

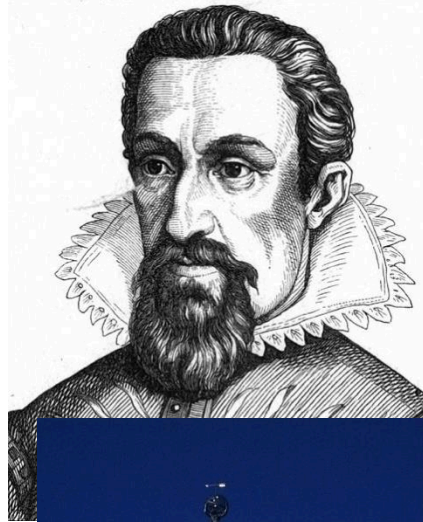
Welcome to Prague, AXRO 2022

City of Astronomy and X-ray Astronomy

René Hudec



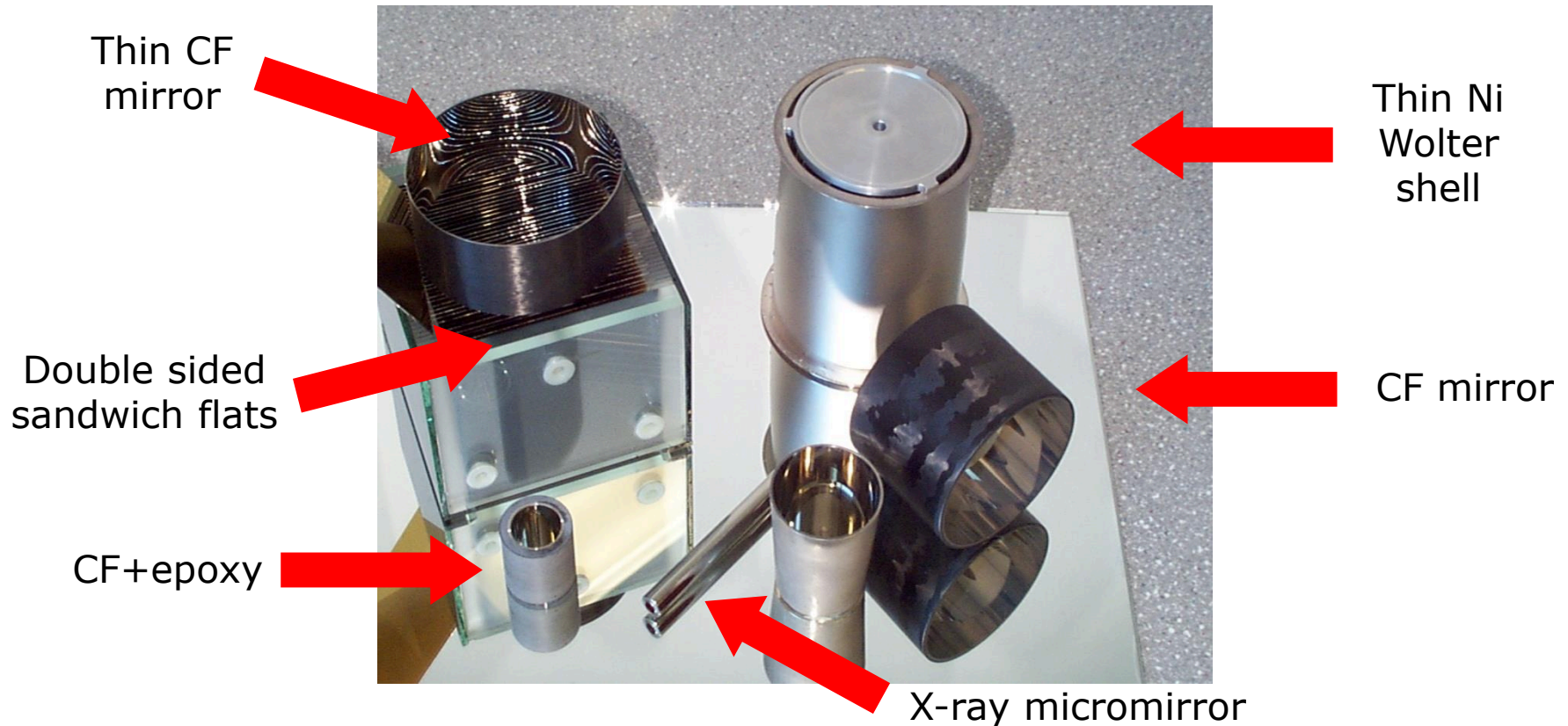
Prague – historical city of astronomy: Tycho de Brahe, Kepler, Einstein, Doppler ... and astronomical X ray optics



