THE LAST POEM OF JAMES CLERK MAXWELL

A Victorian Drama

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DRAMATIS PERSONAE

• **JAMES CLERK MAXWELL** (1831-1879), incomparable Scottish physicist, only 5 feet and 4 inches tall, Professor of Experimental Physics at Cambridge, famous for his investigations of Saturn's rings, optics, heat and most recently electricity and magnetism. A strange Galloway accent, a racing mind and a penchant for humor make him incomprehensible to many, especially students. "Why don't you give them thinner?" is advice he offers other instructors but apparently never tries himself. Although deeply religious and somewhat mystical, he believes that religious matters should remain private.

• **PETER GUTHRIE TAIT** (1831-1901), second Scottish physicist, well-known for *Treatise on Natural Philosophy* written with William Thomson (a.k.a. Lord Kelvin). Chauvinistic and overly confident, Tait loves nothing more than a good argument with a worthy opponent. Many years from now, Thomson will recall: "We never agreed to differ. We always fought it out. But it was almost as great a pleasure to fight with Tait as to agree with him." Friend of Maxwell since school days in Edinburgh.

• **BALFOUR STEWART** (1828-1887), still another Scottish physicist! Together with Tait he will publish *The Unseen Universe* and *Paradoxical Philosophy*, hastily written nonsense that attempts to reconcile religious miracles with science. Not surprisingly, it will be immediately popular.

• **CHARLES DARWIN** (1809-1882), English naturalist has convinced all reasonable people that species evolve over time from a common origin. Religion and arguments about it give Darwin terrible headaches. Consequently, he has no speaking role in this drama.

• **JOHN TYNDALL** (1820-1893), physicist, but Irish, Professor of Natural Philosophy at the Royal Institute. He writes and lectures on science to general audiences.

• **LUDWIG BÜCHNER** (1824-1899), German philosopher and scientist who champions scientific materialism. His book, "Kraft und Stoff (Force and Matter)" published in 1855, has been translated into many languages including English and widely read.

• **WILLIAM CLIFFORD** (1845-1879), English mathematician and philosopher. A bold advocate of the new non-Euclidean geometries, he speculates that all motion of matter

results from curvature of space. An outspoken atheist, he insists on proof for any belief. Colleagues like him, but many wish that he would be quiet on matters of religion.

With reference to **FELIX KLEIN** (1849-1925), German mathematician whose bold *Erlanger Programmm* proposes to classify all geometries through the study of symmetries. Klein observes that a knotted circle would come untied in 4-dimensional space.

Events and chronology are believed to be accurate. All spoken lines are quotations, faithfully reproduced.

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SETTING OF DRAMA: Britain, mid-nineteenth century. Church leaders are fighting two enemy forces. Tyndall and colleagues, encouraged by Darwin's "Origin of the Species," question the authority of the Bible and the occurrence of miracles. Meanwhile, German materialists such as Büchner are promoting a godless vision of the universe in which only force and matter reign.

> *Büchner:* No force without matter—no matter without force!...That those who talk of a creative power, which is said to have produced the world out of itself, or out of nothing, are ignorant of the first and most simple principle, founded upon experience and the contemplation of nature.

Büchner's league, the "Deutsche Freidenkerbund," will form in 1881, and offer Germany's atheists their first public form. Meanwhile, Darwin's new book, "The Descent of Man," (1871) has caused panic in Church ranks.

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ACT I

SCENE 1: Belfast meeting of the British Association for the Advancement of Science (BAAS), 1874. Founded 33 years earlier, the BAAS now attracts a broad audience, much broader than the more exclusive Royal Society. The word "science" rather than the old term "natural philosophy" reflects the Association's ambitious scope. Indeed Cambridge professor William Whewell has just invented the word "scientist" to describe the new cultivators of knowledge. Annual meetings of BAAS are gala events. Newspapers and magazines will announce schedules of events. Particularly anticipated is the President's Address. This year it is delivered by John Tyndall.

> *Tyndall:* All religious theories, schemes and systems, which embrace notions of cosmogony, or which otherwise reach into the domain of science, must, in so far as they do this, submit to the control of science, and relinquish all thought of controlling it.

Tyndall's call for rationalism is seen by many as an attack on religion. Tait and Stewart are among those who are offended by Tyndall's remarks. In response, they herald

their forthcoming book, "Unseen Universe," in the pages of *Nature* with an anagram that spells out the book's main doctrine:

> *Tait, writing:* Thought conceived to affect the matter of another universe simultaneously with this may explain a future state. - We S(tewart) T(ait)

SCENE 2: Maxwell's study, 1875. Maxwell is once more invited to join the Victoria Institute, which attempts to reconcile Christianity with science. Maxwell drafts a refusal:

> *Maxwell, writing:* Sir – I do not think it my duty to become a candidate for admission into the Victoria Institute. Among the objects of the Society are some of which I think very highly. I think men of science as well as other men need to learn from Christ, and I think Christians whose minds are scientific are bound to study science that their view of the glory of God may be as extensive as their being is capable. [sighs] But I think that the results which each man arrives at in his attempts to harmonize his science with his Christianity ought not to be regarded as having any significance except to the man himself, and to him only for a time, and should not receive the stamp of a society...

