Mills Rebuttal of Rathke Regarding Hydrinos

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Abstract

Rathke has made at least nine fundamental mathematical and physics mistakes that dispatch his argument against hydrinos [A. Rathke, "A critical analysis of the hydrino model," New Journal of Physics, Vol. 7, (2005), pp. 127–134].

The author Mills has published extensively on a classical theory that applies physical laws to all scales including the scale of the one-electron atom [2–13]. With great accuracy, the closed-form solutions give the basic observables of the hydrogen atom as well as those of many other fundamental phenomena of chemistry and physics over a scale of 85 orders of magnitude. A critical test of any theory is its ability to predict new phenomena. In this regard, the classical theory predicts that hydrogen can transfer energy nonradiatively to specific species called "catalysts" that can resonantly accept the energy, and in the process, the electron of the hydrogen atom undergoes a transition to a lower energy state (Introduction and Chapter 5 of Ref. [2]). The product atom called a "hydrino" for small hydrogen may comprise the dark matter, but more importantly, it may be a new clean energy source [14,15]. Rathke has claimed that this reaction is impossible based on perceived flaws in the classical theory that predicts hydrinos. However, as pointed out in this rebuttal, Rathke has made at least nine fundamental mathematical and physics mistakes that dispatch his argument against hydrinos [1]. Furthermore, experiments trump theoretical debates. Hydrinos have been observed experimentally [14,15] and the corresponding power from the process has been independently confirmed at the 50 kW level [16].

MISTAKE 1

Rathke has the wrong sign in his classical wave equation (Rathke Eq. (9)) that was noted in his later published erratum [17].

MISTAKE 2

Rathke states that Mills postulates a wave-particle duality that gives rise to the de Broglie wavelength relationship. This is not true. The de Broglie relationship arises from conservation of angular momentum as given in Chp 1, Classical Physics of the de Broglie Relation section of Ref. [2].

MISTAKE 3

Rathke erroneously substituted the relationship between velocity, angular frequency, and radial position, $v_n = \omega_n r_n$, into the classical wave equation at Rathke Eq. (13) that corresponds to incorrectly treating the velocity as the constant v_n at Rathke Eq. (8). The velocity is constant at every point of the uniform spherical shell of charge comprising the spin function $Y_0^0(\theta,\phi)$ corresponding to the case that $\ell = 0$, but it is *not constant* in the case treated by Rathke wherein $\ell \neq 0$. The spin function is modulated by spherical harmonic $Y_\ell^m(\theta,\phi)$ and time harmonic $e^{i\omega_n t}$

charge-density waves that spin about the z-axis and correspond to the case of $\ell \neq 0$. In these cases, the velocity is a function of the distant r from the z-axis to the spherical surface, and the relationship $v_n = \omega_n r_n$ is not correct as shown in Eqs. (I.58-I67) of Ref. [2].

MISTAKE 4

Rathke is wrong in his subsequent deduction that $a = \sqrt{-\ell(\ell+1)}$, and further has the sign wrong here as well as in the classical wave equation (Rathke Eq. (8)) [1].

MISTAKE 5

Rathke is incorrect in his assertion that Mills' classical derivation is not in agreement with special relativity. The angular momentum is shown in the Introduction and Chp 1 of Ref. [2] to be an invariant Lorentz scalar.

MISTAKE 6

Most significantly, the Rathke criticism regarding treating the electron as a solution of a wave equation is irrelevant since the structure of the electron is derived differently from being a solution of a wave equation, and the claim of a wave equation violation of special relativity is obviously wrong. To avoid quantum theoreticians' predisposition to treat the wave equation with an old quantum mechanics prejudice, the Introduction and Chp. 1 Ref. [2] were edited to give the boundary-value derivation of the structure of the electron comprising an invariant, time-varying, electromagnetic source current and further giving the relationship to the 2-D wave equation. The prior approach of bridging the new classical theory with the historical wave equation was dropped. Specially, using Maxwell's equations, *the structure of the electron is derived as a boundary-value problem wherein the electron comprises the source current of time-varying electromagnetic fields during transitions with the constraint that the bound $n = 1$ state electron cannot radiate energy*. Specially, for time-varying spherical electromagnetic fields, Jackson [18] gives a generalized expansion in vector spherical waves that are convenient for electromagnetic boundary-value problems possessing spherical symmetry properties and for analyzing multipole radiation from a localized source distribution. The Green function $G(\mathbf{x'}, \mathbf{x})$ which is appropriate to the equation

$$\left(\nabla^2 + k^2\right) G(\mathbf{x'}, \mathbf{x}) = -\delta(\mathbf{x'} - \mathbf{x}) \tag{1}$$

in the infinite domain with the spherical wave expansion for the outgoing wave Green function is

$$G(\mathbf{x'}, \mathbf{x}) = \frac{e^{-ik|\mathbf{x}-\mathbf{x'}|}}{|\mathbf{x}-\mathbf{x'}|} = ik \sum_{\ell=0}^{\infty} j_\ell(kr_<) h_\ell^{(1)}(kr_>) \sum_{m=-\ell}^{\ell} Y_{\ell,m}^*(\theta', \phi') Y_{\ell,m}(\theta, \phi) \tag{2}$$

Eq. (2) is well known to be relativistically invariant, and Rathke's entire paper is irrelevant since the structure of the electron is derived as a source current that matches Eqs. (1) and (2) and not as a solution of a wave equation (Rathke Eq. (1)).

