

BlackLight Power

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BlackLight Power, Inc. (BLP) of Cranbury, New Jersey is a company founded by Randell L. Mills, who claims to have discovered a new energy source. The purported energy source is based on Mills' assertion that the electron in a hydrogen atom can drop below the lowest energy state known as the ground state. Mills calls the theoretical hydrogen atoms that are in an energy state below ground level, "hydrinos".^[1] Mills self-published a closely related book, *The Grand Unified Theory of Classical Physics*.^[4]

The proposed theory is inconsistent with quantum mechanics. Critics say it lacks corroborating scientific evidence, and is a relic of cold fusion. Philip Warren Anderson said he is sure it's a "fraud", and Steven Chu called it "extremely unlikely". Blacklight vigorously disputes the allegations of fraud and has announced intentions to proceed legally against individuals and entities that assert these false allegations. To this end, it has recently filed a defamation action in New Jersey.^[5] In 2009 *IEEE Spectrum* magazine characterized it as a "loser" technology because "Most experts don't believe such lower states exist, and they say the experiments don't present convincing evidence".^[6] BlackLight has announced several times that it was about to deliver commercial products based on Mill's theories but has not delivered a working product.^[6]

BlackLight Power Inc.



BLACKLIGHT POWER
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Founded	HydroCatalysis Inc. ^[1] in 1991. ^[2]
Founder(s)	Randell L. Mills
Headquarters	493 Old Trenton Rd. Cranbury Township, New Jersey, USA
Employees	20 fulltime, 14 consultants ^[3]
Subsidiaries	"Millsian, Inc." (http://www.millsian.com).
Website	BlackLightPower.com (http://www.blacklightpower.com/)

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Company

Randell Mills, the founder and CEO of BlackLight Power, received a degree in Chemistry from Franklin & Marshall College in 1982. He later studied biotechnology and electrical engineering at MIT^[7] and graduated from Harvard Medical School.^[2] Claiming a potential power source that "represents a boundless form of new primary energy" and that will "replace all forms of fuel in the world,"^[8] he founded the company in 1991^[2] as HydroCatalysis Inc. which was later renamed to BlackLight Power Inc.^[1] By 2000, Mills raised \$25 million in funding for the company, recruiting several researchers to sit on the board, which

subsequently included representatives of venture capital firms, a former CEO of Westinghouse and turnaround expert^[9] Michael H. Jordan, United States Air Force former Chief of Staff General Merrill McPeak, and ex-deputy director of the Nuclear Regulatory Commission Shelby Brewer.^[2] Mills is the chairman of the board, president and CEO.^{[10][11]}

By 2009, BLP had raised about \$60 million in venture capital^[12] and claimed to have entered into commercial agreements to license its energy technology for the production of thermal or electric power to utilities and private corporations.^[13] In 2013 BLP was one of 54 applicants to receive ~\$1.1M grant from the New Jersey Economic Development Authority^[14] and was awarded a *Trailblazer* award by the New Jersey Technology Council.^[15]

In 2008 Mills envisioned that CIHT (Catalyst-Induced-Hydrino-Transition) cell stacks could provide power for long-range electric vehicles,^[12] and claimed this electricity would cost less than 2 cents per kilowatt-hour, compared with the then national average of 8.9 cents per kilowatt-hour.^[16] In 2010, the company claimed that "CIHT technology was independently confirmed by Dr. K.V. Ramanujachary, Rowan University Meritorious Professor of Chemistry and Biochemistry"^[17] and in 2014 announced a solid fuel version of this technology (SF-CIHT) that they claim has been validated by independent researchers which could provide electricity for 10% or less of traditional infrastructure costs.^[18]