Many years later, Maxwell's biographer, Lewis Campbell, would find nobody who could recall the famous physicist's views on religion. According to one colleague: "Unfortunately his love of speaking in parables, combined with a certain obscurity of intonation, rendered it often difficult to seize his meaning; but bright and penetrating little sayings, usually whimsical in form, and sometimes accompanied by strange gestures, recurred almost unfailingly at no distant intervals."

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ACT II

SCENE 1: Tait's study, Edinburgh, 1877. Stewart and Tait are using "The Unseen Universe" to argue that religious miracles and immortality of the soul are not incompatible with science. God must be hidden from us because all of our thoughts are "conditioned." Their so-called principle of Continuity comforts us with the assurance that while nature might be difficult to comprehend, it will never do anything to completely confound us.

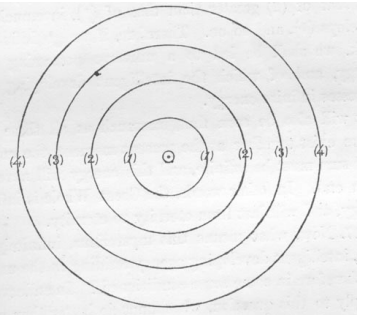
> *Tait, writing:* ...what the principle of Continuity demands is an endless development of the conditioned. We claim it as the heritage of intelligence that there shall be an endless vista, reaching from eternity to eternity, in each link of which we shall be led only from one form of the the conditioned to another, never from the conditioned to the unconditioned or absolute, which would be to us no better than an impenetrable intellectual barrier...Finally our argument has led us to regard the production of the visible universe as brought about by an intelligent agency residing in the unseen.

But how does the intelligent developing agency which resides in the unseen operate? As scientists, Stewart and Tait must have a theory:

Stewart, wrtiting: We therefore welcome an hypothesis like that of Sir W. Thomson, which regards the primordial atoms of the visible universe as vortices somehow produced in a pre-existing perfect fluid...In the production of the atom from a perfect fluid we are driven at once to the unconditioned – the Great First Cause.

Every thought and every action send eternal vibrations into the perfect fluid. Inconveniently, nothing in our visible world, including fluids, is perfect. Tait is not deterred. He imagines particles of good ether next to better ether, particles of better ether next to even better, ad infinitum:

Tait, writing: Let us begin by supposing an intelligent agent in the present visible universe, – that is to say a man [pause]– to be developing vortex-rings – smoke-rings, let us imagine. Now, these smoke-rings are found to act upon one another, just as if they were things or existences; nevertheless their existence is ephemeral, they only last a few seconds. But we may imagine them to constitute the grossest possible form of material existence. Now, each smoke-ring has in it a multitude of smaller particles of which the present visible universe is composed...so we may imagine ordinary molecules to be developed as vortex rings out of something much finer and more subtle than themselves.. In fine, there is no end to such a process... Our meaning is made clear by the following diagram.



SCENE 2: Clifford's study, University College, London, 1877. Uncritical criticism of "The Unseen Universe" was kind. Clifford's comments in *Fortnightly Review* were not.

Clifford, writing: Let us contemplate the reposeful picture of the universal divan, where these intelligent beings whiled away the tedium of eternity by blowing smoke-rings from sixty-three kinds of mouths... [scornfully] How fertile of resource is the theologic method, while it once has clay for its wheel!

SCENE 3: Maxwell's study, Cambridge, 1878. A rumor is spreading that Stewart and Tait are writing a sequel to "The Unseen Universe." As Maxwell writes to Tait, annoyance with his friend's public religious pronouncements is disguised by humor.

Maxwell, writing: It is said in *Nature* that U.U. is germinating into some higher form. If you think of extending the collection of hymns given in the original work, do not forget to insert 'How happy could I be with Ether.'

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ACT III

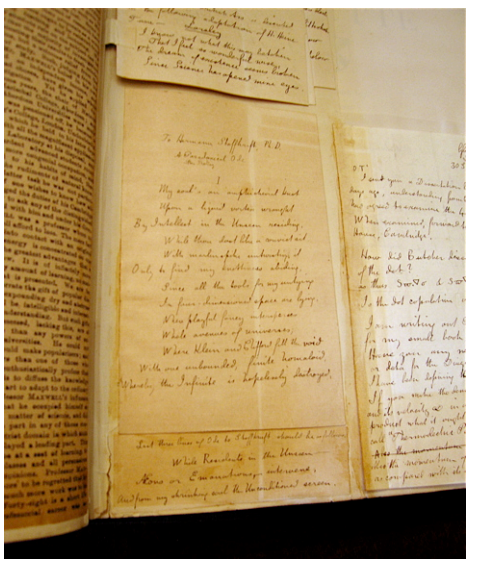
SCENE: Maxwell's study, 1878. Stewart and Tait have now published their sequel, "Paradoxical Philosophy." It takes the form of an imaginary dialogue that somehow converts a German materialist Dr Hermann Stoffkraft (Stoff + Kraft) to a belief in the doctrines of "The Unseen Universe." Maxwell's review in *Nature* reveals his exasperation.