History of Grazing Incidence X-Ray Optics in the Czech Republic

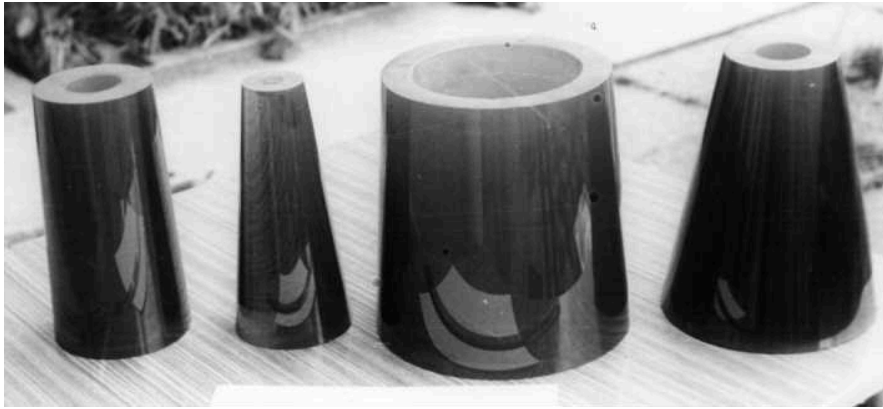
- 1st X-ray mirror in **1969/1970**, for solar telescope in INTERKOSMOS program
- The early stages of the X-ray optics developments in the Czech Republic are closely related to the INTERKOSMOS Space Program (Soviet and East European equivalent of ESA operated until 1989). All of the X-ray imaging telescopes onboard Soviet spacecrafts were equipped with the Czech X-ray optics (exception: X-ray normal incidence mirrors in the special channel of the TEREK telescope). Later on, laboratory applications have started.
- **Total number of X-ray mirrors produced: more than 50**
- Total number of mirrors flown in space: 10
- Total spacecrafts with Czech X-ray optics: 5
- **Total number of space experiments with Czech X-ray optics onboard: 10**

Various replicated X-ray optics

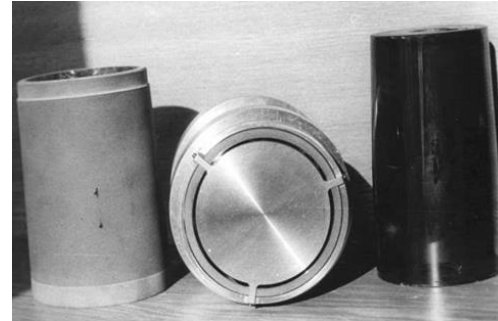


The Grazing Incidence Astronomical X-Ray Optics in the Czech Republic: more than 50 years of development

X - ray mirrors produced by replication in the Czech Republic



The four mandrel used for the manufacture of X-ray mirror nested array for the RT-4M soft X-ray telescope (Glass ceramics Sital). Flown onboard the space station Salyut 7 in 1981.



TEREK
Phobos 1
1988



Two identical mirrors (large hyperbolas) of the RT-4M mirror array (Ni surfaces), 1981.



