Brief information about the project

Name of the project	AP19575366 Investigation of the physical properties of the accretion disk around black holes and their mimickers
Relevance	To date, the most important and urgent problems of modern astrophysics are issues related to the physics of black holes (BHs): supermassive and stellar masses. BHs are a prediction of general relativity (GR) and play an important role in astrophysics. However, within the framework of classical GR, BHs have a space-time singularity. From a physical point of view, these singularities present many problems. But in some cases, the singularity is not a problem for physics, because it is hidden behind the event horizon. There are metrics in which there are naked singularities. In some models, naked singularities, bosonic stars, gravity stars, etc., are considered as BH mimickers.The formation of supermassive black holes (SBHs) is unknown and less studied. A number of SBH candidates have been observed in the early Universe. One notable example is ULAS J1342+0928 with mass 800*10:^6 mass of Sun, located at z = 7.54. To determine the mass of SBHs, the method of measuring the spectra emitted by their accretion disks is used, with the exception of Sgr A* in the Milky Way and the SBHs candidate in the M87 galaxy. The influx of matter (gas and dust) to the central gravitating object is called accretion by astrophysics, which is one of the most common processes in astrophysics, including close binary systems. The most striking observational manifestations of accretion occur when the central object is a BH. Accretion onto BHs releases a large amount of energy per unit of accreted mass. And its rates is steady against the SBHs at the centers of galaxies, making them the brightest continuously emitting objects in the Universe (like quasars and blazars). Convincing evidence of the existence of rotating BHs and event horizons is provided by the analysis of luminosities and spectra of accreting BHs.
Purpose	The aim of this project is to study the circular motion of test particles in an accretion disk and the luminosity of an accretion disk in a gravitational field, described by the Hartle-Thorn and Quevedo-Mashhoon metrics.
Objectives	1. Calculation of the angular velocity, angular momentum of test particles in an accretion disk in the space-time of Hartle-Thorne and Quevedo-Mashhoon. 2. Determination of the energy of test particles, the flux of electromagnetic radiation and the differential luminosity of the accretion disk in the space-time of Hartle-Thorne and Quevedo-Mashhoon. 3. Study of the behavior of the spectral luminosity of the accretion disk in the space-time of Hartle-Thorne and Quevedo-Mashhoon.

Expected and achieved results	1. The angular velocity and angular momentum of test particles for circular orbits in Hartle-Thorne and Quevedo-Mashhoon space-time will be obtained. 2. The energy of test particles for circular orbits and the radiating flux of the accretion disk in the space-time of Hartle-Thorne and Quevedo-Mashhoon will be calculated. 3. The differential and spectral luminosities of the accretion disk in Hartle-Thorne and Quevedo-Mashhoon space-time will be investigated.
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List of publications with links to them	Ye. Kurmanov, K. Boshkayev, T. Konysbayev, M. Muccino, A. Urazalina, G. Ikhsan, N. Saiyp, G. Rabigulova, M. Karlinova, G. Suliyeva, A. Taukenova and N. Beissen Analysis of dark matter profiles in the halos of spiral galaxies // Physical Sciences and Technology. Vol. 10 (No. 3-4), 2023: 4-16 https://doi.org/10.26577/phst.2023.v10.i2.01
Patents	-