ABOUT SAMUIL ARONOVICH KAPLAN (1921 - 1978)

Samuil Aronovich Kaplan was born on October 10, 1921 in the town of Roslavl in the Smolensk Region. After finishing secondary school in 1939, he was called for military service, and was in the army when the war began. He fought at the Leningrad Front, and took part in the breakthrough of the siege of Leningrad.

As early as 1945, while S. A. Kaplan was still serving in the army, he successfully passed the examinations for an entire pedagogical course, and received a diploma as a teacher of mathematics. After being demobilized, he entered graduate school in the Astrophysics Department of Leningrad University, defending his dissertation in 1948, ahead of schedule.

Samuil Aronovich's debut in astrophysics was exceptionally bright. In his dissertation, he studied the mechanical equilibrium of white dwarfs, whose pressure is entirely due to a completely degenerate electron gas. In contrast to the previously known model of Chandrasekhar, he took gravity into account in a general relativitistic treatment. A number of extremely important results came from this work, of which we will note only three. It became clear that (1) the limiting mass for the formation of white dwarfs was less than 1.44 $M_\odot$ (as in Chandrasekhar's model), and was equal to 1.2 $M_\odot$; (2) this limiting mass corresponds to a finite radius for white dwarfs $\sim$ 1000 km; and (3) the maximum density in the center of such a "limit" white dwarf was also finite, and equal to $\sim 2 \times 10^{10}$ g/cm^3 (for the case of an iron white dwarf). These same results were obtained by Chandrasekhar only fifteen years later.

The second fundamental importance of the results obtained by Samuil Aronovich is the creation of an elegant theory for the cooling of white dwarfs. In brief, its essence is as follows. The extremely degenerate internal layers of the white dwarf are nearly isothermal, due to the high thermal conductivity of the gas. They are covered by a thin shell of non-degenerate gas, which contains nearly the entire temperature differential of the star. Taking the outer layers to have a Kramer opacity, Samuil Aronovich derived a relation between the surface and internal temperatures. He was also able to obtain the time dependence of the white dwarf luminosity. The same results were obained by Mestel two years later.

Another classical result of Samuil Aronovich' work came from his investigations of the stability of orbits in a spherically symmetric Schwarzschild field. He established the minimum radius for the orbit of a particle around a black hole, at which stable motion is still possible, which is a factor of three greater than the Schwarzschild radius.

These results of Samuil Aronovich concerning orbit stability and the effects of general relativity in white dwarf theory became part of the Golden

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Fund of astrophysics, and have been referenced by Einstein.

After finishing his graduate work, Samuil Aronovich was sent to the Astronomical Observatory of Lvov University. There, he began his active pedagogical activities, which he continued right up until his death. It was in Lvov that the now famous Kaplan Astrophysical School was founded. Many of his students now play leading roles in astronomical departments of various countries of the former Soviet Union. In Lvov, there was a sharp change in the scientific interests of Samuil Aronomich from superdense to superrarified matter. He carried out a number of investigations concerning the state of the interstellar gas, the absorption and excitation of the atoms in it, and the intensity of the interstellar radiation field.

Starting in the beginning of the 1950's, S. A. Kaplan was one of the first to participate in the development of a new field of astronomy: cosmic gas dynamics. His work was the first to turn attention to the important role of taking into account radiation in gas dynamical processs. Samuil Aronomich developed the theory of interstellar turbulence, worked out observational methods for studying this phenomenon, and determined parameters of the turbulence. His work also substantially developed the theory of ionization fronts – the most characteristic gas dynamical structure in the interstellar medium. This cycle of research works was included in the first monograph on the dynamics of the interstellar medium, which was published in 1958. For many years, this book served as the main textbook on cosmic gas dynamics in the education of astrophysics students in many universities around the world.

In 1961, Samuil Aronovich moved to Gorky (now Nizhnii Novgorod), and remained there until the end of his days, as a senior scientist at the Radio Physics Research Institute, continuing his pedagogical activity as a professor at Gorky University. In Gorky, without losing contact with the problems that interested him earlier, S. A. Kaplan began to do research in the new area of plasma astrophysics. In his research with various students and colleagues, he obtained many important results, which then found wide application in the solution of various problems in astrophysics. In essence, the theory of cosmic plasma turbulence was developed rather fully, for both the non-relativistic and relativistic cases. The turbulence spectrum and particle distribution function were determined, various types of instability were investigated, and stabilizing mechanisms operating against these instabilities were discovered.

Samuil Aronovich also carried out much interesting research concerning other problems in astrophysics. In particular, under his supervision, numerical simulations were executed on a personal computer in order to study the evolution of protoclusters and proto-solar systems; such simulations were extremely rare at that time. He considered problems in stellar astronomy related to stellar evolution. In a number of papers, he studied the dynamics of the solar atmosphere. For example, with his students, Samuil Aronovich de-

veloped an efficient method for calculating the evolution of a finite-amplitude wave propagating in a plane inhomogeneous medium; all stages of the wave were considered — linear propagation, front formation, and dissipation. Using this method, the possible formation of a temperature inversion zone in the atmospheres of solar-type stars was first demonstrated.

The fruitful educational activity of Samuil Aronovich should especially be noted. He wrote many excellent books (in all, there have been more than twenty editions of his books). Above all, we should mention such fundamental monographs as "Interstellar Gas Dynamics" (1958), "The Interstellar Medium" (1968, with S. B. Pikel'ner), "Plasma Astrophysics" (1972, with V. N. Tsytovich), "Plasma Physics of the Solar Atmosphere" (1977, with S. B. Pikel'ner and V. N. Tsytovich), "Physics of the Interstellar Medium" (1979, with S. B. Pilel'ner), and others. He also wrote a number of excellent popular books, of which the best known are "The Physics of Stars" (1961) and "Fundamentals of Radio Astronomy" (1966).

The great erudition of Samuil Aronovich and his encyclopedic knowledge of virtually all areas of astrophysics attracted many astronomers to him. The beneficial influence of his mighty intellect acted upon nearly all young Soviet astrophysicists in the 1950's–1970's.

His tragic death in July of 1978 cut down S. A. Kaplan while he was still at the height of his strength and talent.