

George Michael Volkoff 1914-2000

George Volkoff was one of the pivotal figures of UBC's Physics Department in the mid 20th century. He left the Soviet Union as a young man and quickly rose to prominence as a master of the new quantum mechanics and general relativity. He gained his Ph.D on the theory of neutron stars with J. R. Oppenheimer at Berkeley, and worked on nuclear fission in Montréal during WWII, but the rest of his career was entirely spent at UBC.

Early Life

Born in Moscow, Russia, George Volkoff emigrated with his family to Vancouver in 1924 when he was ten. His father was unable to find work here, and moved his family to Harbin, Manchuria in 1927. His mother died shortly after the move. Three years later at the age of 16, George Volkoff returned to Vancouver to attend UBC. He completed his BA in physics in 1934, and his MA in 1936. His father moved from Harbin back to the Soviet Union, and died in Stalin's "Great Purge".

Neutron Stars

In 1936 George Volkoff became a graduate student of J. Robert Oppenheimer at Berkeley. His most famous paper, "On Massive Neutron Cores" grew out of his doctoral thesis work. Building on the work of Richard Tolman, Volkoff derived what became known as the Tolman-Oppenheimer-Volkoff equation, a general-relativistic equation of state for neutron stars.

FEBRUARY 15, 1939 PHYSICAL REVIEW VOLUME 55

On Massive Neutron Cores

J. R. OPPENHEIMER AND G. M. VOLKOFF
Department of Physics, University of California, Berkeley, California
(Received January 3, 1939)

$$\frac{dP(r)}{dr} = -\frac{G}{r^2} \left[\rho(r) + \frac{P(r)}{c^2} \right] \left[M(r) + 4\pi r^3 \frac{P(r)}{c^2} \right] \left[1 - \frac{2GM(r)}{c^2 r} \right]^{-1}$$

Density, ρ
Pressure, P
Total mass, M
Radius, r
Gravitational constant, G



George Volkoff at UBC in 1956.

Arising from this formulation is the Tolman- Oppenheimer- Volkoff (TOV) limit, which is an upper bound to the mass of stars composed of neutron-degenerate matter. The TOV limit is analogous to the Chandrasekhar limit for white dwarf stars. No neutron core can be more massive than 1.5-3.0 solar masses (which corresponds to an original stellar mass of 15-20 solar masses). Above this limit, the neutron-neutron short-range repulsive force and neutron degeneracy can no longer resist gravitation, and the core will collapse into a black hole.



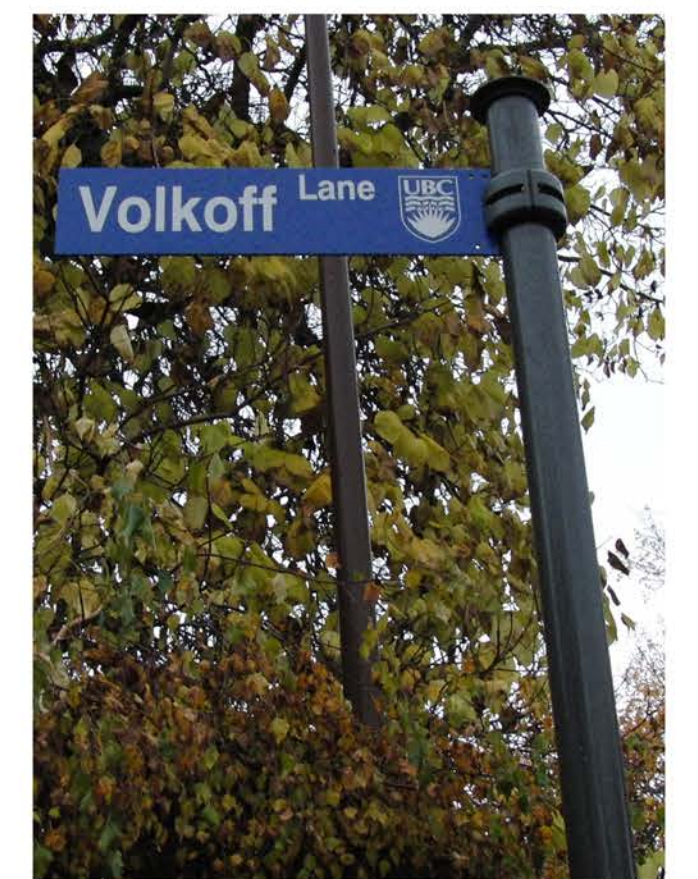
Some of the research staff of the Montreal Laboratory in 1943. Volkoff is the third seated on the floor from the left.

