

A Soviet physicist speaks to the world

PROGRESS, COEXISTENCE & INTELLECTUAL FREEDOM. By Andrei D. Sakharov (With Introduction, Afterword and Notes by Harrison E. Salisbury) 158 pp. W. W. Norton, New York, 1968. Cloth \$3.95, paper \$1.50

by JACK M. HOLLANDER

Two huge and complex human systems, founded under disparate conditions and conceived out of totally different assumptions about the nature of man, evolve on this earth. The Soviet Union and the United States are sovereign; they are mighty, and they face each other in enmity. Should the natural flow of human events, as we know those events from history, proceed, these two systems face inevitable collision—not because of their different political structures, not because of their different economic systems, but because they are there, sovereign and mighty and in confrontation.

From the earliest days of his presence on earth man has fought with his fellows whenever nonintegrated groups faced each other: at the family level, tribal level, feudal-estate level, province level and, most recently, at the nation-state level. Intervals of peace, brief as they have been, came when the one group overcame the other or when a larger threat, real or imagined, was perceived. The clock has struck midnight many times, but always we have managed to reset it and start it ticking again, always toward the same end.

In this century man has experienced for the first time the social effects of the finite size of his planet. His enterprises—his communications, his pollutions, his wars—have become worldwide. He realizes his capability to despoil the earth, to destroy his life upon it, and he knows that if he does so, he will not be able to move the remnants of his species to another planet. There is no place to hide.

The dilemma is unique in human history. Global nuclear war involving the Soviet Union and the US would not be the "extension of politics" that war has always been; it would be global suicide, global annihilation.

Rational man knows that it must not happen. He also knows that man has not developed the sure capacity to avoid war. He witnesses one of the most dangerous tight-rope walks in history, with the governments of the US and the Soviet Union proclaiming their desire to avoid nuclear catastrophe, yet continuing to pursue the kinds of policies that in the past have ended in war: the pursuit of spheres of influence, the stubborn defense of the political status quo, the avoidance of contacts, the reliance on classical ideas of security through regional alliances and security through armaments races.

He believes that a durable peace



... we must learn to live together
or we shall perish together ...

can only be achieved among nations if their external interactions are regulated by a higher sovereignty, by international law. Though he constantly hears that such ideas are utopian and impractical, he feels instinctively that to retain his faith in methods that have always before failed to keep the peace is no less utopian, no less impractical. He recalls the words of Benjamin Disraeli: "A practical man is a man who practices the errors of his forefathers."

Our hope for the future rests on the assumption that man is at least sufficiently rational to ensure his own sur-

vival. The utopian of one day becomes the practical of the next. But world law is still far in the future, and meanwhile society continues to evolve; new situations arise; old problems cry out for solution. In this generation the US and the Soviet Union bear a special responsibility to defy the uniform course of history, to back away from the abyss of war.

Much has been written about this topic in the US and other western countries, and nowhere has more been written than among the community of physicists, who, because of their presence as midwives to the birth of nuclear weapons, feel with a special keenness the urgency to reduce the probability of nuclear war. We know that the same sense of concern and urgency is shared among our Russian colleagues, but we have had regrettably few opportunities to receive and study the products of their thinking.

It was therefore with enthusiasm and with a special feeling of empathy that American physicists noted the first publication in this country (in *The New York Times*) of the essay by Andrei D. Sakharov entitled "Progress, Coexistence, and Intellectual Freedom." Sakharov, a widely respected Soviet theoretical physicist and member of the Academy of Sciences, has contributed extensively to thermonuclear and weapons research in the USSR. He is also no newcomer in the field of social criticism, having worked and written in support of educational reforms in the Soviet Union and in defense of freedom of inquiry in research. Accompanying his text in this book version is an illuminating set of historical and explanatory notes by *New York Times* foreign correspondent and managing editor Harrison E. Salisbury, a writer well known for his competence in the interpretation of Russian history and current developments.

The Sakharov essay is a blueprint for peace, a development on the theme of Soviet-American cooperation. Its basic thesis is that mankind can survive only if the US and the Soviet Union learn to live together without war, to help establish and to participate in a workable international system for



HARRISON E. SALISBURY

coping with the world's problems and divisive forces.

Sakharov opens his essay by examining those divisive forces, and he concludes that foremost among them is the threat posed by the nuclear weapons themselves, which, because of their enormous destructiveness and relative cheapness, are a peril to the existence of humanity. He makes clear his opposition to further escalation of the arms race by the development of anti-ballistic-missile systems, which he characterizes as ineffective and senselessly expensive, and he calls for a US-USSR moratorium on their construction.

Commenting on foreign policy, Sak-

harov denounces with equal fervor the role of the US in Vietnam and that of the Soviet Union in the Middle East. It is significant that he sees Vietnam in terms of the "harm this war is doing to the true goals of the American people, which coincide with the universal tasks of bolstering peaceful coexistence." In the Middle East crisis he points his finger directly at the Soviet Union for its "irresponsible encouragement of so-called Arab unity."