One of the first Czech X-ray Wolter mirrors, 1970, aperture 50 mm



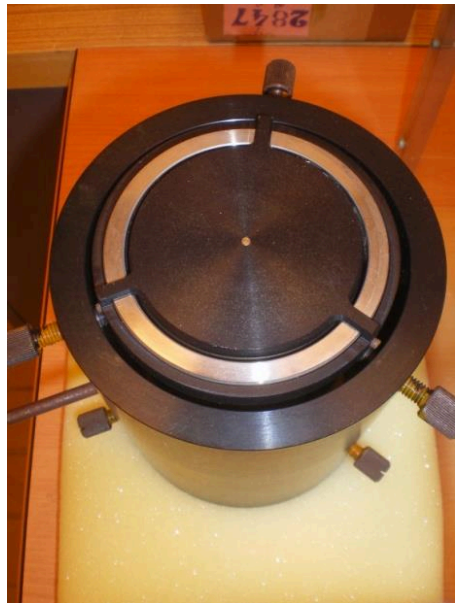
Replicated Wolter - 1 X-ray mirrors of the KORONAS satellite (aperture 80 mm), 1989



The galvanoplastic (electroforming) replication adopted from gramophone industry



115 mm aperture X-ray mirror for AUOS-S-IK, solar, FWHM < 10 arcsec, thick Ni



Solar X-ray Wolter mirror 8'0 mm thick Ni



Thin Ni mirror for DSRI, 1986, thin Ni, 150 mm

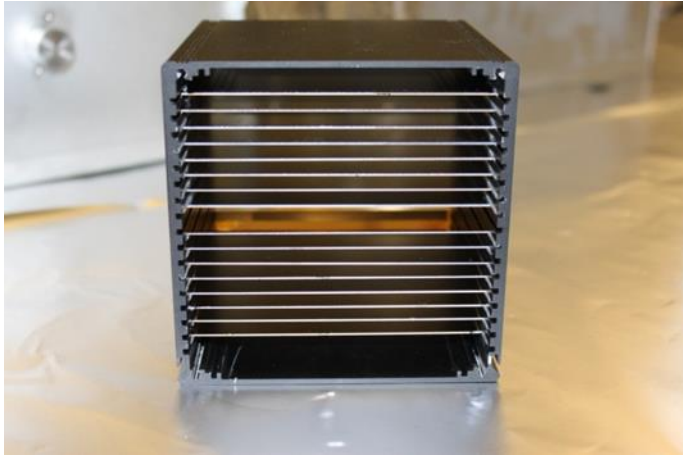


115 mm Wolter, Ni/epoxy, 1979

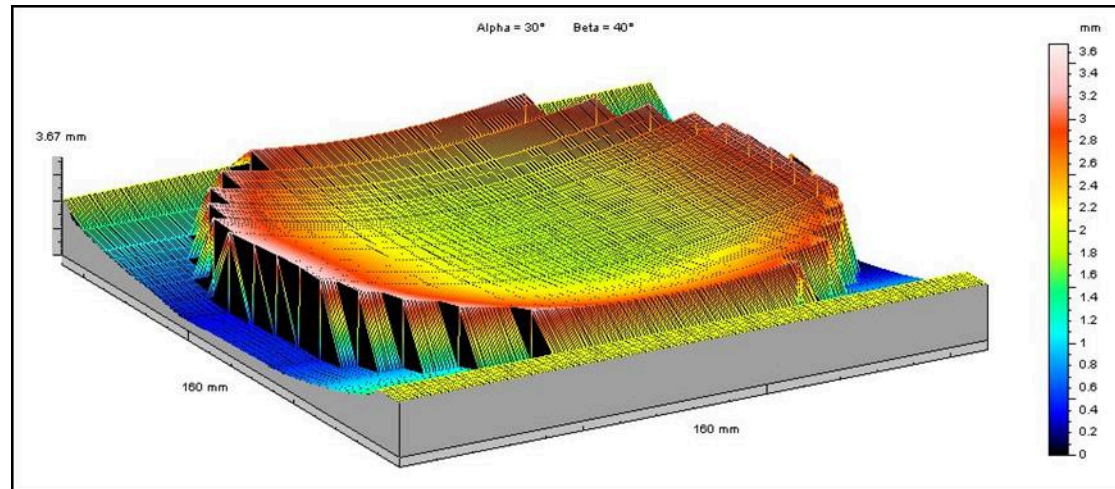
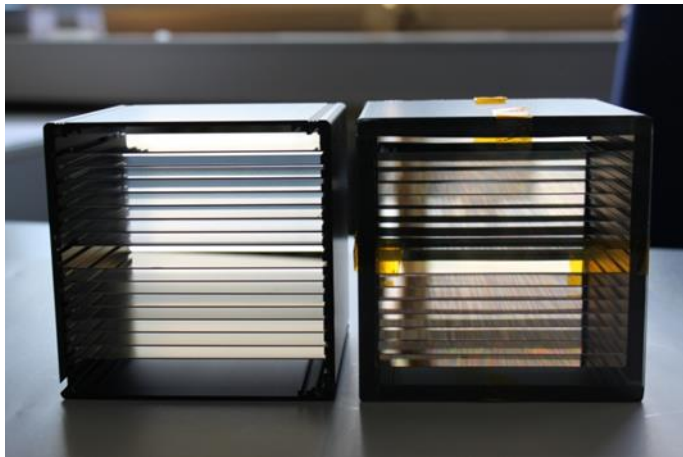