WWII and Aftermath

In 1943, Volkoff was summoned to Montreal to work on the Canadian heavy water program. A new laboratory had been formed at the Université de Montréal around refugee scientists from Frédéric Joliot-Curie's group in Paris. Volkoff liaised with the Met Lab in Chicago, which was a key component of the Manhattan Project. In 1945-1946 he was appointed head of the theoretical physics branch of the division of Atomic Energy of the National Research Council. He contributed to reactor theory and the development of the first nuclear reactor in Canada, the heavy water NRX reactor in Chalk River, Ontario.



J. Robert Oppenheimer visits UBC in 1955. From left to right: Gordon Shrum (Head of the Physics Department), Norman MacKenzie (UBC President), Oppenheimer and George Volkoff



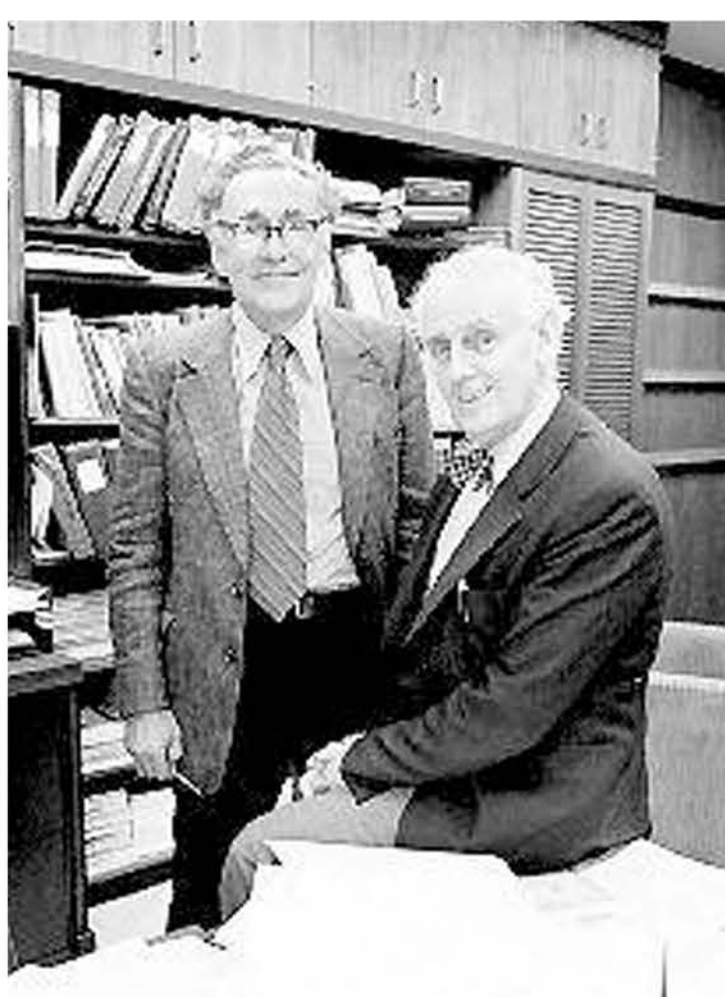
Lane between Hennings and Hebb commemorating George Volkoff.

70 Years of Association with the University of British Columbia

Volkoff was an assistant professor at UBC from 1940-1943. After his war work, he returned to UBC in 1946 as a professor. His research focussed on Nuclear Magnetic Resonance. The first student he supervised was Thomas L. Collins, he was the first to receive a Ph. D from UBC in any subject.

Nuclear Electric Quadrupole Interaction in Crystals with Nonaxially Symmetric Fields*

H. E. PETCH,† D. W. SMELLIE,‡ AND G. M. VOLKOFF
Department of Physics, University of British Columbia,
Vancouver, Canada
(Received September 17, 1951)

