

History of science and science live

Problems of Theoretical Physics (Collected Works on the occasion of the Centenary of Ya I Frenkel's birthday) (Compiled by V Ya Frenkel') (St.-Petersburg: A F Ioffe Institute for Physics and Technology, RAS St.-Petersburg, 1994) 259 pp

The idea of publishing a reader's notes on the history of science and its place in the ongoing process of science materialised while I was reading a collection of articles devoted to the 100th anniversary of Ya I Frenkel. I might also venture to say that the collection was given to me by my friend Viktor Yakovlevich Frenkel, the compiler of the collection, who, for many years has been successfully devoted to the writings of his father. This man "belongs, alas, to a bygone generation of universal physicist which was engaged in the most diverse fields of physics and which is currently on the verge of extinction" (Zh I Alferov, p. 5).

The life and career of "Yakov Il'ich... is related primarily to St. Petersburg" (Zh I Alferov, *ibid*). Thanks to the work of V Ya Frenkel, the most important Leningrad (St. Petersburg) chapter of the inception and development of Soviet (Russian) physics, has been studied more thoroughly than others. The compiler displays a son's love for his celebrated father on virtually every page of the collection. Admittedly, the format leaves much to be desired: a drab cover, few photos and small print. This is all the result of the editor's lack of funds at the A F Ioffe Institute of Physics and Technology of the Russian Academy of Sciences. The lackluster format of the volume is, however, to some extent, offset by its contents.

An important place in the history of science is reserved for the issue of those who coined the language of science. The role of the language of science is understandably critical as even common courtesy demands a standardisation of terms and concepts on the part of all authors. Ya I Frenkel did much to enrich the vocabulary of science. S T Walker and G A Stark published a list of authors in the *American Journal of Physics* (38 (12) 1380 1970) of the names of particles and quasiparticles. Frenkel's name appears three times (sic!) on this list. He introduced the name exciton (1931) and photon (1929). He coined the term 'hole' for an atom which has vacated its crystal lattice node (see p. 230). Furthermore, "such concepts as the Frenkel exciton, the Frenkel defect and Frenkel-Pula effect, the Bohr-Frenkel (nucleus) drop model, the Frenkel-Kontorova mobile dislocation model and the Frenkel effect in powder metallurgy became firmly established in the language of modern physics". (p. 202).

During most of my scientific career I have worked under the direct supervision of I M Lifshits. Il'ya Mikhailovich is

the one who taught me to admire Ya I Frenkel. He used to mention Frenkel's great expertise, especially when it came to scientific intuition, the ability to get to the bottom of a phenomenon and simplify analysis to the maximum. On his 60th birthday Lifshits named Frenkel among the people who had played an important role in his life. Such love rarely goes unrequited. Frenkel's glowing review of Lifshits' doctoral dissertation (May 1941) has survived. Frenkel ended his address to the dissertation council with the following words: "This youth will succeed in accomplishing what I have been unable to achieve" (memoirs of Ya E Geguzin).

I have not been able to read or even skim through all of Ya I Frenkel's works. But I have read two of his books carefully and keep referring to them consistently. These are *The Kinetic Theory of Liquids* and *Introduction to the Theory of Metals*. Reading them was not only instructive. It was also a pleasant experience. This cannot be said of most books, even the most useful ones.

I was never lucky enough to have met Ya I Frenkel, nor did I ever hear him speak. But some of my good friends who are physicists were well acquainted with this man, whom they so admired. First of all there is V B Fiks, who is considered to be a student of Ya I Frenkel. The former held his teacher in the highest esteem, would often tell stories about him or quote his sayings. He looked up to Ya I Frenkel as a multifaceted personality and a remarkably magnanimous human being. Fiks' longstanding association (at the time of our conversation) with Ya I Frenkel was a vivid, joyous and comforting recollection (Fiks was then seriously ill).

There is an article in the collection by V Ya Frenkel from UFN (113 (3) 535 1974) entitled *On the Style of Ya I Frenkel's Scientific Creation* which includes an interesting analysis of the language of Ya I Frenkel's works, his figures of speech, the priority of qualitative evaluations which take priority over precise calculations. Towards the end of the article, the author also speaks of his father's contributions in the field of art: mention is made of his lyrical and humorous poems, landscapes, portraits, pencil sketches and "...musical ability which are said to be of an active nature: he was not a virtuoso but played the violin tastefully, taking his instrument with him wherever he went on long business trips or summer holidays" (p. 240). The author goes on to pose the question: "Could it be that this facet of his intellectual activities found embodiment in the scientific publications of Frenkel?" (*ibid*) This question obviously presupposes an affirmative reply. While the idea is nowhere formally stated in the article, the reader intuitively feels the unified nature and image of the scientist who wrote: "The right to use metaphors should not be the monopoly of poets (p. 229)". While reading the collection, I was positively impressed that Ya I Frenkel was a most interesting figure who merits serious literary analysis by writers of Stefan Zweig's talent. This task is facilitated by the large number of publications, the availability of letters,

