the organizational phenomenon of universities, industrial firms and the US government collaborating to meet international competition in products and research, both basic and applied. Their highly readable book, *The New Alliance: America's R&D Consortia*, concisely describes selected consortia and poses questions that should be considered.

Increased global competition and the relaxation of US antitrust laws concerning collaboration in research by American firms have sparked the creation of more than 50 research and development consortia in areas ranging from power pumps to semiconductors. Almost half of these consortia do research related to electronics. In the typical consortium, industrial competitors pool financial and intellectual resources to focus on costly, long-term basic research in fields of potential commercial importance. The research results are made available to the participating companies, which then decide whether to use the data to produce proprietary products. These new consortia differ from previous ones in that they concentrate on such issues as product development and manufacturing processes and, in most cases, are not officially affiliated with a university or a governmental agency.

The organizational structures of the consortia vary. The Microelectronics and Computer Technology Corporation in Austin, Texas, consists of 22 companies, each of which paid $150 000 to $1 million to join. MCC has its own building and 405 employees, of whom 295 are scientific staff; in 1986 it had $65 million in funding for research on advanced computer chips. Padco, a pump consortium with four participants, does not have its own facilities or staff. It spends $3 million to $4 million on research that is spread among its member companies. Other consortia, such as the Semiconductor Research Corporation, collect funds from their members to finance university research. The authors clearly point out that these entities are themselves experiments of a sort, so forecasting how successful they will be is difficult.

I wonder if such a fast-changing phenomenon would not be more appropriately reviewed in a technical and business journal, so as to bring news of changes more quickly to concerned leaders. The organizations resulting from these efforts may find themselves in competition with the founding institutions as they struggle for an existence different from an industrial, university or government research laboratory.

The authors have nonetheless performed a significant service in framing questions with which to examine the data regarding the impact of foreign researchers and manufacturers on what used to be a US-dominated domestic market.

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Reminiscences About I. E. Tamm

Edited by E. L. Feinberg
Nauka, Moscow (US dist. Imported, Chicago), 1987. 324 pp. 1.90 rubles ($10.95) pb
ISBN 0-8285-3557-4

Reminiscences About I. E. Tamm is a collection of approximately three dozen short articles by writers who personally knew Igor E. Tamm (1895–1971), one of the best theoretical physicists in the Soviet Union. Tamm was—with his student Andrei Sakharov—one of the major developers of the Soviet hydrogen bomb, and he lived to see Sakharov emerge as a prominent Soviet dissident.

Tamm created the department of theoretical physics at the Lebedev Physics Institute in Moscow, where Sakharov is a senior fellow to this day. But we will not find Sakharov's name among the contributors to this volume.

One should bear in mind, however, that the current collection is a translation from a Russian edition published in 1981. Publication of these reminiscences during Leonid Brezhnev's conservative regime was a substantial accomplishment. Among the contributors we find Tamm's "heir," Vitaly Ginzburg (in my opinion perhaps the best Soviet physicist today), Ilya Frank, solid-state theorist Rudolf Peierls, geneticist Nikolai Timofeev-Resovsky, Daniil Danin (a renowned Soviet science writer), Boris Kuznetsov and Victor Frenkel (Soviet historians of science), a musicologist and a mountain climber.

What emerges is the sketch of a remarkable portrait. It is the story of a baptized German Jew (Tamm means "naive" in Hebrew) who as a radical youngster was sent by his family in 1913 to study in Edinburgh. They did this to keep him away from both revolutionary Russia and tumultuous London. With the outbreak of the First World War, Tamm transferred after a year in Edinburgh to the School of Physics and Mathematics at Moscow University; he graduated in 1918. During the years of war and revolution Tamm was at times an active participant, volunteering for service

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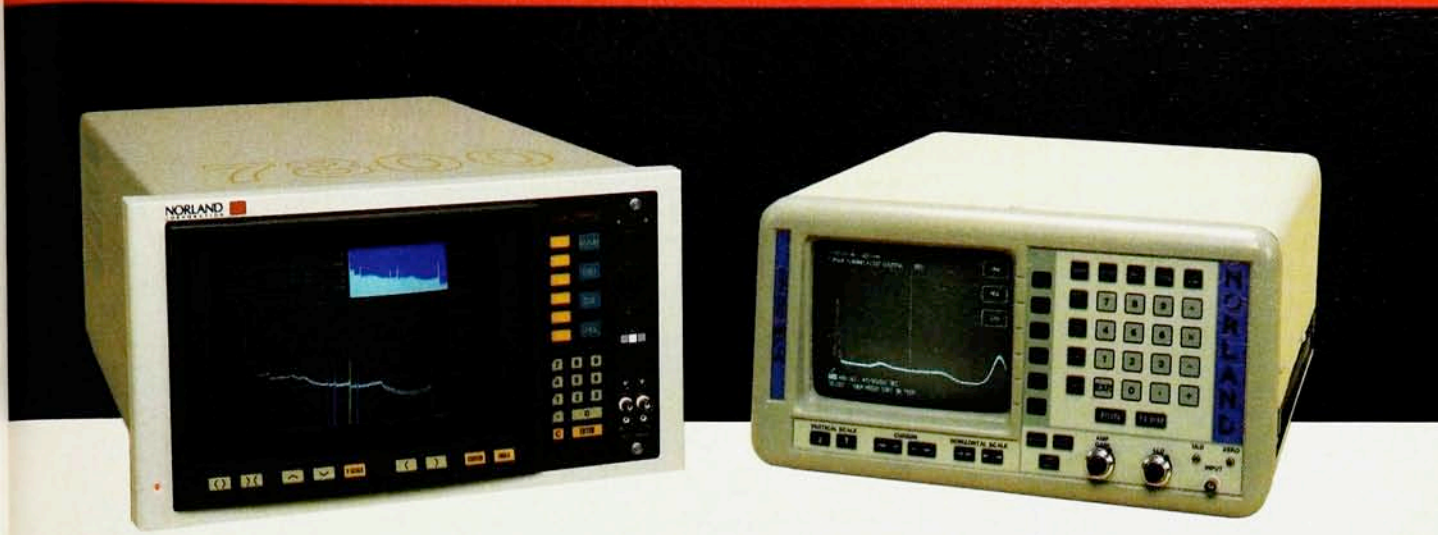

