

A physicist whom the twentieth century left behind

Night Thoughts of a Classical Physicist

Russell McCormmach

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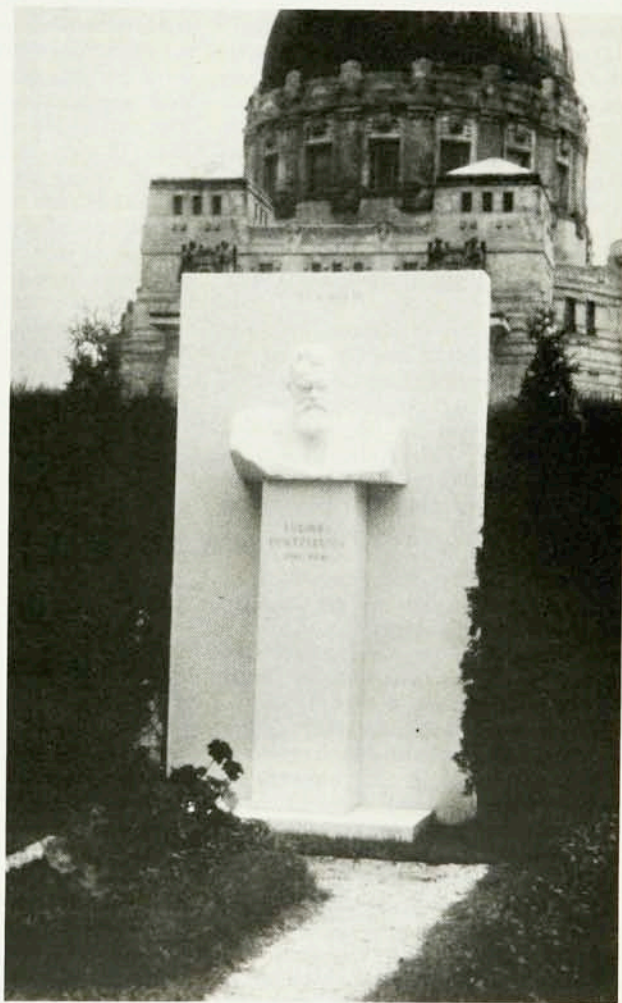
Reviewed by Robert Andersen

Unlike the revered masters and mentors of his epoch, Viktor Jakob, the "classical physicist" in this intriguing literary incursion into the social history of German science, does not figure in Pogendorff's biographical dictionary. There is no entry for this Honorary Ordinary Professor saddled with a Semitic name, outdated loyalties, and a plodding and unoriginal intellect. The "night thoughts" he entertains are not even his own; rather the elegiac "meditations," by which this hapless epigone evokes the terrain of a watershed in physics, belong to his non-factitious colleagues. Jakob, it turns out, is an effigy, a composite painstakingly constructed from "real voices and events of the past" by Russell McCormmach, a historian of science at Johns Hopkins.

As a representative life, Jakob's personifies the ethos of the highwater mark of German science, the classical school of Hermann von Helmholtz, Gustav Kirchhoff, Heinrich Hertz, Max Planck, and Paul Drude. As an invented figure he enables the author to compress an imposing amount and variety of primary source material (personnel files, research notes, obituaries, and so forth) into a thematic unity. Indeed, the "cross-referencing" of copious notes is at once a strength and a weakness in this work. McCormmach has mated a literary model, the German novella, to rigorous, "German," scholarship to produce a hybrid genre, neither fiction nor history but rather their dialectic combination.

In submitting his mastery of the archives to the discipline of the literary form, McCormmach has attempted both to raze a cultural totem and evoke ironic pathos for a sensibility overwhelmed by modernizing pressures. The totem is the classical world-view—not just an intellectual armature but a "set of virtues, a quality of thought and character"; the sensibility is that of a

Tomb of the classical physicist Ludwig Boltzmann (1844–1906) in front of the University of Vienna. His life—and his suicide—has parallels with that of the fictitious Victor Jakob, whose biography is reviewed here. (Photo from the University of Vienna, courtesy AIP Niels Bohr Library.)



69-year-old physicist whose meager achievements and old-fashioned ways invite the patronizing ridicule of his younger colleagues; the pathos is the realization that history has passed him by, turned him into a "type, and a nostalgic one at that"; the irony arises from the fact this beleaguered "type" acts as a foil to dramatize the abrupt ascendancy of the anti-type: the ambitious atomic physicist who mocks Jakob by usurping all but a corner of his blackboard for arcane equations; and the modernizing pressures were galvanizing a fragmentation of culture and

an inversion of values that, in a crescendo, reached the senseless slaughter of the First World War. The year is 1918; the setting is a provincial university; and the narrative, punctuated by italicized dream sequences, turns on Jakob's bewilderment and distress in the face of imminent cultural extinction.

"Professor Jakob's Space," as the Privatdocent derisively refers to it, is progressively shrinking. This ardent devotee of Johann Wolfgang von Goethe, disciple of James Clerk Maxwell, student of Helmholtz and admirer of

Drude, is forced to reckon not with honorable retirement but with painful self-reflection. For Jakob the venue that crystallized his character and exalted his profession has been upended. Now even the once formidable Reich that Jakob helped "unify" during the campaign of 1870 is collapsing. Indeed, the character of the descent they share also shifts from classical to modern: The head-wound Jakob suffered as a young lieutenant now recurs as a maiming of his psyche.

