necessarily involves the rest of the hydrino theory of atomic structure set out in Classical Quantum Mechanics. I say this because the claims do not specifically require that the lower energy state hydrogen species must conform to the description of matter given by the theory. The possibility therefore arises that lower energy state hydrogen exists, but that the explanation for it does not involve the propositions set out in the theory. I think that is unlikely, not least because it would require not just one but two (or

more) exotic new theories of matter. Also from what I am able to understand of the new theory the low energy states and the atomic structure propositions are indeed part of the same explanation, and finally, the new theory is presented by Dr Mills as one coherent whole. I will therefore disregard the possibility that more than one new theory is involved and work on the assumption that it needs to be taken as a whole. The question in paragraph 20 above - whether low energy state hydrogen exists - consequently translates into a slightly different one - whether the theory of Classical Quantum Mechanics is or is not true.

- 22 Such a question is difficult to address, to say the least, since the nature of the scientific method is such that scientific theories can never be shown to be 100% true. However, theories that are generally accepted as valid descriptions of nature it seems to me conform to certain criteria. The main criteria may be as follows: a) the explanation provided by the theory is consistent with existing generally accepted theories. If it is not, it should provide a better explanation of physical phenomena than do current theories, and should be consistent with any accepted theories that it does not displace; b) the theory should make testable predictions, and experimental evidence should show rival theories to be false and should match the predictions of the new theory; c) the theory should be accepted as a valid explanation of physical phenomena by the community of scientists who work in the relevant discipline. It may be that other criteria can be identified, for example that a successful theory should also be intellectually satisfying and economical in its explanation, but I think that for any theory to be accepted as “true” it must satisfy at least a), b) and c) above. Where I refer to the “truth” or “validity” of a scientific theory in this decision it is in that sense.
- 23 I then need to ask what level of confidence should be demanded in the truth of this theory in order for patents to be granted on effects which depend on it. If, as in the present case, an applicant proposes a new theory and claims an invention dependent on it, it would be unfair to the applicant if the patent was refused but the theory turned out in due course to be true. If on the other hand patents were allowed to be granted on inventions depending on any theory, however speculative, then in the words of *Paez’s Application (BL O/176/83)* “it would be completely wrong and against public interest to bestow upon misleading applications the rights and privileges of a granted patent”. I consequently take the view that it is appropriate to demand a real but moderate level of confidence in the truth of the theory. I will therefore make the assessment on the basis that it should be more probable than not that the theory is true if I am to allow the applications to proceed.

### **Is Classical Quantum Mechanics true?**

- 24 The fact that the theory of Classical Quantum Mechanics does not satisfy criterion a) in paragraph 22 above is what has led the examiners in these applications to raise objections. Looking at the disagreements between the new theory and standard physics; the idea that an atom might possibly be able to exist in an energy state lower than the lowest normal energy state (the ground state) predicted by quantum mechanics immediately raises the question, why don’t hydrogen atoms in the ground state relax spontaneously to whatever is the

lowest energy predicted by Classical Quantum Mechanics? Such relaxation would be required in standard physics and would be accompanied by the emission of photons corresponding in energy to the energy of the transitions. The explanation according to Classical Quantum Mechanics as to why this does not occur is that transitions below the normal ground state are prohibited where they involve the emission of photons, but permitted where they occur by non-radiative transfer of energy, for example by resonant collision with another atom. Dr Mills kindly left me a copy of his book "*The Grand Unified Theory of Classical Quantum Mechanics*" - October 2007 edition. An explanation of this effect can be found on pages 14 to 17.

- 25 In another aspect, standard physics explains the size of the normal hydrogen atom in terms of the Heisenberg uncertainty principle since, according to the uncertainty principle, it is not possible to confine the electron within a smaller space. However hydrogen atoms in the lower energy states permitted in Classical Quantum Mechanics are said to have smaller radii than hydrogen in its ground state. The explanation for this in Classical Quantum Mechanics is that the uncertainty principle is an artifact of measurement systems and does not in reality apply to particles. The radius in Classical Quantum Mechanics arises from the balance between electrostatic and centrifugal forces on the electron. See pages 72 to 75 of Dr Mills' book.
- 26 This one part of Classical Quantum Mechanics theory consequently involves disagreement with generally accepted quantum mechanics in many aspects of their respective descriptions of physical systems. The list includes the nature of the electron, the structure of the atom, the existence of the ground state as the lowest possible energy state, the idea that an atomic system in an energy state higher than its lowest possible state is prohibited from transitioning spontaneously to a lower state, the idea that an atomic energy transition can be prohibited by photon exchange but allowed by another process such as collision, the minimum normal radius of the hydrogen atom and the idea that the uncertainty principle applies only to measurements rather than in actuality.
- 27 It is clear that for Classical Quantum Mechanics to replace standard quantum mechanics would require a seismic shift in our understanding of physics. Classical Quantum Mechanics is also said to explain a wide range of other phenomena. As summarised on page 20 of Dr Mills' book, the theory describes some 50 atomic, molecular and quantum phenomena. The same page summarises a unification of Newton's Laws, the Maxwell equations and Special and General Relativity from which emerges an explanation of mass and gravitation, and explanations for a further 20 or so mass-related and cosmological phenomena. It is clear that the theory, if correct would be exceedingly far-reaching.
- 28 So, the new theory does not meet the first part of criterion a) in paragraph 22, in that it is not consistent with existing generally accepted theories. That is not surprising since the whole point of Dr Mills' proposition is that current explanations provided by quantum mechanics are flawed. The second part of criterion a) consequently comes into play; does Classical Quantum Mechanics provide a better explanation of physical phenomena than existing theories and is

