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SCIENTIFIC LEGACY OF PROFESSOR GUSEINOV OKTAY HANGUSEIN

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Professor Oktay Guseinov is an outstanding astrophysicist, Doctor of Physical and Mathematical Sciences. Oktay Guseinov is the founder of relativistic astrophysics in the Republic of Azerbaijan and established the first scientific school in this area in Azerbaijan. After graduating from university in 1963, O. Guseinov began his scientific career under the guidance of the world-renowned scientist, physicist, and physical chemist Academician Yakov Borisovich Zeldovich in Moscow. Three-time Hero of the Soviet Union, Ya.B.Zeldovich was one of the creators of the atomic and hydrogen bombs and the famous Soviet rocket "Katyusha". He was a student of Lev Landau. O.Guseinov was fortunate to interact and work with such a brilliant scientist and his circle. As a result of his scientific activities, O.Guseinov made significant contributions to astrophysics, radio, and X-ray astronomy - contributions that play an important role in the development of these fields of modern science. He had foresight in science; relying on his knowledge, he could predict what might be occurring in space. With the advancement of technology, observational data confirmed the reality of the objects and scientific phenomena predicted by O.Guseinov. It is enough to list some of them to understand the magnitude of his scientific legacy.
Keywords: Supernova Remnants – Radiative SNRs – Radio emission

1. NEUTRINO ASTROPHYSICS

Ya. B. Zeldovich and O.H. Guseinov calculated in 1964-1965 what the flux and energy of neutrinos emitted from a star as a result of an explosion in our Galaxy should be. They also proposed that these neutrinos could potentially be detected using existing neutrino telescopes.

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Fig. 1. Prof Guseinov O.H.

- Ya.B. Zeldovich, O.H. Guseinov - "Neutronization of matter during collapse and the neutrino spectrum" Doklady AN SSSR, v.162, No.4, 1965 [17]
- Ya.B. Zeldovich, O.H. Guseinov - "Neutronization of He-4" J. Exs. Theor. Phys., Letters, 1, 11, 1965 [20].

From 1966 to 1968, Oktay Guseinov analyzed the collapse of hot stars, stating that antineutrinos are also important, and during the explosion, the energy of neutrinos and antineutrinos could be higher than previously calculated.

- O.H. Guseinov - "On experimental possibilities of detection of the collapsed stars" Aston. J., v.43, p.772, 1966; Sov. Astron., v.10, p.613, 1968 [3, 4].
- O.H. Guseinov - "Neutrino radiation during stellar collapse" Astron. J., v.45, No.5, 1968; Soviet Astronomy, v.12, p.783, 1969 [4, 5].

In 1987, the explosion of a massive star was recorded in the Large Magellanic Cloud. The energy and flux of antineutrinos detected by Japanese and American neutrino telescopes matched the values predicted by Ya. B. Zeldovich and O.H. Guseinov. The observed particles were indeed the antineutrinos that should have been produced in the stars explosion, as Guseinov predicted. Zeldovich and Novikov noted that this idea belonged to Guseinov (Uspekhi Fizicheskikh Nauk, 1965, 86, No. 3, 473) [21].

Japanese scientist Masatoshi Koshiba, using the Super-Kamiokande II neutrino telescope, and American R. Davis were able to detect particles from the explosion. They were awarded the Nobel Prize in 2002 for these observations. American scientists Prof. V. Trimble and Prof. P. Leonard also wrote on this

topic (PASP 1996. 108, pp. 8-34) [16]. "We were struck by two scientists, such as Zeldovich and Guseinov (in 1965), who predicted the neutrino flux from a supernova explosion caused by collapse, and Guseinov (in 1966), who predicted that, despite the neutrino background from past explosions, antineutrinos from the collapse could be at an observable level"

2. THE NECESSITY OF SEARCHING FOR NEUTRON STARS AND BLACK HOLES IN CLOSE BINARY SYSTEMS AND THEIR STRONG X-RAY SOURCES

Ya. B. Zeldovich and O.H. Guseinov showed that the components of X-ray sources could be neutron stars or black holes and described in 1965 how to observe these stars. In 1970, O.H. Guseinov, in his paper, explained what the properties of neutron stars, black holes, and binary star systems might be.

