Reviews

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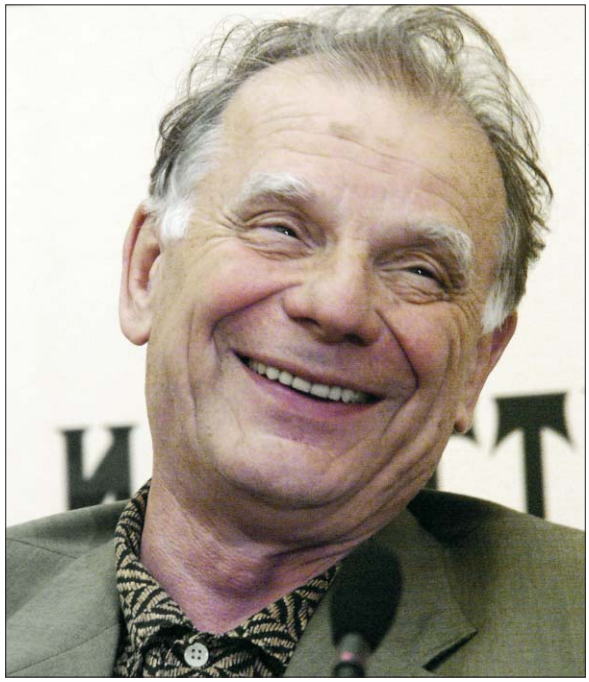
A Nobel for communism



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Socialist science
Noble-prize winner Zhores Alferov.

Lenin's Laureate: Zhores Alferov's Life in Communist Science
Paul R Josephson
2010 MIT Press
$29.95/£22.95
307pp

Zhores Ivanovich Alferov's share of the 2000 Nobel Prize for Physics for the invention of heterotransistors was long overdue. Since their first appearance in 1967, these devices have revolutionized the handling of light signals in electronics in much the same way that the transistor had earlier revolutionized the technology of handling electric currents. The heterotransistor, or heterojunction, allowed the development of affordable miniaturized semiconductor appliances that have transformed daily life, underpinning a whole range of gadgets, including CD players, fibre-optic-cable networks, environmentally friendly LED lamps and more efficient solar cells.

But other aspects of Alferov's career are less well known, as they run counter to widely held stereotypes. The title of Paul Josephson's biography, *Lenin's Laureate*, reflects the fact that Alferov is an outspoken communist, who at the age of 80 remains a leading member of the parliamentary opposition in Russia. Moreover, his prize-winning work took place in the Soviet Union during the 1960s – a period when, according to conventional wisdom, Soviet science lost its competitive edge in electronics after the shift from vacuum tubes to semiconductors. Computers serve as the key case in point, in the wake of decisions by Soviet ministerial commissions in 1967–1969 to abandon an original line of BESM-6 computers in favour of reverse-engineering the IBM-360 system. Yet as Alferov's Nobel indicates, Soviet scientists played an often-overlooked role in the development of other crucial components of modern-day information technology.

Alferov's research career started in 1953 at the Leningrad Physico-Technical Institute, where he helped to develop the first generation of Soviet semiconductor electronics. After completing his thesis in 1961, he embarked on an independent, forward-looking research programme on heterojunctions. At the time, labs in different countries were proudly getting ready to announce their first semiconductor lasers. However, these early devices were still inefficient, and they only worked at extremely low temperatures. In theory, lasers based on heterojunctions promised huge improvements, but almost everyone – including Vladimir Tuchkevich, Alferov's academic advisor and the director of the Leningrad Institute – thought that, in practice, the chances of making suitable materials were nil. Two different semiconductors had to match not only in several electric properties, but also in their lattice structure.

Working with a small group of young colleagues and students, Alferov persisted, and in 1967 they accomplished the crucial breakthrough with the first ideal pair of semiconductors, gallium arsenide (GaAs) and aluminium gallium arsenide (AlGaAs). The following year, they built the first double-heterostructure laser, and in 1970 the team made it work continuously at room temperatures – an improvement for which we should feel thankful whenever we play or record a CD or DVD. The team's accomplishment was recognized in the Soviet Union by the highest award – a Lenin Prize – in 1972.

Not every Nobel-prize winner garners a book-length biography, especially so quickly. Historians are notoriously slow to address recent and complex topics, and Josephson, a professor of history at Colby College, Maine, should be commended for his brave effort. He is uniquely qualified for the task, having previously researched the history of Leningrad physics and having known Alferov personally for years. But although he is unmatched in the speed of his research and writing, Josephson pays some price in occasional sloppiness, ranging from some trivial oversights to more serious inconsistency of thought. For example, Natalia Sonina, whom Alferov describes warmly as his first teacher in semiconductors, becomes "Nina" in Josephson's translation. He reconstructs Alferov's scientific trajectory on the basis of the Nobel lectures and various commentaries about the prize, but only cites, without seriously analysing, the original scientific papers by Alferov's research team.