Physics is the touchstone of this portrayal of psychic dissonance. One of those whose work "sought to order all phenomena under a single principle," Jakob finds himself out of sorts with the revolutionizing thrust of the new physics. More than out of sorts: cast off. Too intelligent to dismiss the brilliant work of the young turks, Niels Bohr and Albert Einstein, Jakob is still loath to abandon a career dedicated to the formulation of the relations of the world-ether. His very identity is tied to the fate of the "electromagnetic standpoint."

Indeed, because classical physics seeks to elucidate the "essence" of nature, as the hegemonic discipline it entails qualities of character as well as intellectual stamina. Now that the rising generation—*Knabenphysik*—has employed its mathematical wiles to undermine the classical imprint, a cultural void has opened up, giving rise to expressions of rancid nationalism, careerism, egoism, and the cult of the irrational. Caught in the squeeze between the technologizing and mathematicizing of physics—between the *Geheimrat* and the *Privatdozent*—Jakob beats a tired retreat. Having asked the "fundamental questions" throughout his career as a theorist, Jakob recoils at the possibility that the answers he sought were all along couched in an impenetrable mathematics that suggests the only remaining valid standpoint is—anything goes.

If culture-pessimism unhinges Jakob, his unyielding identification with the classical paradigm kills him. His interior transit, across a psychosocial mine field, has become a death-trip. McCormmach tracks Jakob through the interstices of career, character, profession, and historical moment, in the process laying bare, in graceful, spare prose, the "irrational" underside and "extrarational" orbit of scientific rationality and progress. Personal antipathies and jealousies, bureaucratic tyranny and individual stubbornness, racism, nationalism, ambition, thematically configure this unfolding of the dreams and delusions of the German scientific mandarin. The all-too-human context of scientific striving has never more scrupulously nor graphically been represented.

McCormmach has taken heady risks in exposing his scholarly specialty to the light of day. But the result—a model of economy, penetration, and boldness—more than justifies the effort. It is neither trendy, nor tendentious, nor a slick vehicle for making the history of science palatable and entertaining. Quite the opposite. Of all the compounded ironies that make this history-as-novella beguiling, none is more striking than the one fashioned by the contrast between the ease of access, due to the narrative form and the personal, "confessional" idiom, and the demanding nature of the material, the intellectual, social, and psychological terrain traversed. This deceptive work rewards slow reading and "shuttled" perusal of the scholarly notes. The jettisoning of the classical framework, in physics as in the culture as a whole, came as a series of shocks extending over a generation. The ramifications of that cumulative shock-wave, here so incisively and affectingly explored, have exact parallels to our own nested crises.

If the novella doesn't quite come off—if Jakob is subject to too weighty, self-conscious, and philosophical pronouncements—the history conveys the breakdown and collapse of a grand and grandiose conceit: our own.

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Cosmic Plasma

H. Alfvén

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Cosmic Plasma, characteristic of the work of Hannes Alfvén, is full of thought-provoking and original ideas. Although I very much enjoyed reading it, it is by no means an easy book. The ideas are important and provocative, but they are presented weakly. I was also put off by the truism that Alfvén repeats in many forms that in making theoretical speculations in new fields one must be very careful if one is to avoid incorrect theories: Either the theory must be rigorous, self-consistent and rational, or it must be thoroughly grounded in laboratory experiments. It is true that first theories of a subject such as the Earth's magnetosphere have been grossly in error and have had to be discarded. But, it is also true that the theory of plasma physics has advanced with predictive theories as well as theories after the fact. Everyone agrees that bad science has not usually paid off!

One difficulty in following Alfvén's arguments results from the analogies he makes between electric circuits and cosmic phenomena. It is not easy to

understand how pieces of plasma are to behave like wires while the rest of the plasma is to be ignored. When Alfvén applies these equivalent circuit models to cosmic situations, he invokes voltages and electric fields whose origins are not intuitively clear. For example, he attributes the voltages driving the auroral currents to a slippage between the magnetospheric plasma and corotation. But what is the slippage due to? Couldn't the situation be the other way around, with the slippage due to the resistance in the circuit? Too often the reader must supply the missing qualitative ideas in these circuit pictures.

Another difficulty in reading this book is a consequence of the prominent lack of uniqueness in the models Alfvén suggests. For example, in his construction of the magnetosphere-tail model he starts with sets of currents taken from observation whose choice he does not explain.

Although the physical explanations Alfvén presents are unclear, the ideas he sets forth are impressive. One such idea is the importance he finds in double layers, too long neglected, in cosmical phenomena. He gives many examples of phenomena in which the double layer may be crucial. It certainly plays some role in aurorae, where local acceleration takes place. It is probably important also in solar activity. Alfvén also maintains it is significant for larger-scale phenomena, such as the heliosphere, cosmic-ray acceleration in the heliosphere and, on the largest scale, galactic radio sources. It is difficult to judge whether double layers are active in these larger settings, which require large currents to pass through small regions, until one understands why plasmas prefer this configuration. Although it is dangerous to argue from laboratory experiments to such large-scale phenomena, double layers might be present and should be taken seriously. We need an argument that establishes that double layers are or are not present. What is not needed is ignoring them. Alfvén is quite right to emphasize this need.

Alfvén advances the idea that filamentation is prevalent on astrophysical scales. Unfortunately, the origin of filamentation that he presents—pinch effects and magnetic ropes—is not convincing. Starting with a pinch effect that is already a filament, he shows that given the proper geometry it will be enhanced. Here he ignores the induced electric fields associated with pinching the longitudinal fields, which stabilize the pinching. He also fails to clarify the origin of the driving longitudinal electric fields.

Alfvén emphasizes that it is inappropriate to treat phenomena locally. A case in point is the exploding double layer, where the energy source is forc-