- Ya.B. Zeldovich, O.H. Guseinov - "Collapse of stars in binaries," Astrophys. J., v.144, p.840, 1966; Astron. J., No.2, 1966. [18, 19]

- O.H. Guseinov - "X-ray source in binaries", Sov. Aston. 1970, 47, 1143. [6]

It was necessary to search for neutron stars and black holes in close binary stars, which are powerful sources of X-ray emission, using telescopes located on satellites in space. The first orbital X-ray telescope, UHURU, was launched in 1971, and after the satellite began operation, the ideas and predictions of O.H. Guseinov were confirmed, with the discovery of X-ray pulsars. In I. Novikov's book "HOLES IN SPACE AND TIME" (2006, p.112) [14], it is stated: "I want to emphasize that the organization of the search for relativistic objects in the Universe was initiated in 1965 by Yakov Zeldovich and Oktay Guseinov" Andrew G. Lyne and Francis Graham-Smith in their book "PULSAR ASTRONOMY," Cambridge University Press, 1998. It was noted: "Compact stars, whether white dwarfs or neutron stars, were predicted as observable sources of X-rays. In 1964, the predictions were made by Zeldovich and Guseinov." M. Longair, in his book "THE NEW COSMIC CENTURY: A HISTORY OF ASTROPHYSICS AND COSMOLOGY" (2006, p. 199) [12], writes: "in 1965, Yakov Zeldovich and Oktay Guseinov proposed that the observation of X-rays or γ -rays from spectroscopically single-lined binary systems could indicate either a neutron star or a black hole."

Riccardo Giacconi led the scientific programs of the orbital X-ray telescope "UHURU" and was awarded the Nobel Prize in 2002 for finding X-ray sources using the satellite.

O.H. Guseinov recalled the work [6, 7] while in Turkey: "Before 1971, it was not even known whether X-ray sources were point-like, as the uncertainty in their

coordinates could be as large as 4-5 degrees. To determine what these sources were and to identify which optical star they were a component of, it was necessary to understand the characteristics of X-ray and optical bands of the binary X-ray sources we predicted. I sent this work to a journal in 1967, but because the results seemed incredible and the work appeared too early, it was only published in 1970."

O.H. Guseinov, K.I. Novruzova - "Collapsed Stars in Binary Systems" Astronomicheskii Zhurnal, Vol. 48, p.221; Soviet Astronomy, Vol. 15, p.173, No.1, p.173, 1971 [9, 10]

3. RADIO AND X-RAY ASTROPHYSICS

In 1966, Oktay Guseinov and Pavel Amnuel, predicted that certain celestial bodies could emit periodic X-rays, even before the first pulsars were discovered. Six months later, in the UK, an astrophysical group led by Antony Hewish at Cambridge recorded an unexpected, regularly repeating signal during research on radio emissions in the interplanetary medium.

- P.R. Amnuel, O.H. Guseinov -"X-rays during the accretion of interstellar matter" Izvestiya AN Azerb. SSR, No. 3, 1968. [1]
- P.R. Amnuel, O.H. Guseinov -"The influence of interstellar medium parameters on accretion by neutron stars" Astron. Nachr., v. 294, p. 139, 1972. [2]

For the detection of the signal using the meridian radio telescope, Hewish was awarded the Nobel Prize in 1974.

As a result, the astrophysical objects predicted in advance by O.H. Guseinov, representing our country, have been found in galaxies, and the scientific events have been confirmed. Those who confirmed these findings through their observations were awarded the Nobel Prize:

1. Japanese Masatoshi Koshiba, American R. Davis in 2002.
2. English Antony Hewish in 1974.
3. Italian Riccardo Giacconi in 2002.

Of the six Nobel Prizes awarded in cosmology up to 2002, three were related to the research conducted by Professor Oktay Guseinov, whose significant predictions have secured his place in the history of global cosmology.

