



## Obituaries

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### **Michael Marinov**

Michael Marinov, the theorist who, with Felix Berezin, introduced the classical description of spin by anticommuting Grassmann variables, died of cancer on 17 January in Haifa, Israel.

Born on 4 July 1939 in Moscow, Marinov studied at Moscow University and received his PhD in 1966 from the Institute of Theoretical and Experimental Physics (ITEP). His PhD study was devoted to spinning particles--the subject various aspects of which he continued to investigate throughout his life. During his 14 years at ITEP, Marinov went through all the stages of an academic career, from junior to senior researcher.

Marinov achieved worldwide recognition in the area of quantum field theory and related problems in mathematical physics. He had a deep understanding of the path integral method and used it extensively in his studies. Most theorists in the 1970s viewed this approach as rather symbolic compared to the operator method. Marinov analyzed the relation of the method to canonical quantization in his review on path integrals published in *Physics Reports* in 1980.

With the path integral method, the transition from classical to quantum physics can be understood as integration over paths near classical trajectories. A uniform treatment of bosons and fermions in the path integrals is another advantage of this method, which is based on the representation of fermions through anticommuting Grassmann variables. Berezin was largely responsible for advancing the calculus, including integration, on these variables. In 1975, Berezin and Marinov introduced a novel extension of that concept--namely, a classical description of spin by Grassmann variables. This idea sounds strange for spin- $1/2$  particles: We are used to viewing their spin properties as quantum phenomena. For Marinov, however, the introduction of classical spin trajectories was quite logical within the framework of path integration over anticommuting variables. This logic now is well-recognized and accepted.

Marinov also used path integrals fruitfully in the challenging area of quantization on manifolds with nontrivial geometry. In this complicated problem, which he started to tackle in 1979 with Mikhail Terentev, Marinov focused on manifolds associated with Lie groups. He continued to work on this problem until the end of his life. In his last years, he studied path integrals with application to quantum tunneling and multidimensional semiclassical approximation.

The year 1979 was a turning point in Marinov's life. In pursuit of his lifelong dream of living in Israel, Marinov applied for exit visas from the Soviet Union for himself

and his family. In those days, such applications were considered high treason in the USSR. Denied permission for the visas, Marinov became a refusenik, with all the ensuing political consequences. The only "crime" committed by refuseniks was that they had applied for and been denied exit visas for Israel. And yet the Soviet state treated them essentially as criminals--fired from jobs and blacklisted, with no access to work (except low-paid manual labor), constantly intimidated by the KGB, and on the verge of arrest. In fact, the most active refuseniks, those who tried to organize and fight to reclaim their rights, were imprisoned.

The subsequent eight years brought Marinov incredible hardships, and he struggled to survive with dignity. Resigning from his position at ITEP, he earned his living as an English translator and as a construction worker. Despite all the obstacles, he continued to do research in physics. In addition, he volunteered to teach physics at the unofficial university organized by refuseniks to educate Jewish students who were barred by authorities from regular universities. His family--wife Lilia and daughters Masha and Dina--gave him the strength to endure. Only in 1987, with the advent of *perestroika*, were the Marinovs allowed to leave the Soviet Union.

In 1988, Marinov joined the TechnionIsrael Institute of Technology in Haifa. There, he launched a vigorous research program and also became an insightful teacher and an excellent thesis adviser to many students who are now scattered all over the world.

Marinov belonged to two cultures and two countries. His physics career began at ITEP, and he always had warm feelings for that period of his life. The note that concludes his 1980 review in *Physics Reports* reads, "Having left ITEP forever with the intention to settle in the Promised Land of my Forefathers, I would like to use this opportunity to acknowledge gratefully the possibility to work for many years at the Theory Division organized by the late Professor Isaac Pomeranchuk."

He will be missed greatly by all of us: his friends, colleagues, and students.

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