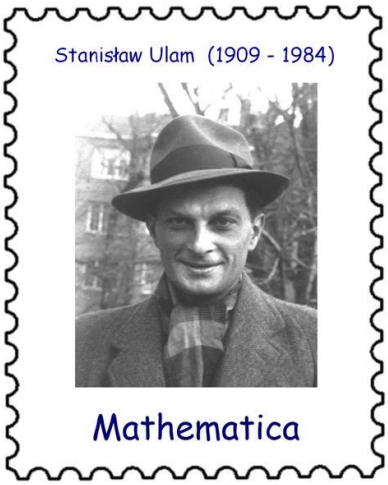
STANISŁAW ULAM (April 13, 1909 – May 13, 1984)

by HEINZ KLAUS STRICK, Germany



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When STANISŁAW MARCIN ULAM was born in 1909 to the wealthy Jewish lawyer JOSEPH ULAM, his birthplace Lemberg (today Lviv, Ukraine) was still part of the Austro-Hungarian Empire. After the Russian army invaded eastern Galicia in 1914, the family initially fled to Vienna. Then they followed JOSEPH ULAM, who served as a staff officer in the army, to various locations, including Moravian-Ostrava (today: Ostrava, Czech Republic), where STANISŁAW started school. In the years that followed, the boy was taught by private teachers until he passed the entrance exam for high school in 1919 – back in Lemberg (Lwów), now in Poland. In 1927 he passed his final exam there with brilliant grades.

JOSEPH ULAM had actually planned for his son to study law so that he could later take over his law office. However, he had to realize that his son's talents lay more in the mathematical and technical area.

STANISŁAW applied in vain for a place at the Faculty of Mechanical and Electrical Engineering, so he initially began studying general engineering at the *Lviv Polytechnic* (*Politechnika Lwowska*), hoping to be able to transfer at a later date.

One of his lecturers in mathematics was STEFAN BANACH, whose lectures and seminars led to ULAM's study plans changing. As early as 1929, his contribution to the arithmetic of cardinal numbers was published in the specialist journal *Fundamenta Mathematicae*, edited by WACŁAW SIERPIŃSKI.

Since career prospects for mathematicians in Poland were generally very poor at the time and as a Jew he had even fewer prospects, he gave himself an ultimatum: If he succeeded in solving a set theory problem posed by KAZIMIERZ KURATOWSKI, he would stick with mathematics, otherwise he would pursue a career as an electrical engineer.

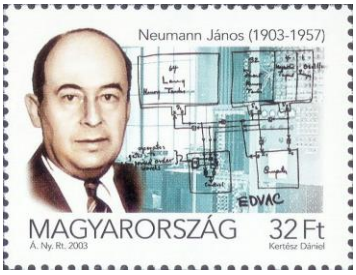
ULAM solved KURATOWSKI's problem before the end of his freshman year. He soon became a regular at the *Scottish Café* (*Kawiarnia Szkocka*), where the Lviv mathematical elite met. Problems that could not be solved were recorded in the *Scottish Book* (*Szkocka Księga*) – a collection of unresolved (or solved at a later date) problems with many entries, in particular by HUGO STEINHAUS, BANACH, KURATOWSKI and, above all, ULAM.

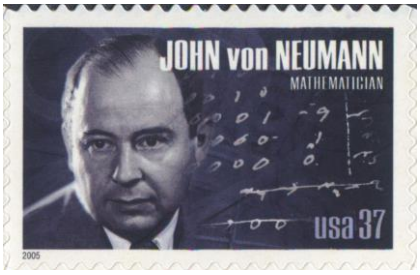
One of ULAM's conjectures was the theorem: *At any point in time there exists a pair of antipodal points on the earth's surface with the same temperatures and the same air pressure.* (This is the so-called *BORSUK-ULAM theorem* which KAROL BORSUK succeeded in proving in 1933.)

After completing his studies, ULAM received his doctorate under KURATOWSKI in 1933. ULAM then went on a study trip to various universities in Switzerland, France and England, where he attracted attention through his contributions to discussions at events. ULAM was the first male lecturer at *Girton College*, Cambridge (an institution for female students).

In 1935 he received an invitation from JOHN VON NEUMANN to work at the *Institute for Advanced Study* in Princeton; this was followed by a three-year offer from the Society of Fellows of Harvard University. ULAM spent his 1937 summer vacation in Poland, together with VON NEUMANN (who also left traces in the Scottish Book). In the late summer of 1939 he left his homeland (along with his younger brother ADAM) just in time before German troops invaded the country.