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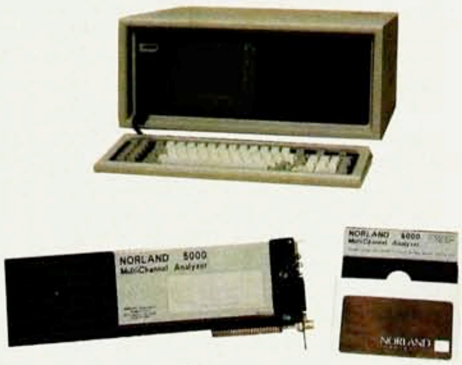

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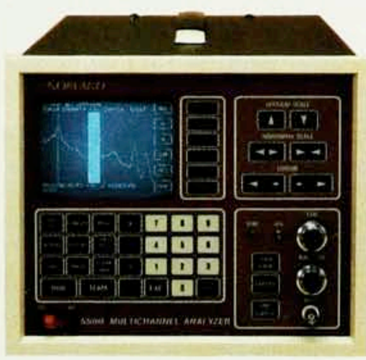

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at the front as a medical orderly in 1915. In the summer of 1917 he was elected a delegate to the first congress of Soviets; Tamm represented a social-democratic group that at the time was close to the Bolsheviks.

The revolutionary turmoil did not separate Tamm from his profession—it just slowed him down. He published his first paper at the age of 29, but in the following years he more than made up for this late start. By 1939 he was the author of several significant articles dealing with macroscopic electrodynamics, the quantum theory of light scattering in crystals, the relativistic quantum mechanics of electrons (inspired by Paul A. M. Dirac's work), the quantum theory of metals and the theory of the nuclear force. During 1937–39, Tamm developed with Frank the theory of radiation for an electron moving at a velocity exceeding the phase velocity of light in a given medium. The theory explained the nature of Čerenkov radiation, and won for Pavel Čerenkov, Tamm and Frank the 1958 Nobel Prize in Physics.

The volume leaves no doubt that Tamm greatly benefited at the beginning of his career and throughout the 1930s from his close friendship with Leonid Mandelstam, one of the founders of Soviet physics. Tamm was also influenced by Dirac, whom he met for the first time in Leiden in 1928. A third man greatly helped Tamm with his academic career and trips abroad—Boris Gessen, a childhood friend who became known in the 1920s as a prominent Soviet philosopher of science and follower of Nikolai Bukharin, one of the early Soviet leaders. Subsequently Gessen became dean of the School of Physics at Moscow State University and used his position to assist the careers of both Mandelstam and Tamm. During Stalin's great purge of 1937–39, Gessen was liquidated, together with other followers of Bukharin.

By the beginning of World War II Tamm had lost his most vital link to the Soviet authorities. He had to rely solely on the merits of his research and the strength of his character—and also good luck. Tamm had the good fortune to possess all three. His good luck was, of course, the Soviet atomic bomb project, in which he became one of the key figures. The creation of the Soviet H-bomb made him, in due time, a highly visible public figure whose lifestyle, tastes and attitudes—of which he made no secret—greatly influenced his Soviet contemporaries. His enthusiasm for mountain climbing, Pasternak's poetry and Shostakovich's music had a beneficial influence on post-Stalinist Soviet society. In 1964 (as we learned recently from Roald Sagdeev in *Moscow News* 1, 12, 1988) Tamm, together with Sakharov, succeeded in blocking the election to the Soviet Academy of a Lysenkoist directly supported by Nikita Khrushchev, then leader of the USSR.

Such examples of Tamm's civic courage, as well as a more detailed description of the more dramatic episodes in his life, will appear, I hope, in an expanded edition of this fine book.

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An Informal Introduction to Theoretical Fluid Mechanics

James Lighthill
Clarendon (Oxford U. P.), New York, 1986. 260 pp.
$35.00 hc ISBN 0-19-853631-3

Here is the second monograph in a new series, sponsored by the Institute of Mathematics and Its Applications (UK), that seeks to present students, both undergraduate and graduate, with short, accessible books on practical applications of mathematics. How appropriate that the first volume on fluid mechanics should be authored by such an eminent worker in the field as James Lighthill. The principal aim of the book is to demonstrate how one may integrate data from experimental studies with theoretical analyses to produce practically useful mathematical models (including manageable computer models) for a wide range of important fluid flows. The first three chapters present the basic principles of fluid mechanics and the means of characterizing fluid flows. The organizing principle of the remainder of the book is vorticity—either its absence or its concentration in thin or narrow regions. Although vorticity is present in the flows of all real fluids past solid bodies, for many practically important problems—particularly external flows about streamlined and, to a lesser extent, blunt bodies—one may consider much or most of the flow domain as being free of vorticity, that is, irrotational. The vorticity—generated by the bodies themselves and related to their lift and drag—is in these flows often confined to narrow regions about the bodies and in their wakes. At least four chapters are devoted to irrotational flows. Much of the remainder treats vorticity and its consequences in one context or another.