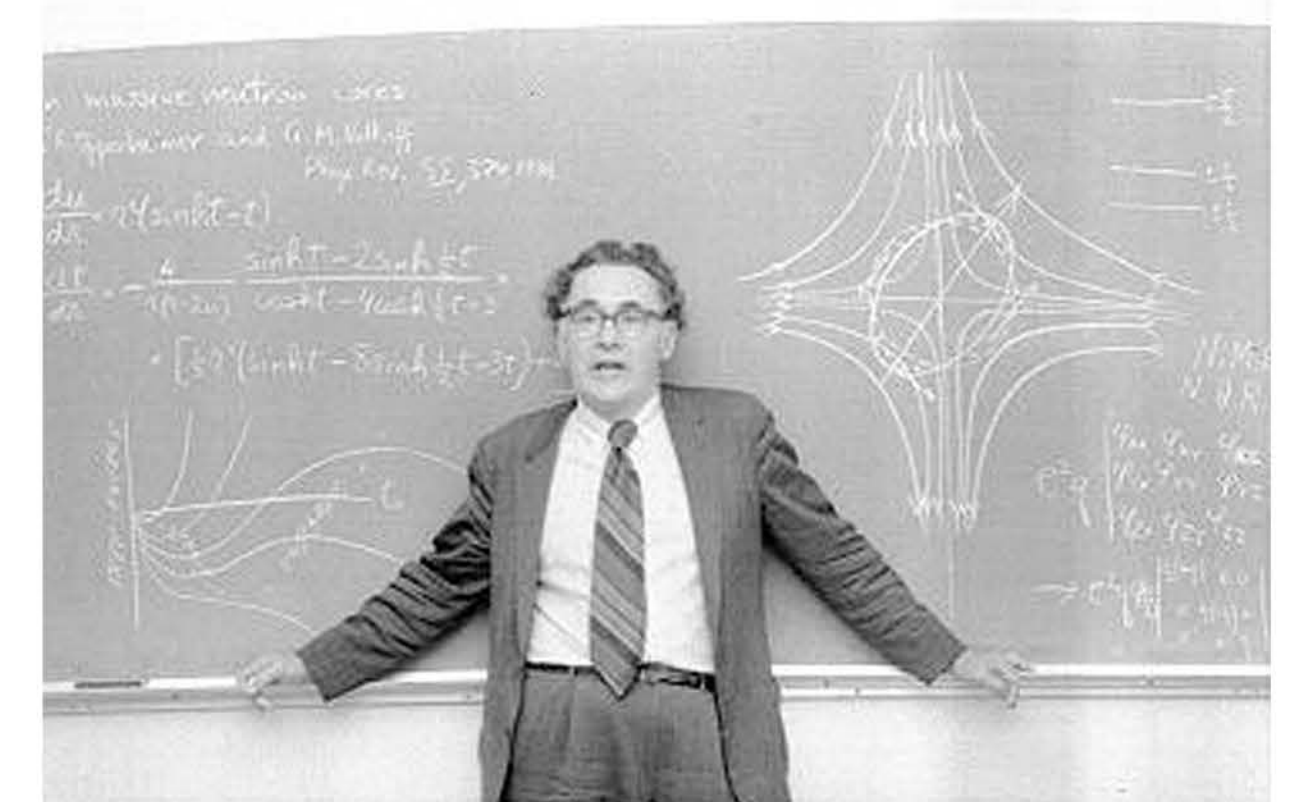


George Volkoff in 1979, outgoing Dean of Science, with Cyril Finnegan, the new Dean.

After Gordon Shrum retired George Volkoff was appointed Head of the Physics Department (1961-1970) and then Dean of Science (1970-1979). During his time at UBC he was a member of the Senate for three periods.

He was president of the Canadian Association of Physicists 1962-1963. He was also one of the many scientist to support and push for the building of the TRIUMF cyclotron.

He was made a member of the Order of the British Empire in 1946, and a member of the Order of Canada in 1994. He died in Vancouver in 2000.



George Volkoff, lecturing in Hennings, December 1971.

References:

Erich Vogt, "In Memoriam George Michael Volkoff", <[http://www.cap.ca/pic/archives/56.5\(2000\)/volkoff-Sept00.html](http://www.cap.ca/pic/archives/56.5(2000)/volkoff-Sept00.html)>
Elizabeth Bell, Alex Volkoff and Olga Volkoff. "George Michael Volkoff 1914 - 2000." Editorial. Globe and Mail 30 May 2000
Patrick Bruskiewich, "George Volkoff and Reactor Physics in Canada." Canadian Undergraduate Physics Journal 6.5 (2008): p.18-22

Poster prepared by Muriel Dunn, Theresa Liao and Chris Waltham
UBC Physics & Astronomy Outreach Program