numerous references to him, which reveal the complexity of the essentially tragic destiny of Ya I Frenkel. And, as it turns out, I now realise that Ya I Frenkel's character is not as simple as it would appear. Why is it that this scientist, despite his good-natured disposition and genuine kindness, had almost no students? And why have even those physicists who were critical of the scientist, while he was alive, eventually come to consider themselves as Frenkel's students? Under the heading "Excerpts from the scientific and epistolary heritage..." (p. 180 – 201) much material has been collected which will be instrumental in such analysis. There is one poetic quote in a letter (to his wife) that I cannot pass over in silence: "I think our letters form a kind of double necklace which beautifies that part of the globe which lies between Leningrad and Minneapolis, 1931" (p. 190).

An important place in artistic analysis should rightfully be devoted to the events which, along with the premature death of Ya I Frenkel, make it possible to speak of the scientist's destiny as being tragic. Frenkel was well acquainted with all leading physicists the world over. "Physicists constitute a narrow caste whose members are well known to one another in all parts of the globe", — he writes in 1931.

Ya I Frenkel went to visit Einstein in 1925 "with a certain agitation which disappeared as soon as I saw him in person. He turned out to be an extremely sweet person" (p. 196). His proximity to the makers of the new physics does not mean (frankly speaking) that he took part directly in those scientific breakthroughs which may be correctly termed revolutions. He was among the first of those who realised what was happening in the new physics, and realised it so deeply that he set it out in the textbooks used at lectures and, above all, applied to the new physics in his work. This is one side of the coin. But the obverse side is strictly Soviet in nature. A man who unquestionably belongs to world culture, who discussed the philosophy of natural sciences with the most outstanding minds of his age, who took part in establishing the new school of thought right from the first years of the existence of the Soviet Union, was compelled to demonstrate his ideological purity. At the end of his life, Ya I Frenkel was made to feel the open anti-Semitism of the Stalinist regime. It was especially opprobrious that he was not chosen as a member of the Academy of Sciences. I believe that Ya I Frenkel was the only correspondent member whose works were published in the series *Classics of Science (The Kinetic Theory of Liquids, 1975)*.

Space limitations will not allow an analysis of the separate articles of this collection. In identifying the relationship in the works of Ya I Frenkel between qualitative and quantitative phenomena, the authors of the collection assign priority to qualitative work. Moreover, the Russian scientist clearly had a firm grasp of theoretical physics. Therefore these words of his are unsurprising: "Theoretical physics... involves framing the quantitative description of one or another phenomenon... should find the principles which make it possible to pose a question and turn it into an equation" (P. 189). One might also wonder whether Ya I Frenkel was often mistaken in his qualitative evaluations. 'The Rating of the Works of Ya I Frenkel according to data of the Science Citation Index (SCI) for 1945–1992' shows that the works of Ya I Frenkel are still of interest. They continue to be quoted 40 years after the death of the author. This is never the case with incorrect works. Several examples (few, unfortunately) in the collection make it possible to follow up Frenkel's hypothesis on the essence of phenomena. In keeping with the jubilee nature of

the collection, examples are cited of those hypotheses which were subsequently confirmed (see the articles of K S Shifrin, p. 111, V I Perel' and V Ya Frenkel, p. 202, as well as the commentary to the note of Ya. I. Frenkel *On the Temperature of the Solar Corona*, p. 159). Indeed, I found it very interesting to read the article of A I Slutsker et al. (pp. 42 – 69), which describes the modern condition of computer experimentation, the basic principles of the theory of which "were laid in the classical works of Ya I Frenkel" (from annotations to the article).

Not only did I 'brush aside' articles which lie far outside my personal sphere of interests, I did not even read in depth, only looked through, works on nuclear physics, electro-dynamics etc. They were intended for another reader.

To my opinion, one reads the Collected Works "Questions of theoretical physics" with interest. When reading, the questions of general character along with those related to the life and works of Ya I Frenkel appear. Some of them could be answered by re-reading the book pages. Others, as I guess, are still waiting for answering with the aid of science historians.

The most essential feeling I have got on reading the Collected Works is that the works of Ya I Frenkel live in modern physics.

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