

Abstract

The installation of a digital planetarium called Unisphere was completed at the Institute of Physics of the Silesian University in Opava in 2019. This academic planetarium is mainly used for educational purposes in programs focussing on astrophysics and of multimedia technology. One of the first projects the creative group is working on is the production of 10 short fulldome programs on very advanced astrophysical topics. One of them was also presented at the FFB festival in Brno (<https://www.fulldomefestivalbrno.com/>) and GDP 2023 in Solingen (<https://galileum-solingen.de/ueber-uns/planetariums-netzwerk/gdp-tagung-2023/>).

Accretion disk at black holes

The show provides a brief recap of the history of the term "black hole" and its connection to the evolution of very massive stars. The physical properties of the close vicinity of black holes are briefly described, in particular the formation of the typical accretion disks that surround black holes in most cases. **(21 minutes)**

Optical effects in extreme gravitational fields

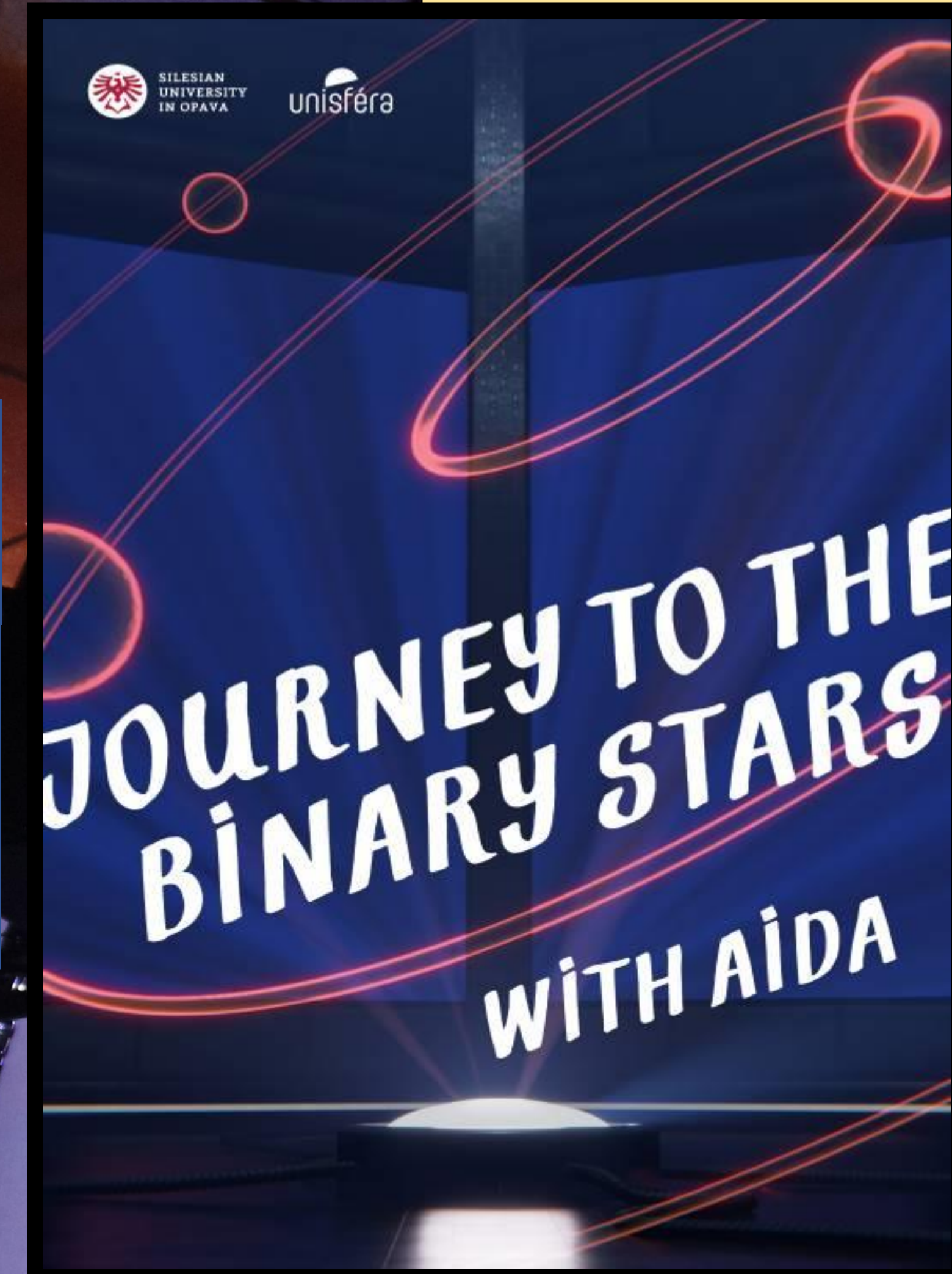
This show aims to introduce the viewer to the issue of optical imaging in strong gravitational fields. The history of its modelling, first discoveries and its use in today's space exploration. It aims to educate and motivate. It is an initial step towards a possible future deeper study of these processes. **(38 minutes)**