> *Maxwell, writing, mildly irritated*: To exercise the mind in speculations on such media may be a most delightful employment for those who are intellectually fitted to indulge in it, though we cannot see why they should on that account appropriate the words of St. Paul.

For Maxwell, any question of the soul's immortality is not merely academic. He is dying, and very likely knows it by now. For months he has been suffering from stomach pains, but he has consulted no doctors. As he writes, he has trouble swallowing. He will soon learn that he has the same cancer that took his mother at the very same age that he is now. Within a year he will die.

Sensitive but shy, Maxwell has often expressed himself to friends in comic verse. He takes up his pen to write one last poem. A loose parody of lines from Percy Shelley's "Prometheus Unbound," Maxwell's "A Paradoxical Ode" pokes fun at "The Unseen Universe," evolution, the vortex atom theory and German materialism. But on a deeper level, it seems to express his feelings about life and what, if anything, might come afterwards.

The original version of "A Paradoxical Ode" is contained in a large scrapbook recently donated to the James Clerk Maxwell Foundation by a relative of Tait, and stored in a locked cabinet. The second author had the pleasure of 'discovering' the poem during a visit in the summer of 2006. A version of it was published in G.C. Knott's "Life and Scientific Work of Peter Guthrie Tait" (1912), and subsequently reproduced, each time, it seems, with small mutations. Maxwell's version has a more personal tone than in any found elsewhere.



Maxwell reads:

To Hermann Stoffkraft, Ph.D.
A Paradoxical Ode.
[After Shelley]

I

My soul's an amphicheiral knot[1]
Upon a liquid vortex wrought
By Intellect in the Unseen residing,
While thou dost like a convict sit
With marlinspike untwisting it[2]
Only to find my knottiness abiding,
Since all the tools for my untying
In four-dimensioned space are lying[3],
Where playful fancy intersperces,
Whole avenues of universes;
Where Klein and Clifford fill the void
With one unbounded, finite homaloid[4],
Whereby the Infinite[5] is hopelessly destroyed.

II

But when thy Science lifts her pinions
In Speculation's wild dominions,
I treasure every dictum thou emittest;
While down the stream of Evolution
We drift[6], and look for no solution
But that of survival of the fittest[7],
Till in that twilight of the gods
When earth and sun are frozen clods,
When, all its matter degraded[8],
Matter in aether shall have faded,
We, that is, all the work we've done[9],
As waves in aether, shall for ever run
In swift expanding spheres, through heavens beyond the sun.

III

Great Principle of all we see,
Thou endless Continuity!
By thee are all our angles gently rounded,

Our misfits are by thee adjusted,
And as I still[10] in thee have trusted,
So let my methods never be confounded!
O never may direct Creation
Breach in upon my contemplation,
Still may the causal chain ascending,
Appear unbroken and unending,
And where the chain is best to sight
Let viewless fancies guide my darkling[11] flight
Through aeon-haunted worlds, in order infinite[12].

$$\frac{\partial p}{\partial t}$$ [13]

Taped to the bottom is an addendum, sent some days afterwards.

Last three lines of Ode to Stoffkraft should be as follows.

While Residents in the Unseen–
Aeons or Emanations – intervene,
And from my shrinking soul the Unconditioned[14] screen.

Notes: 1. An amphicheiral knot is one that can be deformed into its mirror image. In Shelley's poem, Asia refers to herself as an "enchanted boat" drifting without course or star, driven only "by the instinct of sweet music." 2. Convicts might be given the task of recovering hemp from rope by using a marlinspike; 3. Maxwell was doubted that we live in a world of more than 3 spatial dimensions. In a letter to C.J. Monroe, dated 1871, he asked: "If you have 4 dimensions this becomes a puzzle, – for first, if three of them are in our space, then which three?" 4. Three-dimensional space in which the axioms and postulates of Euclid hold; 5. The Infinite was often identified with God; 6. In Shelley's poem, Asia also drifted down a stream; 7. "Survival of the fittest" was a term invented by popular philosopher Herbert Spencer; 8. Dr Stoffkraft asserts that all energy degrades. With the end of humanity, collective consciousness will disappear; 9. Perhaps a very personal note; 10. always; 11. In the dark; 12. Likely intended as a bad rhyme. 13. Maxwell signs his letter with $\partial p/\partial t$, an abbreviation of $\partial p/\partial t = JCM$, a short-hand for one of the laws of thermodynamics; 14. Kant's notion, greatly elaborated upon by Herbert Spencer.

Why did Maxwell send the addendum? Maybe he was teasing Tait by pointing out an unfortunate consequence of his philosophy – that the principle of Continuity should prevent Maxwell from ever encountering the Unconditioned, even after death.

Maxwell's thoughts about death are unknown to us. Nevertheless, according to a physician who attended him, "No man ever met death more consciously or more calmly."

Finis

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Sources.

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