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(*b*. Gomel, Russia, 2 January 1905; *d*. Moscow, U.S.S.R., 24 September 1938)

mathematics.

The son of a teacher, Shnirelman displayed remarkable mathematical abilities even as a child. In his twelfth year he studied an entire course of elementary mathematics at home: and in 1921 he entered Moscow University, where he attended courses taught by N. N. Lusin, P. S. Uryson, and A. Y. Khinchin. While still a student he obtained several interesting results in algebra, geometry, and topology that he did not wish to publish, considering them of insufficient importance. After two and a half years Shnirelman graduated from the university, then remained for further study. Having completed his graduate work, he became professor and head of the department of mathematics at the Don Polytechnical Institute in Novocherkassk (1929). In the following year Shnirelman returned ro Moscow and taught at the university. He was elected a corresponding member of the Soviet Academy of Sciences in 1933, and from 1934 he worked in the Mathematical Institute of the Academy.

In 1927–1929 Shnirelman, with his friend L. A. Lyusternik, made important contributions to the qualitative (topological) methods of the calculus of variations. Their starting point was Poincaré's problem of the three geodesics, which they first solved completely and generally by showing the existence of three closed geodesics on every simply connected surface (every surface homeomorphic to a sphere). For the proof of this theorem the authors used a method, which they broadly generalized, that had been devised by G. Birkhoff, who in 1919 showed the existence of one closed geodesic. Shnirelman and Lyusternik also applied their "principle of the stationary point" to other problems of geometry "im Grossen." They also presented a new topological invariant, the category of point sets.

In 1930 Shnirelman introduced an original and profound idea into number theory, using the concept of the compactness α of the sequence of natural numbers, $n_1, n_2, n_3,...$so that $(x \geq 1)$ where $N(x)$ is a number of the members of the sequence not exceeding x, and proving that every natural number n is representable as the sum of a finite (and independent of n) number of members of the sequences with a positive compactness. This allowed Shnirelman to prove, in particular, that any natural number is the sum of a certain finite number K of prime numbers— the Goldbach hypothesis in a less rigid form. According to the Goldbach hypothesis $K = 3$; by Shnirelman's method it is now possible to show that K is not greater than 20. Shnirelman also stated several arithmetical propositions, among them a generalization of Waring's theorem.

BIBLIOGRAPHY

I. Original Works. Shnirelman's writing include "Sur un principe topologique en analyse," in *Comptesrendus... de l'Adémie des sciences*, **188** (1929), 293–297, written with Lyusterniki; "Sur le problème de trois gésiques fermées sur les surfaces de genre 0," **189** (1929), 269–271, written with Lyusternik; "Ob additivnykh svoystavakh chisel" ("On the Additive Properties of Numbers"), in *Izvestiya Donskogo politekhnicheskogo instituta v Novocherkasske*, **14** nos, 2–3 (1930), 3–28, also in *Uspekhi matematicheskikh nauk*, **6** (1939), 9–25; "Über neue kombinatoriche Invariante," in *Monatshefteür Mathematik und Physik*, **37** (1930), 131–134; *Topologicheskie metody v variatsionnykh zadachakh* ("Topological Methods in Variational Problems"; Moscow, 1930), written with Lyusternik; "Über additive Eigenschaften von Zahlen," in *Mathematische Annalen*, **107** (1933), 649–690; "Ob additivnykh svoystvakh chisel" ("On the Additive Properties of Numbers"), in *Uspekhi matematicheskikh nauk*, **7** (1940), 7–46; and "O slozhenii posledovatelnostey" ("On Addition of Sequences"), *ibid*., 62–63.

II. Secondary Literature. See "L. G. Shnirelman (1905–1938)," in *Uspekhi matematicheskikh nauk*, **6** (1939), 3–8; *Matenuitika r SSSR za pvatnadtsat let* ("Mathematics in the U.S.S.R. for Fifteen Years"; Moscow-Leningrad, 1932); *Matematika v SSSR za tridtsat let* ("Mathematics in the U.S.S.R. for Thirty Years"; Moscow-Leningrad, 1948); and *Matematika v SSSR za sorok let* ("Mathematics in the U.S.S.R. for Forty Years"), 2 vols. (Moscow, 1959), esp, II, 781–782.

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