Life under a black sun - exoplanets near BH

The show consists of a walk through the solar system, defining the habitable zone and the need of the heat for life. We go over other planetary systems that may exist including the possibility of a black hole as the central body. Finally describe the criteria they must meet in order to have exoplanets capable of hosting life. **(20 minutes)**

Astrophysics full of extremes (temperature)

The world around us is governed by physical laws that people have been trying to formulate with increasing precision for centuries. Let's go together to the very limits of the laws of physics! And in doing so, we can also learn about the extreme values that physical quantities can take on. Our first journey explores extreme temperatures. **(15 minutes)**



Journey to the binary stars with AIDA

The show about binary stars has been translated into English and its visual design has been re-created in a more advanced version. The show was also presented at the FFB 2022 festival in Brno and GDP 2023 in Solingen.

The trailer for this show can be found at <https://www.fddb.org/>

Accretion structures near BH and neutron stars

The show describes the behaviour and appearance of various models of accretion disks around black holes and neutron stars in the form of an explanation with historical connotations. The principle of accretion processes and the properties of several of their physical models are explained. Methods for modelling proper accretion disks are also briefly mentioned. **(20 minutes)**

Radiation in strong gravity

Two key physical mechanisms of radiation are explained, namely the Hawking radiation and the Penrose process. It explains that while the first phenomenon is a consequence of the analysis of quantum fields on a curved black hole background, the second physical phenomenon is classical. Finally, the problem of radiation in extreme gravity is summarized by the three laws of (black-hole) thermodynamics. **(15 minutes)**

Cosmic microwave background

At the beginning of the show the definition of the electromagnetic spectrum and atmospheric transparency for radiation of different wavelengths is given. Afterwards the connections of our knowledge of the large-scale structure of the Universe to the properties of the CMB are presented and we look at the Universe in the microwave spectrum, at wavelengths corresponding to 2,7 K. **(18 minutes)**

X-ray observational space missions

This show presents in an engaging way the history and the present of space observations in the X-ray region of the electromagnetic spectrum. The development of X-ray astronomy could only occur with the development of cosmonautics, and the show presents both historical milestones and current missions in which scientists from the Institute of Physics in Opava are involved. **(20 minutes)**

Binary systems with a neutron star

The story takes place aboard a fictional spacecraft during a journey to the Alpha Centauri system. The basic properties of the different types of binary stars are communicated through a conversation between the astronaut and the on-board artificial intelligence. The communication between them does not lack humour and irony. **(15 minutes)**

Binary systems with a black hole

A loose continuation of the show "Binary systems with a neutron star". In the form of an informal conversation, this show explains the role of compact objects in binary systems, in particular X-ray pulsars, neutron stars with X-ray flares, and also binary systems with a black hole or with two neutron stars. **(15 minutes)**

Conclusions and acknowledgements

All shows were produced only in Czech, but English translations of the scripts are also available. If you are interested feel free to contact us, your own translation into other languages is also possible.

Many thanks to the whole team!

Scripts: Martin Petrásek (3 episodes), Jan Novotný (2 ep.), Debora Lančová, Jan Schee, Jan Hladík, Adam Hofer, Tomáš Gráf, Directed by Adam Hofer, Voices/actors Viktorie Pejková, Adam Langer, Supervision: Jan Hladík, Debora Lančová, Jan Novotný, Jan Schee, 2D animation: Jan Bartoš, Vojta Pazdera, 3D animation: Viky Kurečků, Sound: Jiří Malík, Editing: Martin Petrásek, Production: Lucie Dospivová, Head of Production: Tomáš Gráf



Contact: Tomáš Gráf, Institute of Physics, Silesian University in Opava, Bezručovo náměstí 13, 74601 Opava, Czech Republic
Email: tomas.graf@fpf.slu.cz Website: <https://www.slu.cz/phys/cz/>
Phone: +420 734 268 124

References:

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- <http://whoo.slu.cz/>