Josephson's characterization of the Soviet academic system also follows some existing stereotypes that do not necessarily hold true. He describes as a disadvantage the fact that Soviet academic institutes often had to manufacture some basic instruments and materials in-house, rather than purchasing them as their Western counterparts were able to do. Yet this very feature apparently helped Alferov's collaborator Dmitry Tretiakov to discover the right kind of semiconductor synthesized in the laboratory next door. Josephson often recites the mantra that the Soviet system did not respect the autonomy of researchers and pushed them too strongly towards applied results. But at least in Alferov's case, the blame is misdirected. "The system" trusted Alferov enough to support his research despite his supervisor's doubts. Meanwhile, in the US, Herbert Kroemer filed a patent for the double-heterostructure laser simultaneously with Alferov in 1963, but was refused support by his employer, Varian Associates in California's Silicon Valley, as "the device could not possibly have any practical applications". In the end, Kroemer shared half of the 2000 Nobel prize with Alferov.

For the biographical part of his narrative, Josephson relies mostly on Alferov's own account *Nauka i Obshchestvo*, a collection of autobio-

graphical essays and popular talks published in Russian in 2005. The book has also appeared in Italian but, as far as I know, it has not been translated into English – probably because of its strongly communist content. Alferov became a communist in the same manner in which others become Catholics or Baptists: by way of his family and cultural upbringing. His father, a worker and a soldier, joined the Bolshevik party in 1917 because of its anti-First World War stance. An atheist and communist internationalist, he married a Jewish girl despite protestations from their religious families. The couple named their sons Marks, after Karl Marx, and Zhores, after Jean Jaurès, a French socialist assassinated in 1914 for his opposition to the imperialist war.

The older son Marks turned 18 in 1942 and volunteered to defend his socialist homeland against fascism. After fighting heroically at Stalingrad and Kursk, he died in another major battle at Korsun, Ukraine, in 1944. To his younger brother, Marks Alferov has remained a life-long role model. Like him, Zhores joined the communist youth league, the Komsomol, and in 1965 the Communist Party. During the era of *perestroika*, he sympathized with the reformist line of Mikhail Gorbachev. For Alferov, communism now means primarily the defence of social welfare, public education and healthcare, and last, but not least, the revival of Russian science and hi-tech industry. As an internationalist, Alferov regards the dissolution of the Soviet Union as a terrible mistake, and the rise of post/anti-Soviet nationalism as a tragedy for its peoples.

For Zhores Alferov, communism now means the revival of Russian science

Such views are not welcomed by today's mainstream media, and to make them publishable, Josephson softens Alferov's story and punctuates it with a general narrative about Soviet history and science. This narrative is not always relevant, but it is sufficiently anti-communist and thus more familiar to its intended readers. However, I think a better strategy would have been to not downplay Alferov's communism, but to explain it as a modern variety, which has evolved about as far from its original version as modern global capitalism has from its origins in racist, slave-holding colonialism.

To do this, one needs to overcome the wishful blindness that wants to believe communism is just a thing of the past. Such blindness prevents the public from coming to terms with the continuing international persistence and popular appeal of communism, or even from admitting that if elections in post-Soviet Russia had been more democratic and fair, then communists would have won them on more than one occasion. For the foreseeable future, the prospects for a democratic transfer of power between political parties in Russia continue to be linked with the new communist movement as a key player. To comprehend this political situation, we need to start hearing, rather than turning a deaf ear to, the political voices of Alferov and his comrades.

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Web life: *lightsources.org*

URL: www.lightsources.org

So what is the site about?

Lightsources.org bills itself as a site for "news, information and educational materials about the world's synchrotron and free-electron laser light-source facilities". As such, it incorporates a repository for press releases, an archive of research papers, a database of photographs and other images, copious links to individual synchrotron facilities, employment opportunities, equipment manufacturers, conferences...we could go on.

This sounds pretty comprehensive.

Definitely. The site lists every light source we had ever heard of and plenty we had not – including some, such as Armenia's Center for the Advancement of Natural Discoveries using Light Emission (CANDLE), that are still under construction. The people behind it are press officers and other communicators from 25 different facilities, including familiar names such as the UK's Diamond Light Source and the European Synchrotron Radiation Facility in Grenoble, France. All together, 71 different facilities appear in the site's directory, along with links to information about the types of experiments being performed there, current schedules, instructions on how to apply for beamtime, and other relevant material. It is also updated daily, which is a big plus for a "portal"-type site that derives a lot of its value from links to externally hosted content; we found only a couple of outdated links across the entire site.

Wait – what if I am not really sure what a light source is?

Then you have come to the right place. If you click on the tab labelled "What is a light source?", you will discover that they are "accelerator-based sources of exceptionally intense, tightly focused beams of X-rays and ultraviolet radiation, as well as infrared, that make possible both basic and applied research in fields from physics to biology". Essentially, the light produced in a synchrotron or free-electron laser is coherent, inherently bright and can be easily manipulated to produce an essentially monochromatic beam, thus allowing scientists in many disciplines to probe the structure of matter on the nano- and meso-scale. For a biologist, that might mean studying the structure of a protein molecule or a single cell. A materials scientist or engineer, on the other hand, might use the same light source to obtain high-resolution images of cracks or structural defects.

Why should I visit?

By their very nature, light sources serve a broad community. Some of the people who use them will, of course, already be intimately familiar with the machines that make their experiments possible. Others – occasional or first-time users, perhaps – will know very little. The great thing about *lightsources.org* is that it caters for both groups: you can find very basic information here about how light sources work; but the site also provides useful links for experienced researchers who need information about proposal deadlines for beamtime, phone numbers for staff at a particular facility, current operating schedules and so on.