In 1941, ULAM accepted a professorship at the University of Wisconsin-Madison; in the same year he received American citizenship and married a French scholarship holder who studied English literature there. His application to join the US Air Force as a volunteer failed because of his poor eyesight.





In 1943 he approached VON NEUMANN and asked him about the possibility of working for the army. He then received an offer signed by HANS BETHE (on behalf of ROBERT OPPENHEIMER) to work on "an unspecified project" which had to do with, among other things, the "physics of the interior of stars".

From then on, ULAM worked as part of the *Manhattan Project* at the *Los Alamos Nuclear Research Center* (New Mexico). This project was about developing a bomb based on nuclear fission. In order to trigger the self-sustaining chain reaction through neutron multiplication, two models were discussed: shooting two masses of highly enriched uranium at each other (*gun type*) or compression of a mass using polygonal explosive lenses with conventional explosives (*implosion type*). ULAM was tasked with carrying out the calculations necessary for the polygonal design of the second type.

It is unclear what part he ultimately had in the construction of the atomic bomb, as the documents from this period are still secret. He later expressed his belief that the development of the atomic bomb would make a (world) war impossible – unless an accident occurred.

In parallel to his work on the atomic bomb, ULAM was one of the main developers of the *Orion program*, which aimed to develop a nuclear engine for space rockets. The project was cancelled in 1965 after the nuclear powers signed the *Partial Test Ban Treaty*.

After the end of the war, ULAM left Los Alamos and accepted a position at the University of Southern California (USC) in Los Angeles, settling near the college with his wife Françoise and one-year-old daughter Claire.

In January 1946 he was diagnosed with viral encephalitis, which temporarily limited his ability to speak. Friends also suspected a change in his personality (which his wife later repeatedly denied). Nevertheless, those responsible for secrecy at Los Alamos were concerned that he might reveal research secrets due to illness.

During the recovery phase, while playing a game of solitaire, he had the idea of simulating the game hundreds of times using a computer – he was thinking of using the *ENIAC* (*Electronic Numerical Integrator and Computer*), which was developed during the World War.

Together with VON NEUMANN and NICHOLAS METROPOLIS, he developed the *Monte Carlo method* for simulation. (This name was chosen by METROPOLIS because ULAM always talked about his uncle, who liked to go to the casino in Monte Carlo to gamble.)

After the Soviet Union also had atomic bombs in 1949, American President TRUMAN commissioned the Hungarian physicist EDWARD TELLER to develop the hydrogen bomb and ULAM returned to Los Alamos. When unexpected difficulties arose, ULAM was able to demonstrate that TELLER's chosen design could not work and then proposed a solution that ultimately made the project a success. The scheme of this bomb is called the TELLER-ULAM configuration after its creators.

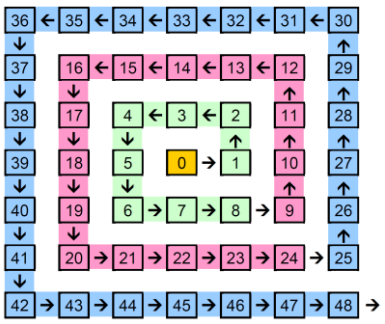
Numerous other researchers, including ENRICO FERMI, were also involved in the development of the hydrogen bomb, which was detonated for the first time on November 1, 1952. TELLER was often referred to by the press – without justification – as the father of the hydrogen bomb; he himself repeatedly tried to downplay ULAMS contribution to the development.

In the following years, ULAM accepted various offers for visiting professorships at Harvard, MIT, and San Diego (California). Most recently, he became dean of the mathematics department at the University of Colorado; he also worked as an advisor to the government.

In 1984, ULAM died of a heart attack in Santa Fe, New Mexico. His wife lived there until her death in 2011. She ordered that both be buried in the *Montparnasse cemetery* in Paris.

STANISŁAW ULAM wrote a wealth of articles on mathematical topics in set theory, topology, functional analysis, group theory and graph theory. The *Monte Carlo method* has found diverse applications in various areas, including finance, social sciences and environmental research.

His name is also associated, among other things, with the so-called *ULAM spiral* – a rather accidental discovery that prime numbers form a remarkable structure when the natural numbers are written down in a spiral around the number zero.



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103	66	37	16	15	14	13	12	29	54	87
104	67	38	17	4	3	2	11	28	53	86
105	68	39	18	5	0	1	10	27	52	85
106	69	40	19	6	7	8	9	26	51	84
107	70	41	20	21	22	23	24	25	50	83
108	71	42	43	44	45	46	47	48	49	82
109	72	73	74	75	76	77	78	79	80	81
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