The author lays great stress on the seriousness of the threat to peace posed by the food shortage in the underdeveloped, overpopulated countries. He feels that this grave problem cannot be solved by population-control measures alone, and in fact he opposes the imposition of birth-control programs in a discriminatory manner on the poor. Massive programs of direct assistance from the developed countries will be necessary to ease the coming "crisis of hunger," and they will have to be financed by heavy taxation in those countries. In Sakharov's view, a prerequisite to such action is a change in the psychology of white Americans, who "are unwilling to accept even minimum sacrifices to eliminate the unequal economic and cultural position of the country's black citizens." In candor one should add that the virus of racism is confined neither to white people nor to the US.

In a chapter that must be especially

significant for Soviet readers, Sakharov frankly discusses the tragedy of the recent police dictatorships, taking a surprisingly similar view of the Stalin and Hitler regimes. His purpose in dwelling on some of the most sordid aspects of the Stalin regime, such as his open reference to the ten to fifteen millions of Soviet citizens who perished at the hands of that regime, is surely not to sensationalize the past nor to partake in the politics of de-Stalinization, but rather to assert the implacable opposition of Soviet intellectuals to the recent emergence in the Soviet Union of a neo-Stalinism under which a number of liberal writers, crying out with passion and conviction for free expression, have already been arrested and imprisoned. Those Americans who endured the intellectual intimidations of the Joseph McCarthy era will read these comments of Sakharov with sympathetic understanding.

A high point of the Sakharov manifesto is his statement that "mankind can develop smoothly only if it looks upon itself in a demographic sense as a unit, a single family without divisions into nations other than in matters of history and tradition." Here is his clarion call for world government.

Convergence theory. Basic to the hope of Andrei Sakharov for progress, coexistence, and intellectual freedom is a view of Russian and American societies as following a course of development in which their enormous historical differences, and the influences of divisiveness and enmity that stem from those differences, will gradually diminish. In characterizing the Soviet and American industrial development he finds a simple yet apt analogy: a picture of two cross-country skiers with one in the lead and the other, initially far behind, now catching up. However, only the first skier has borne the burden of breaking the fresh snow, so the second skier cannot be said to be the faster, only comparable in strength to the first.

Were industrialization a game, says Sakharov, the score would be tied; American capitalism and Soviet socialism have both achieved a high productivity of labor and a good standard of living for most of the population. America continues to lead the way in research and development, especially in the newer industries, but on the other hand the Soviet Union has made remarkable progress in spite of the terrible destruction of World War II and the absurdities of the Stalin years.

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These distinctions notwithstanding, Sakharov sees a remarkably parallel development taking place in the industrial management and social character of the two societies, each borrowing the best aspects of the other while retaining the successful and theoretical aspects of its own system. The inevitable rapprochement will be the result also of an increasing parallelism in their world view, which is becoming more international, more humanistic.

Indeed there is much to support the "convergence theory." What Marxist theoretician of the last century, with his conception of immutable classical capitalism, could comprehend the lack of apparent contradictions in an American capitalism that can accommodate the management of its industry by a techno-structure, its programs of Medicare, antipoverty and Social Security, its multiplicity of legislation regulating corporate activity, utilities, transport, communication? And what disciple of Lenin would have predicted that the Soviet Union would in so few years become a consumer-goods oriented society, with profit-like incentives finding a place in its economics?

Theoretical capitalism and communism were human concepts, oversimplifications which, like theories in physics developed to account for some limited observation, could not endure without modification, without extension, without adjustment to the conditions of the real world. But people are better social experimenters than theoreticians, and they can make a system work regardless of the initial con-

ditions imposed on it. Nothing is more natural than that two such limiting systems, having originated out of opposite and partly incorrect assumptions, should appear to borrow ideas from each other. They do not in fact consciously do so; rather, they deal with the same basic human problems, which by their nature require solutions that have much in common, even if discovered independently.

Optimistic prognosis. Sakharov concludes his essay with an optimistic prognosis, in the form of a four-stage timetable, for international development in the remaining years of the 20th century.

Stage one involves the deepening of the ideological polarization between and within the communist nations, leading to the possibility of changes in some of them as dramatic as the introduction of multiparty systems.

In the capitalist countries, stage two will witness the defeat of racism and militarism and the continuation of social reforms facilitating rapprochement with the socialist world.

The tremendous resources of the Soviet Union and the US will be harnessed in stage three, made possible by the economics of disarmament, to elevate the living standards of the poorer countries by means of massive scientific-industrial projects.

The smoothing of residual national contradictions and the creation of a world government will come in stage four by about the year 2000, which will usher in a period of unprecedented scientific and technological progress in

which decisive gains will be effected in the fields of nuclear and thermonuclear power, transportation (including space), communications and the life sciences.

It is interesting that in his essay Sakharov repeatedly stresses the importance of using the "scientific method" in solving essentially political problems. Although we normally associate this terminology with areas of inquiry where controlled and verifiable experiments are possible, the author's meaning is clear: One should not reject conclusions based on objective analysis even if it happens that they conflict with one's preconceptions or with dogmatic political theory.