Patents

BLP holds several patents based on graphic modelling software,^[19] but has had problems with one patent. A 2000 patent based on its hydrino-related technology^{[20][21]} was later withdrawn by the United States Patent and Trademark Office (USPTO) due to contradictions with known physics laws and other concerns about the viability of the described processes. A column by Robert L. Park^{[22][23]} and an outside query by an unknown person^[24] prompted Group Director Esther Kepplinger of the USPTO to review this new patent herself. Kepplinger said that her "main concern was the proposition that the applicant was claiming the electron going to a lower orbital in a fashion that I knew was contrary to the known laws of physics and chemistry", and that the patent appeared to involve cold fusion and perpetual motion.^[23] She contacted another Director, Robert Spar, who also expressed doubts on the patentability of the patent application. This caused the USPTO to withdraw from issue the patent application before it was granted and re-open it for review, and to withdraw four related applications, including one for a hydrino power plant.^[22] One of the four applications was so near to issuance that it appeared in the USPTO's *Gazette* as US 6,030,601 (<http://worldwide.espacenet.com/textdoc?DB=EPODOC&IDX=US6,030,601>).^[22]

BlackLight filed suit in the US District Court of Columbia, saying that withdrawal of the application after the company had paid the fee was contrary to law. In 2002, the District Court concluded that the USPTO was acting inside the limits of its authority in withdrawing a patent over whose validity it had doubts, and later that year, the United States Court of Appeals for the Federal Circuit ratified this decision.^{[23][24][25][26]} Applications were rejected by the UK patent office for similar reasons.^[23]^{[27][28][29][30]} The European Patent Office (EPO) rejected a similar BLP patent application due to lack of clarity on how the process worked. Reexamination of this European patent is pending.^[23]

In 2014 BLP announced having lodged applications for multiple worldwide patents covering power generation systems based on their SF-CIHT cells.^[31]

Claims

Mills claims that under controlled experiments certain chemicals may react catalytically with atomic hydrogen to generate a plasma which emits bright light in the ultraviolet/soft x-ray spectrum. The company claims that the special plasma byproducts called "hydrinos" have been experimentally observed to have an energy state below the ground state of hydrogen.^[32]

Mills first announced his hydrino state hypothesis on April 25, 1991, in a press conference in Lancaster, Pennsylvania, as an explanation for the cold fusion phenomena that had been reported in 1989. According to Mills, no fusion was actually happening in the cells, and all the effects would be caused by shrinkage of hydrogen atoms as they fell to a state below the ground state. Mills added that the increased proximity between the atoms would cause them to fuse sporadically, and some of

those atoms would be deuterium atoms (a hydrogen atom with one extra neutron), which would explain why there were occasional readings of neutrons. No experimental evidence was offered by Mills at the time to support his claims which violate accepted nuclear physics.^{[1][33][34][35]}

Model of the free and bound electron

Mills claims that Maxwell's equations of classical physics can be applied to the electron by mathematically representing the electron as a flat disk of spinning charge.^{[4]:1–52} Mills' model for the bound electron or "orbitsphere" treats the mathematical representation of the electron orbit as a "dynamic spherical shell" of zero thickness surrounding the nucleus, whereas quantum mechanics usually represents the electron orbit as an electron shell or probability wave. Mills' model claims to provide an explanation for measured phenomena including quantization of angular momentum and magnetic moment. Unlike the accepted atomic model where electrons can only occupy whole number orbits (e.g. 1, 2, 3 where orbital 1 is the ground state), Mills' model allows for fractional quantum orbitals between these (e.g. orbits below 1, such as 1/2, 1/3, 1/4...). Mills claims to derive "classical" orbitals from the classical nonradiation condition defined by Hermann A. Haus in 1986.

BlackLight process

According to Mills, a specific chemical process he calls "The BlackLight Process" allows a bound electron to fall to energy states below what quantum theory predicts to be possible. In the hydrogen atom, these states are postulated to have an effective radius of $1/p$ of the ground state radius, with p being limited by the speed of light to a positive integer less than or equal to 137.^{[4]:26,203–232} He terms these below-ground hydrogen atoms 'hydrinos'. Mills' mechanism consists of a non-radiative energy transfer between a hydrogen atom and a catalyst that is capable of absorbing a certain amount of energy. The total energy Mills says is released for hydrino transitions is large compared with the chemical burning of hydrogen, but less than nuclear reactions. Mills claims that limitations on confinement and terrestrial conditions have prevented the achievement of hydrino states below 1/30, which would correspond to an energy release of approximately 15 keV per hydrogen atom.^[36]