it consistent with any remaining theory that it does not displace? I am not in a position to assess this for myself. My understanding of these very profound areas of physics is a long way short of what would be necessary to do so. Even if I did have the necessary expertise, I am not sure that one person's assessment is likely to give a conclusive view. What seems to be of far more importance is how the theory is viewed by the relevant science community generally, that is the body of expertise in this area of knowledge. I address that in due course below.

- 29 The second criterion, b), in paragraph 22 is concerned with the new theory providing testable predictions, and with experiments producing evidence that supports the theory and shows rival theories to be false. Dr Mills has provided a great deal of material in the form of research papers reporting on experiments that have been carried out by BlackLight and others. Many of them have been published in peer reviewed journals, and BlackLight has gone to some trouble to invite other scientists to visit BlackLight laboratories in order to obtain independent verification. They produce results which at times are explained in terms consistent with the new theory, or inconsistent with existing theories.
- 30 Many of these experiments concern calorimetry of electrolytic cells. BlackLight maintain that a catalytic reaction involving the production of hydrinos takes place in such cells. This is said to result in the generation of excess heat – more than can be accounted for by standard explanations of the electrical and chemical effects in the cell. Other results concern spectra obtained from plasmas which are said to be unexplained by standard theory but consistent with hydrino theory. Dr Mills also described at the hearing how BlackLight is able to calculate the bond geometries of organic and other molecules based on the results of Classical Quantum Mechanics in a way that is more efficient than is possible using standard quantum mechanics, and that such calculations are providing a useful tool for industry, analysing and designing chemical species.
- 31 I am not well placed to assess how convincing this material is. Persons able to do so would be experts in the field, familiar with the predictions of standard science and with the new theory; familiar with setting up experiments in these fields; aware of pitfalls that might introduce errors in conducting such experiments and the precautions needed to avoid them; and skilled in the analysis and interpretation of results in such a way as to produce valid, rigorous and repeatable results. I do not meet these requirements and can not make a direct assessment myself. However I have perused the references that BlackLight provided and have gained an impression of the type of work that has been done, the results obtained and the explanations given for those results.
- 32 BlackLight provided me with a collection of 114 reference papers shortly before the hearing and a further two at the hearing. Of these, 79 have Dr Mills as the principal or another author. I have thought it best to concentrate on papers not directly involving Dr Mills in order to gain as independent as possible a view of experiments and results. Of the 37 remaining papers I have identified 15 that contain relevant experiments, results and conclusions. Others of the 37 papers include commentaries solicited by BlackLight on the accuracy of calculations in the Mills' book on Classical Quantum Mechanics, solicited declarations as to specific experimental results relating for example to spectra, experiments dealing

with issues not central to the new theory, and reports which do not contain results or conclusions. I have not commented further on those.

- 33 Of the 15 papers 12 involve experiments, 2 are statements prepared for the US Patent and Trademark Office relating to experiments and one is a letter from an academic, supporting an aspect of Classical Quantum Mechanics. The papers were produced variously by i) Rowan University, apparently on behalf of NASA, ii) one Keith Keefer, iii) Professors Phillips and Kurtz of Penn State University, iv) NASA, vi) Chalk River Laboratories, vii) Messrs Gernert and Schaubach of Thermacore Inc, (in one case on behalf of Wright Laboratory of the US Air Force), viii) Drs. Peterson and Isenberg of Westinghouse STC, ix) Drs. Nesterov and Kryukov of Moscow Power Engineering Institute, and x) Idaho National Engineering Laboratory. Much of this work involves BlackLight (or HydroCatalysis Power Corporation as it was called earlier) in some way, and where that is the case, while there is no reason to doubt the work or views represented, it cannot be considered entirely independent. The Rowan University work and Keith Keefer's paper appear to have been commissioned by BlackLight. Professor Phillips is said in one of his four papers to be contracted to BlackLight. The two statements are in support of a BlackLight US patent application, so were presumably solicited. In other work, the Thermacore report for the USAF relates partly to recommendations and funding for further work so it may have been in their interest to emphasise any "success" in experiments in order to support proposals for further work. In addition much of this is quite old – 12 of the 15 papers are dated in the early and middle 90's.
- 34 The 15 papers relate primarily to calorimetry of electrolytic cells in experiments that have been set up to determine whether excess heat is produced. The impression is that in most cases the experiments produce some level of excess heat that the scientists find hard to explain. In some cases no excess heat is produced, and in some cases where excess heat is produced the commentary indicates that more rigorous experimental conditions may be necessary to confirm the results. Some accounts consider the possible reasons for excess heat and are unable to suggest anything other than hydrinos. Others suggest there may be more ordinary explanations. Although the authors tend to mention the hydrino theory, they do not in the main conclude that it explains any excess heat. I do not know if there were a range of experiments with negative results that I have not been given. My impression is that these authors do not find evidence in their work which supports Classical Quantum Mechanics.
- 35 Criterion c) takes on greater importance since I am unable to address a) or b) directly. Where a new theory is accepted even as a possible explanation of physical systems that might rival currently accepted theory, one would expect to see activity in the scientific community directed at establishing whether it has any validity. One would expect such activity to take the form of academic papers and correspondence in learned journals providing support for or refutation of the theory by authoritative and independent scientist, conferences at which it is the only or an important topic, scientists working on it in different countries, further bodies of work by independent groups including contributions of new aspects and developments, evidence of its incorporation into mainstream physical theories, reportage of it as a serious theory in newspapers and popular science journals,