Although Sakharov is well aware of the situation of contemporary America, he rightly focuses his primary attention on problems within his own society, problems with which he is intimately familiar and whose solutions he can contribute to directly. He clearly identifies his priorities, and it is interesting to contrast them with our own. Many pages are devoted to the question of intellectual freedom and only a few paragraphs to pollution.

Addressing ourselves to our own situation we would reverse the emphasis, acknowledging thankfully the freedom we enjoy to speak our minds but at the same time admitting that words can identify but can not solve problems. We could not overlook the grotesque imbalance of an industrial-military-academic system that can outproduce the rest of the world in missiles, automobiles and an infinity of gadgetry



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but that cannot seem to marshal the economic forces to eradicate the cancerous decay of its cities, to provide quality schools for all its children, adequate housing for all its citizens, and that cannot keep its water fit to drink, its air fit to breathe. We would wish to reexamine our traditional, largely self-defined, concept of "standard of living," to enlarge its scope to include a measure of the quality of life as well as the quantity of things in it. A nation, like a person, will be judged not by what it can do but by what it actually does.

Coexistence. The "convergence theory" occupies a central role in Sakharov's presentation, and is one of the main arguments supporting his prognosis of a Soviet-American rapprochement. The fact of convergence we cannot doubt, but it could be questioned whether convergence is either a necessary or a sufficient condition for coexistence. Many historical systems that had fought bitterly—religious, ethnic, national groups—have learned to live together in peace, without convergence, when it served their best interest to do so. The US and the Soviet Union must become aware of their own ultimate, and identical, best interest, which is not necessarily to become alike but rather to pursue

peace so that each can survive and develop in its own way.

One cannot help but be deeply moved by the sincerity, by the idealism of the Sakharov essay. Yet it is an idealism tempered by the reality of our time: We must learn to live together or we shall perish together. Sakharov is surely aware that Russian-American cooperation is not a panacea but a prerequisite, that a "pax Russo-Americana" would be unacceptable, that all nations must play a role in the crucial years ahead. He makes no claim to having designed a perfect nor even a detailed plan for the future; rather, he sets forth his ideas for discussion, for criticism—so that the dialog—from which such a plan can emerge, and without which it will not—can be kept in motion. Political leaders have largely failed to do this; the hour grows late; others must try. The American scientific community should be grateful to Sakharov for the effort he has given and should accept the challenge to continue it, to enlarge upon it.

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Theory of the microworld

THE MATHEMATICAL PRINCIPLES OF QUANTUM MECHANICS. By Derek F. Lawden. 280 pp. Methuen, London (Barnes & Noble, New York), 1967. \$8.00

by GARRISON SPOSITO

Is quantum mechanics really difficult? That is the question put to professors by harried undergraduates and worn-out doctoral candidates as they seek reassurance in their intellectual wrestling matches with the theory of the microworld. It is also the question that professors put to themselves in the quiet privacy of their sanctums and which, unhappily, they tend to answer in the unhesitating affirmative. All right; suppose it is true. Being optimistic about such things, we can ask what can be done to sugar-coat this really difficult subject without loss of precept or content. Besides some rather obvious and probably not very useful suggestions having more or less to do with the Madison-Avenue ap-

proach ("Hilbert space is your friend"), one can postulate that quantum mechanics may be made simpler in a way most scientists would not suspect.

What could be done is to make its presentation at the undergraduate level more mathematical. Notwithstanding the screams of horror and derision, I can point out in defense of this



ostensibly treacherous innovation that one of the major difficulties the neophyte quantum theorist has is the assimilation of new concepts in what appears to be a mathematical milieu far different from the one he so painstakingly mastered during his study of classical physics. Why do wave functions have to be square-integrable? Why is there a Principle of Superposition? What does a complete set of states have to do with things? These are mathematical requirements that are difficult to justify on wholly empirical grounds, in the same way that the definitions of the length of a vector in three-space and vector addition are difficult to justify in the classical domain. Why not tell the students the truth: In a very real sense classical and quantum physics are both mathematical children of the same abstract mother—the notion of a normed vector space.

Even if a professor does accept the idea that a first course on quantum theory ought to emphasize the mathematical structure more, he is still faced with the problem of finding a suitable text. One quite feasible possibility is to use a good physics book along with an inexpensive, physically oriented, mathematics supplement. Derek Lawden, professor of mathematics at the University of Canterbury in New Zealand, has supplied us with an adequate candidate for the supplement.

His book, originally written for undergraduate applied mathematicians who wish to know about physics, comprises seven chapters: two on states, three on observables, one on perturbation techniques and one on the Dirac equation. There are also seven appendixes on the properties of special functions and other mathematical details that serve to embellish the main text.

The discussion in the book is generally good, but occasionally lacks the organization and relevance that the rigor-seeking physics student might wish to find. I am not sure just why matrices have to be discussed right along with vector spaces or why a chapter entitled "Observables Having Continuous Spectra" devotes half its pages to observables having discrete spectra. Those students who think they might find out something about the delta "function" will also be disappointed since the rigorous meaning of that artifact is not only highly ignored by the author but is even blighted by his cool introduction of nonentities like