Experiments

In 1996 NASA released a report describing experiments using a BLP electrolytic cell. Although not recreating the large heat gains reported for the cell by BLP, unexplained power gains ranging from 1.06 to 1.68 of the input power were reported which whilst "...admit[ing] the existence of an unusual source of heat with the cell...falls far short of being compelling". The authors went on to propose the recombination of hydrogen and oxygen as a possible explanation of the anomalous results.^[37]

Around 2002 the NASA Institute for Advanced Concepts (NIAC) granted a Phase I grant to Anthony Marchese, a mechanical engineer at Rowan University, to study a possible rocket propulsion that would use hydrinos.^[38]

In 2005 Šišović and others published a paper describing experimental data and analysis of Mills' claim that a resonant transfer model (RTM) explains the excessive Doppler broadening of the H α line. Šišović concluded that: "The detected large excessive broadening in pure hydrogen and in Ne–H₂ mixture is in agreement with CM [Collision Model] and other experimental results" and that "these results can't be explained by RTM". The collision model explanation for excessive broadening of the H α line is based on established physics.^[39]

Analysis of Mills' models

In 2005, the *Journal of Applied Physics* published a critique by A.V. Phelps of the 2004 article, "Water bath calorimetric study of excess heat generation in resonant transfer plasmas" by J. Phillips, R. Mills and X. Chen.^[40] Phelps criticized both the calorimetric techniques and the underlying theory described in the Phillips/Mills/Chen article. The journal also published a response to Phelps' critique on the same day.^[41]

In a paper published in *Physics Letters A*, Norman Dombey concluded that Mills' theoretical hydrino states are unphysical. For the hydrino states, the binding strength increases as the strength of the electric potential decreases, with maximum binding strength when the potential has disappeared completely, where Dombey remarked "We could call these anomalous states "homeopathic" states because the smaller the coupling, the larger the effect." The model also assumes that the nuclear charge distribution is a point rather than having an arbitrarily small non-zero radius. It also lacks an analogous solution in the Schrödinger equation, which governs non-relativistic systems. Dombey concluded: "We suggest that outside of science fiction

this is sufficient reason to disregard them."^[42] From a suggestion in Dombey's paper, further work by Antonio Di Castro has shown that states below the ground state, as described in Mills' work, are incompatible with the Schrödinger, Klein–Gordon and Dirac equations, key equations in the study of quantum systems.^[43]

The *Journal of Physics D: Applied Physics* published an article by Hans-Joachim Kunze, professor emeritus at the Institute for Experimental Physics, Ruhr University Bochum,^[44] critical of the 2003 paper authored by R. Mills and P. Ray, Extreme ultraviolet spectroscopy of helium–hydrogen. The abstract of the article is: "It is suggested that spectral lines, on which the fiction of fractional principal quantum numbers in the hydrogen atom is based, are nothing else but artefacts." Kunze stated that it was impossible to detect the novel lines below 30 nm reported by Mills and Ray because the equipment they used did not have the capability to detect them as per the manufacturer and as per "every book on vacuum-UV spectroscopy" and "therefore the observed lines must be artefacts". Kunze also stated that: "The enormous spectral widths of the novel lines point to artefacts, too."^[45]

Another physicist, Jan Naudts, in contrast to those cited above, has provided an argument for the existence of the hydrino in an article^[46] "*On the hydrino state of the relativistic hydrogen atom*". Naudt states, "The present paper shows that one can find arguments in favor of the hydrino state also in the standard theory of relativistic quantum mechanics. ... [and] there are no serious arguments from quantum mechanical theory to reject the existence of the hydrino state."^[47]

Commentaries

In 1999 Robert L. Park, emeritus professor of physics at the University of Maryland, and a notable skeptic has been particularly critical of BLP, and while not having tested Mill's method in a laboratory,^[48] wrote:

