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Little Book of Streamlines FREE

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A Revised *Mr. Tompkins* . . . Worthy of the Original

The New World of Mr. Tompkins

George Gamow and
Russell Stannard
Cambridge U. P., New York, 1999.
258 pp. $24.95 hc
ISBN 0-521-63009-6

Reviewed by Daniel M. Greenberger

Mr. Tompkins in Wonderland was published in 1941, followed in 1944 by *Mr. Tompkins Explores the Atom* (Cambridge). They were written by George Gamow, a famous physicist with a great gift for whimsy, and they were two of a number of books he wrote for the general public. The *Mr. Tompkins* books were very popular when I was in high school in the late 1940s; I was rather taken by them, and I went on to read his *One, Two, Three . . . Infinity* (Viking, 1947; Dover, 1988). The books probably played a minor role in my becoming a scientist. I would guess that there are a good many scientists of my generation who could say that. In 1965, the Tompkins books were updated and combined by Gamow into *Mr. Tompkins in Paperback* (Cambridge).

Back in those days, as I remember it, there were several good mathematics books for the layman (*Lancelot Hogben's Mathematics for the Millions*, (Allen & Lunwin, 1936; Norton, *pb*, 1993), for example), but very few physics books, and the Tompkins books filled an important need.

They involved a sort of passive fellow named Tompkins, who was interested in science and went to hear a series of popular lectures by a professor. Tompkins kept falling asleep during or after the lectures and being transported into a fantastic land where Planck's constant, the gravitational constant, and the speed of light were all such as to make the relevant phenomena of modern physics everyday occurrences. This led to a rather strange series of escapades for poor Mr. Tompkins (whose initials, by the way, were C.G.H.). Ultimately, he met the professor and fell in love with and married the professor's daughter, Maud, providing an element of human interest to the story.

Today the situation is very different. There are many very good books for the layman on many aspects of modern physics, and there are some great science writers out there. Isaac Asimov is dead, but James Trefil and Paul Davies are going strong, and there are quite a few other good writers in this genre. Very often, on special topics, an expert in the field will write a good book for laymen. As an example, I can think of at least ten books that explain the mysteries of quantum theory to nonscientists, even delving into such exotic subjects as Bell's theorem.

So the question arises. Do we need a reworking of *Mr. Tompkins*? The original is still a fine book, but it is 35 years old and out of date. It was written when the big bang and the steady state theory were still fighting it out, and there were no quarks or black holes. Thus, if such a book is to be updated, clearly a major rewrite is in order. Is it worth it? And if it is, what's left of the original Gamow book?

On being asked to review *The New World of Mr. Tompkins*, which is a major reworking of Gamow's original by Russell Stannard, an experienced science popularizer, I decided first to reread the 1965 version. This turned out to be both a good and a bad decision. Bad, because I found myself (like Mr. T) having daydreams, remembering the days when I first read it. The naïveté of the writing and of the drawings have a certain charm, which caught me up again, and when I started reading the new version, I found the changes rather annoying. But as I kept reading, I began to realize that Stannard had actually done a remarkable job of preserving the mood and feeling of the original. There are even portions that have barely been changed, which offer an anchor to the rest of the book. But most of the book has had to undergo a fairly thorough reworking, and new adventures have been added, as well as new lectures by the professor. The good part of rereading the old book is that it made me aware of how faithfully the spirit of the original has been preserved.

After all, in a task like this, one has to give the author a fairly free rein. In a sense, the task is rather like a translation, and the best one can do is to retain the feeling, rather than the substance, of the original. And I think Stannard is to be congratulated on this score. The book still has a charming naïveté, and although the illustrations have been changed, they too still have that same, almost Victorian quality. So, to my surprise, I have to pronounce the translation a success.

If newcomers who have not seen the original read the book, they will find a charming, whimsical introduction to modern physics and will have no sense that Gamow is missing from certain sections. If I have one criticism to make, it would be that, while the explanations are generally satisfactory, toward the end of the book the lectures are a little too detailed and fact-filled. (I caught a few wrong statements, but to my surprise they were also there in the original.)

Back to my earlier question: Was there any point in redoing the book? That depends. Are there other good books that cover the same material? Lots of them! Is there another book that does it so pleasantly, giving the reader a direct, sort of inside view of otherwise very remote phenomena, all within the context of a running short novel? I doubt it! *The New World* . . . is a unique book. I only wonder whether the audience is there for it. Today's kids are raised on multiple murders and high-speed chases. I wonder whether Victorian charm is still an appreciated commodity.

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Little Book of Streamlines

Constantine Pozrikidis
Academic Press, San Diego, Calif., 1999. 176 pp. $49.95 hc
ISBN 0-12-563855-8, Diskette

Practicing fluid dynamicists use a host of visual representations of fluid flow—timelines, streaklines, velocity profiles, and the like. But, no doubt, the most common visualization of fluid motion is that of streamlines, the lines everywhere tangent to the velocity vector. In steady flows, the streamlines are the actual paths of infinitesimal fluid particles and are thus the pathlines. In unsteady flows, this is not the case. And while one can still define instantaneous streamlines—lines everywhere tangent to the particle velocity vector at a particular instant of time—the usefulness of such lines for unsteady flows is much less than it is for steady flows.