and its discussion in text books and popular science books. One would expect that activity to be in proportion to the importance of the new theory. The present theory threatens to overturn substantially the whole basis of our current understanding of fundamental physics and it would consequently be expected to create a huge amount of speculation and work of this sort if it had any degree of credibility.

- 36 Before the hearing, I outlined the difficulty I would have with assessing the theory on my own account, and invited BlackLight to address the question how the theory has been received by the physics community at large in the way I have just discussed. BlackLight did not refer me to any further papers or provide argument to assist me with this point, apart from asserting that the references supplied to me did indeed demonstrate acceptance and verification of the theory by independent scientists. As I discuss above, these references do not convince me that the experimental results provide support for Classical Quantum Mechanics. I find them even less convincing in relation to the acceptance of the theory by the physics community at large. It seems to me on the evidence supplied to me by BlackLight that there is substantially no acceptance of the theory by the physics community.
- 37 I have also researched the theory on the Internet. As far as the “excess heat” experiments go, results have been published and presented at conferences and there is interest from a number of quarters but also scepticism, especially in view of the length of time for which claims of excess heat have been made without, apparently, maturing into conclusive demonstrations or commercial products. I do not think this provides anything in the way of support for the theory. As far as the theory itself is concerned, it appears to have been received in part with scepticism, in part with what could be described as “fan mail”, and seems to generate heated dispute about what should be said publicly about the theory. I see very little serious discussion of the theory itself.
- 38 Dr Mills argued in the alternative that the reason the theory had not found greater interest and acceptance was that others working in the field have a vested interest in ignoring new theories. I do not find that plausible. There is no doubt a significant tendency among scientists to cling onto existing theories, particularly ones into which they have invested time and research. However there is at the same time an obvious willingness to consider new ideas as they arise. In the fields of particle physics and cosmology with which Classical Quantum Mechanics concerns itself, current leaders among unification theories are string theory and supersymmetry. It has certainly been argued that vested interests and a concentration of funding have constrained research into rival ideas. Nevertheless there is a large community of physicists who are working on other ideas such as loop quantum gravity. Speculative ideas also arise which, if reasonably plausible, excite speculation and work by different individuals and teams in order to test them and provide more information. Work on the Higgs particle is an example in the mainstream. Dark matter and dark energy are possible explanations for observations of the effects of gravity on a cosmological scale, and although by no means universally accepted attract work and interest. “Modified Newtonian Dynamics”, perhaps even more speculative has also received serious attention. The proposal by A Garrett Lisi in 2007 that a

unification of the particles and forces could be mapped onto the E8 Lie symmetry group (See *arXiv:0711.0770*) has generated considerable interest and discussion from a range of workers in a very short time. By contrast, the theory of Classical Quantum Mechanics seems to have been absent from such discussion over the period since the appearance of Dr Mills' initial papers canvassing the idea, and the setting up of BlackLight's predecessor in the early 1990's. It consequently appears to me that the theory has been ignored not because of vested interest, but because the physics community does not think it is plausible.

## **Summary**

- 39 In summary, it appears that the theory of Classical Quantum Mechanics upon which these inventions depend, does not reach the threshold that I set for this assessment, namely that it should be more likely than not that it provides a valid description of atomic systems. Accordingly I find that the inventions set out in the independent claims are not capable of industrial application, contrary to section 1(1)(c) of the Act. Since the inventions also rely fundamentally on the existence of a material not generally accepted to exist in nature, I do not consider it would be possible for the skilled person to perform them, contrary to section 14(3) of the Act. I have considered the remaining claims and the content of the specification but do not consider that any valid claim could be drafted. I consequently refuse both applications under section 18(3) of the Act.

## **Appeal**

- 40 Under the Practice Direction to Part 52 of the Civil Procedure Rules, any appeal must be lodged within 28 days.

**P MARCHANT**

Deputy Director acting for the Comptroller