Professor V.M. Lipunov noted in his book "Astrophysics of Neutron Stars" (Springer-Verlag, 1992, p.6) [11]: "A significant ideological and psychological barrier was overcome by Soviet scientists Amnuel and Guseinov (in 1968), who pointed out the necessity of considering the magnetic field of neutron stars. From general considerations, it follows that neutron stars should have strong magnetic fields, and the accreting matter under realistic conditions is a good conductive plasma. The way in which matter falls onto the star can change dramatically in a magnetic field. How matter falls onto the star can change dramatically in a magnetic field. Thus, even spherical accretion near neutron stars can lead to anisotropy in the distribution of matter and, consequently, radiation. As a result of the rotation of neutron stars, the radiation appears to the observer as periodically pulsing."

These objects were named "PULSARS". The discovery of the pulsar was perceived as the beginning of a new era in astrophysics. Professor V.M. Lipunov noted in "Astrophysics of Neutron Stars" (Springer-Verlag, 1992, pp. 11-12) [11]: "All publications regarding the theory of neutron star accretion prior to the launch of the Uhuru satellite were made by Soviet scientists:

1. Novikov, Zeldovich 1966;
2. Shklovskiy 1967;
3. Amnuel, Guseinov 1968;
4. Zeldovich, Shakura 1969;
5. Bisnovaty-Kogan, Fridman 1969;
6. Amnuel, Guseinov 1969;
7. Guseinov 1970;
8. Shvartsman 1970, 1971;
9. Amnuel, Guseinov 1972;
10. Shakura 1972.

4 out of 10 on this topic were completed by Azerbaijani scientists working at the Shamakhi Astrophysical Observatory during those years.

Professor Malcolm Longair, Royal Astronomer of Scotland, Director of the Royal Observatory in Edinburgh, and Vice-President of Clare Hall College at Cambridge, published a book in 2006 titled "THE NEW COSMIC CENTURY: A HISTORY OF ASTROPHYSICS AND COSMOLOGY" [13].

In this book, he discusses the most important scientific achievements from 1900 to 2000 and lists the names, surnames, and years of life of the authors of these results. It should be noted that the Azerbaijani Oktay Guseinov is the only scientist from Turkic-speaking countries recognized in this book, and his scientific achievements are examined in detail.

In 1987, a group of academicians from the Academy of Sciences of the USSR published a book that compiled information about the greatest achievements in Soviet science and technology from 1917 to 1987: "THE GREATEST ACHIEVEMENTS OF SOVIET SCIENCE AND TECHNOLOGY FROM 1917 TO 1987" [15].

Only two individuals of Turkic origin from the former USSR were mentioned in this book: the Azerbaijani astrophysicist Oktay Guseinov and the oilman Emin Taghiyev.

The Shamakhi Observatory held a special place in O.H.Guseinov life, where he worked from 1966 to 1982. He headed the Department of Theoretical Astrophysics, served as Deputy Director, and later as Director of the Observatory. From 1982 to 1992, he headed a laboratory at the Institute of Physics of the Azerbaijan National Academy of Sciences. In April 1992, Oktay Guseinov moved to Turkey at the invitation of the Faculty of Science at METU. By the initiative of the then-president of TUBITAK Professor Dr. Tosun Terzioglu, in 1995, Guseinov became a Turkish citizen with the "special status of a distinguished scholar."

4. CONCLUSIONS

Guseinov was the first to propose a method for searching for black holes in binary systems that were previously unobservable, and he compiled a list of such objects. Under his guidance, several catalogs were published, including: -

- A Complete Catalog of Galactic Supernova Remnants
- A catalog of X-ray sources
- A catalog of white dwarfs
- A catalog of pulsars

Over his 45 years of scientific activity, O.H.Guseinov published more than 300 scientific articles in leading international journals, which have been cited over 1200 times, and these citations continue to this day. Professor O.H. Guseinov is the author of four monographs. He was a person who lived for science. Oktay Guseinov trained young specialists who successfully worked and continue to work in Azerbaijan, Turkey, the USA, and Europe.