Since fluid particles move in a manner consistent with the forces acting on them, streamline patterns, particularly for steady flows, provide insight into the physics of the flows for which they are drawn. Every fluid dynamics text will illustrate its textual material with streamline figures. What the reader will find in Costas Pozrikidis's *Little Book of Streamlines* is very little text and a large compilation of such figures for a wide range of incompressible, mainly steady and two-dimensional (both planar and axisymmetric) flows. (Pozrikidis is professor of fluid mechanics at the University of California, San Diego, and author of the excellent advanced fluid dynamics text *Introduction to Theoretical and Computational Fluid Dynamics*, Oxford, 1997.)

The book contains four main sections: Irrotational Flow, Vortex Flow, Stokes Flow, and Miscellaneous (Flows). Each of these begins with a very brief—a half-page at most—description of the class of flows, and each particular flow is illustrated on one or more pages.

Because a fluid must flow tangent to any impermeable solid body, the reader, or, in this case viewer, of what is basically a collection of figures, may find many of the streamline patterns to be obvious. But many will not, and even the experienced worker in the field should find many of the figures unfamiliar and interesting, particularly, for example, in the Stokes flow section.

The price of the book makes it unlikely that students will be asked to purchase it as a supplement to a regular text in a course. Instructors of basic and more advanced fluid dynamics classes, on the other hand, may find it useful as a source of streamline patterns for many of the flows they discuss in their classes. (Software—FORTRAN 77 programs on a 3 1/2 floppy disk—for calculating the flows accompanies the book.)

One small criticism: The author explicitly states that he chose the origin of streamlines in most of the flows illustrated to give visually pleasing patterns, instead of choosing them so that the flow rate between neighboring streamlines is constant. This means that one cannot generally glean qualitative values of the velocities in these flows from the distance that the streamlines are from each other. This is a minor criticism, however, of what is otherwise a delightful and instructive collection.

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The Unmaking of the Medieval Christian Cosmos, 1500-1760: From Solid Heavens to Boundless Aether

William G. L. Randles
Ashgate, Brookfield, Vt., 1999.
274 pp. $85.95 hc
ISBN 1-84014-624-9

Copernicus published his radical, Sun-centered cosmology in 1543. It took decades for it to gain scientific acceptance. Modern commentators typically have a problem with this delayed adoption of the new celestial blueprint. Why did it take so long? Were those folks dense or blinded by entrenched tradition? Although most scientists recognize the scorn that generally accompanies the phrase, "But that would require new physics!" it is difficult to transport this same reluctance to the Aristotelian climate of the 16th and early 17th centuries.

Part of the new physics eventually ushered in with the Copernican Revolution concerned the nature of the cosmic material. In the 1970s, historians of science argued passionately about whether Copernicus believed in solid celestial spheres and whether this helped drive him to a heliocentric model. Extensive searches failed to find that the solidity of the celestial spheres, or lack thereof, was an active problem in the first half of the 16th century. The issue emerged quite strongly after Tycho Brahe proposed his geo-heliocentric cosmology, in which the orbit of Mars cut through the Sun's orbital circle, and this caused him to espouse a liquid, or fluid, model. Peter Barker has recently argued that evidence from optics, and in particular a challenge from Jean Pena about the cause of celestial refraction, stimulated Tycho's adoption of the fluid spheres.

In *The Unmaking . . .*, William Randles, former director of studies at the School of Higher Studies in the Social Sciences, in Paris, dissects the "new physics" of the celestial medium with great patience and attention. Beginning with three early Christian attempts to reconcile scriptural hints with Greek cosmology, he moves on through the Middle Ages to his area of concentration, the Renaissance. Here he incorporates the recent insights concerning Pena's role. Particularly with respect to astronomical refraction, the 16th-century French natural philosopher challenged the classical Aristotelian notion of spheres of air, fire, and aether, which clearly influenced Tycho's thinking.

At this point religious stances became important. Robert Bellarmine, the cardinal whose conservative view of scriptural interpretation played a major role in the Galileo affair and who had once taught astronomy at the Louvain, was sympathetic to fluid spheres. Christopher Clavius, the leading Jesuit astronomer and a major textbook author, stuck with solid spheres and was cool or indifferent to Tycho's cosmology. But after Galileo discovered the phases of Venus, showing that the planet was circumsolar, the Ptolemaic arrangement was no longer viable; the choice was then between the Copernican and Tychonic geo-heliocentric theories. The Jesuits opted for the Tychonic cosmology to accommodate both the phases of Venus and the scriptural passages that seemed to call for a fixed earth. For them the question of a fluid medium was still an essential element for the discussion.

The debate over the physical nature of the heavens sets the stage for the central concern of Randles's account: the role of Heaven within the heavens—here called the Empyrean, the ultimate home for the blessed. The medieval sacred geography fixed the Empyrean immediately outside the spinning, starry sphere.

How to place Heaven in the new cosmologies was a major hang-up for Catholic philosophers in particular, and Randles discusses at length the opinions reflected in university textbooks in Catholic countries, where the Jesuit viewpoint was particularly strong. The introduction of Descartes's universe of vortices and indefinite extension created a special crisis in finding a physical place for Heaven, but the Cartesian cosmology paved the way for the vast inertial space of *Newton's Principia*.

Astronomy in general, but not cosmology in particular, continued to flourish in the Catholic countries, as