"Unlike most schemes for free energy, the hydrino process of Randy Mills is not without ample theory.^[49] Mills has written a 1000 page tome, entitled, "The Grand Unified Theory of Classical Quantum Mechanics", that takes the reader all the way from hydrinos to antigravity.^[50] Fortunately, Aaron Barth [...] has taken upon himself to look through it, checking for accuracy. Barth is a post doctoral researcher at the Harvard–Smithsonian Center for Astrophysics, and holds a PhD in Astronomy, 1998, from UC Berkeley. What he found initially were mathematical blunders and unjustified assumptions. To his surprise, however, portions of the book seemed well organized. These, it now turns out, were lifted verbatim from various texts. This has been the object of a great deal of discussion from Mills' Hydrino Study Group. "Mills seems not to understand what the fuss is all about." – Park^[51]

In 2002, after conducting a NIAC funded investigation of BLP, Rowan University's Anthony Marchese commented that whilst "agnostic about the existence of hydrinos", he claimed to be quite confident that there was no fraud involved with BLP and although his NIAC grant was criticised by Park, Marchese said "for me to not continue with this study would be unethical to the scientific community. The only reason not to pursue this would be because of being afraid of being bullied."^[38]

In a 2007 review of cold fusion research, researcher Edmund Storms put forward the hydrino model as a possible explanation for cold fusion.^[52]

In 2008 Park also wrote:

"BlackLight Power (BLP), founded 17 years ago as HydroCatalysis, announced last week that the company had successfully tested a prototype power system that would generate 50 KW of thermal power. BLP anticipates delivery of the new power system in 12 to 18 months. The BLP process,^[53] discovered by Randy Mills, is said to coax hydrogen atoms into a "state below the ground state", called the "hydrino." There is no independent scientific confirmation of the hydrino, and BLP has a patent problem. So they have nothing to sell but bull shit. The company is therefore dependent on investors with deep pockets and shallow brains." – Park^[54]

Also in 2009 Steven Chu, then United States Secretary of Energy, said "it's extremely unlikely that this is real, and I feel sorry for the funders, the people who are backing this".^[55] In 1999, Princeton University's physics Nobel laureate Phillip Anderson said of it, "If you could fuck around with the hydrogen atom, you could fuck around with the energy process in the sun. You

could fuck around with life itself." "Everything we know about everything would be a bunch of nonsense. That's why I'm so sure that it's a fraud."^[7] Wolfgang Ketterle, a professor of physics at MIT, said BlackLight Power's claims are "nonsense" and that "there is no state of hydrogen lower than the ground state".^[6]

In 2009 *IEEE Spectrum* magazine criticized BlackLight concluding that "Most experts don't believe such lower states exist, and they say the experiments don't present convincing evidence." It also pointed out that BlackLight has made similar claims before, announcing that it was on the brink of commercializing its revolutionary technology but failing to deliver.^[6] Dr. Michio Kaku, a theoretical physicist based at City University of New York, adds that "the only law that this business with Mills is proving is that a fool and his money are easily parted."^[7] While Peter Zimmerman was chief arms-control scientist at the State Department, he stated that his department and the Patent Office "have fought back with success" against "pseudoscientists" and he railed against, among other things, the inventors of "hydrinos."^[22]

In 2012 after investigating the BLP process, both Meritorious Professor of Chemistry and Biochemistry Dr. K.V. Ramanujachary of Rowan University and Professor of Chemical Engineering at University of California, Santa Barbara, W. Henry Weinberg claimed that the BLP process is legitimate.^[56]

In 2014 after a series of public demonstration events, Blacklight disputed the prior allegations of fraud and has announced intentions to proceed legally against individuals and entities that assert these false allegations. To this end, BlackLight filed a defamation action in New Jersey.^[57]

See also

- List of topics characterized as pseudoscience

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External links

▪ Commentaries by emeritus professor of physics Robert L. Park:

- *BlackLight Power: Some Ideas Are Simply Too Dumb to Die!* (<http://bobpark.physics.umd.edu/WN06/wn011306.html>) from Bob Park's newsletter *What's New*, January 13, 2006
- *Hydrinos: How Long Can a Really Dumb Idea Survive?* (<http://bobpark.physics.umd.edu/WN08/wn060608.html>), *What's New*, June 6, 2008

▪ General media:

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