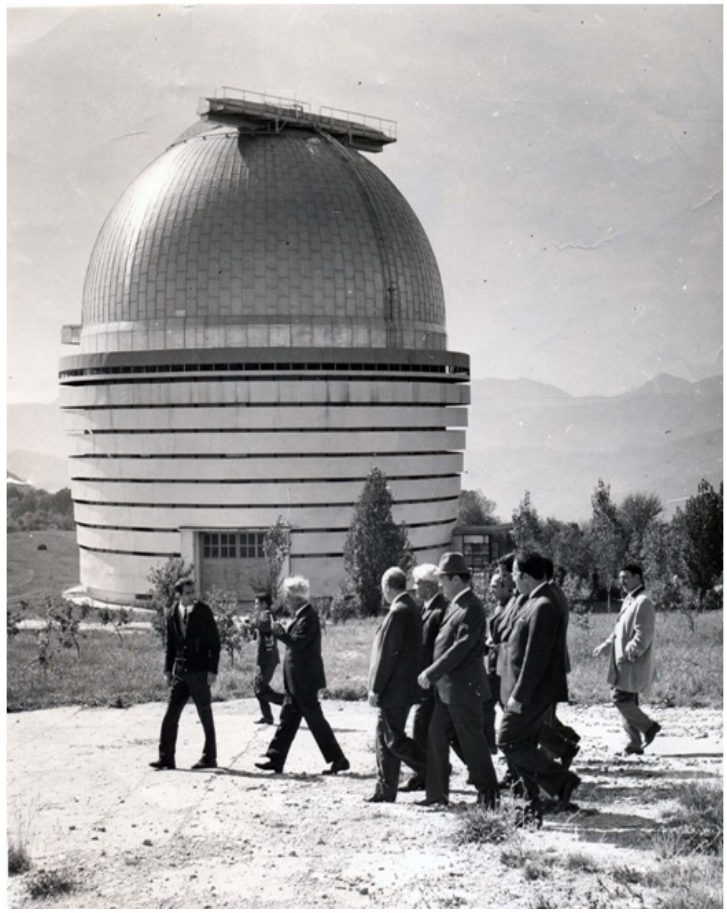

Fig. 2. O.H.Guseinov demonstraits the telescope

At various universities he courses given for Master of Science and Doctor of Philosophy: Astrophysics, General Physics, Thermodynamics, Statistical Physics, Atomic and Nuclear Physics, Particle Physics, Special and General Theory of Relativity, Electromagnetic Theory, High Energy Physics and Astrophysics, Special Studies in Physics.

He was awarded two medals from the USSR, was the author of two patents registered in the Russian Federation, and actively participated in numerous international scientific conferences. A full member of the International Astronomical Union, Guseinov continued his scientific work after retiring. He worked on publishing books in physics:

1. Molecular physics, thermodynamics, and statistical physics (primarily statistical physics);

Fig. 3. O.H.Guseinov with Sultanov G., Keldysh M. and Bagirov G.

2. Classical field theory (including electrodynamics, special and general relativity);

3. Atomic and nuclear physics (with a section on particle physics totaling 30-40 pages).

Additionally, he prepared materials for a question-and-answer format book that would interest schoolchildren, students, and the general public. He also published popular articles on various topics, which was his hobby.

- The Effect of Global Warming on Human Life and Thought
- We're done with Darwin, is it Einstein's turn?
- Universe, Allah, Evolution and Islam -1, 2.
- Wrongly Taught Physics: An Example.

Fig. 4. Memorial meeting at the Institute of Physics.

- If Einstein were in an Underdeveloped Country?
- If Einstein were in Turkey?
- Why Are We Behind in Science?
- Evaluation of Articles by Those Working for Good Physics Education.
- Cheap Ways to Go to Siberia.
- European Union.
- Contribution to Science and Contribution of Some Turkish Scholars to Science.
- Our Opportunity to Contribute to Scientific Thought, Physics Education and Physics Science.
- Brief History of Hydrogen and Neutron Bomb Production in the Soviet Union.
- Genetic Weapons.

- The Ladder or Stick Issue in High School.
- Scalar and Vector Quantities.
- Why aren't Anthills Flooded?
- Nobel Prizes in Physics

and so on.

A book dedicated to the spouses of O.H. Guseinov and his students E. Yazgan and A. Ankay was published in the USA in 2007: "Neutron Stars, Supernovae, and Supernova Remnants" Nova Science Publishers - New York [8].

Oktay Guseinov passed away on March 25, 2009, at his home in Turkey and was buried in the Undjaly cemetery in Antalya.

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