MISTAKE 7

Rathke incorrectly applies incompatible quantum mechanical postulates to classical physics to assert that classical physics does not predict the hydrogen-atom excited states. Under Mills classical physics approach, the electron is not a nonphysical singularity of mass and charge that comprises an all-space probability wave wherein Maxwell's electrodynamic equations and the role of the photon are ignored. Rathke invokes the old, purely mathematical quantum mechanics approach and incorrectly asserts that the electron energy levels are given by solutions of the radial part of the wave equation. In reality, the electron radius must be fixed for the electron to be stable to radiation and to conserve energy and angular momentum. The electron radius changes during transitions with the corresponding absorption or release of energy. The physical solutions of the electron current and photon fields of excited states is given by Eqs. (1.9-1.11), (1.21-1.24), and (I.97-I.108) of Ref. [2].

MISTAKE 8

Rathke also incorrectly applies incompatible quantum mechanical postulates to classical physics to assert that classical physics does not predict the hydrino states. For the excited-energy states of atomic hydrogen given by the Rydberg equation with $n>1$, the $n=1$ state is the "ground" state for spontaneous pure photon transitions, and conversely, the $n=1$ state can absorb a photon and go to an excited electronic state. But, the $n=1$ state cannot directly release a photon and go to a lower-energy electronic state. An electron transition from the $n=1$ state to a lower-energy state is only possible by a nonradiative energy transfer such as multipole coupling or a resonant collision mechanism to form the lower-energy states have fractional quantum numbers, $n=\frac{1}{\text{integer}}$. The physical solutions derived from Maxwell's equations are given by Eqs. (I.115-I.152) of Ref. [2].

It is irrelevant that quantum mechanics does not predict these states since it is only postulated mathematics, not physics. Furthermore, it violates physical laws and misses many phenomena such as the degeneracy of exited states, electron spin, electron g factor, fine structure, and the Lamb shift. Even the Dirac equation missed electron g factor and the Lamb shift. Both the Schrödinger and Dirac equations have many failings including the instability to radiation as admitted by Rathke. The many failings and shortcomings are presented in the Introduction of Ref. [2] and Ref. [3–13, 19–22]. In contrast, the structure of the bound electron was solved using classical laws and a unification theory based on those laws was subsequently developed called the Grand Unified Theory of Classical Physics (GUTCP) with results that match observations for the basic phenomena of physics and chemistry from the scale of the quarks to cosmos [2].

In cases where mathematics of quantum mechanics has been forced to match data, the results of classical law are vastly superior. For example, in a new molecular modeling paper [3], the energies of exact classical solutions of molecules generated by Millsian 1.0 and those from a modern quantum mechanics-based program, Spartan's pre-computed database using 3-21G and 6-31G* basis sets at the Hartree-Fock level of theory, were compared to experimental values. The Millsian results were consistently within an average relative deviation of about 0.1% of the experimentally values. In contrast, the 3-21G and 6-31G* results deviated over a wide range of relative error, typically being >30-150% with a large percentage of catastrophic failures, depending on functional group type and basis set.

MISTAKE 9

Rathke incorrectly places theory over experimental observation. The hydrino states are observed experimentally disproving the postulated mathematics invoked by Rathke. As summarized in the Data section of the Introduction of Ref. [2], some of the prior related studies supporting a novel reaction of atomic hydrogen, which produces hydrinos, hydrogen in fractional quantum states that are at lower energies than the traditional "ground" ($n=1$) state, include extreme ultraviolet (EUV) spectroscopy, characteristic emission from catalysts and the hydride ion products, lower-energy hydrogen emission, chemically-formed plasmas, Balmer α line broadening, population inversion of H lines, elevated electron temperature, anomalous plasma afterglow duration, power generation, and analysis of novel chemical compounds and isolated molecular hydrino [14–16, 23–52].

The recent experimental confirmation of the predictions for transitions of atomic hydrogen to form hydrinos, such as power production and characterization of hydrino reaction products [14,15] as well as pumped catalyst states, fast H, characteristic continuum radiation, and the hydrino product have profound implications theoretically, scientifically, and technologically in that they (1) confirm GUTCP in the prediction of hydrinos, (2) directly disprove atomic theories such as the Schrödinger and Dirac equations based on the definition of $n=1$ as the ground state, the defined state below which it is impossible to go, as expected based on many physical failings and preexisting mathematical inconsistencies [2–13, 19–22], (3) offer resolution to many otherwise inexplicable celestial observations with (a) the identity of dark matter being hydrinos, (b) the hydrino-transition radiation being the radiation source heating the warm-hot interstellar medium (WHIM) and behind the observation that diffuse Hα emission is ubiquitous throughout the Galaxy requiring widespread sources of flux shortward of 912 $\mathring{A}$, and (c) the energy and radiation from the hydrino transitions being the source of extraordinary temperatures and power regarding the solar corona problem, the cause of sunspots and other solar activity, and why the Sun emits X-rays [14], and (4) directly demonstrate a new field of hydrogen chemistry and a powerful new energy source that currently operates at over 50 kW with performance levels projecting superiority over other energy sources such as fossil-fuel and nuclear energy sources [15]. These results have been independently confirmed at the 50 kW level following a thorough study by a team at Rowan University [16]. The production of enormous amounts of power that was predicted to be impossible according to Rathke experimentally disproves his arguments. A theoretical paper that provides further material dispatching his arguments is in press [5].

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