**X-ray Optics
laboratory at
Astronomical
Institute
Ondřejov**

Years 2005-2015

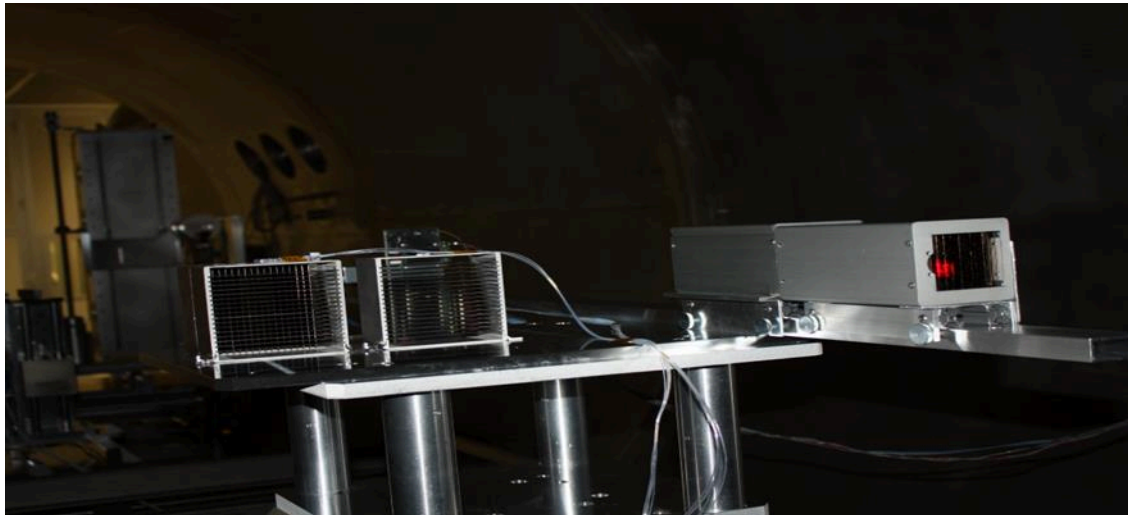
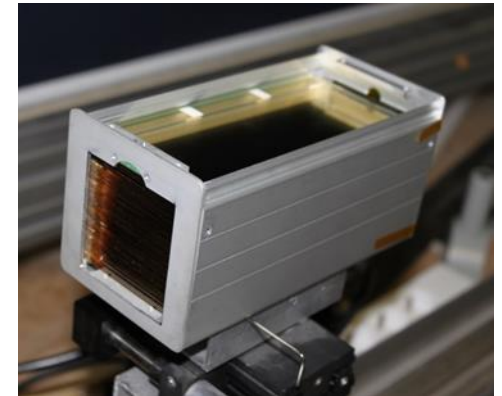


Various modules of MFO Multi Foil Optics
Novel substrates bent thin glass foils
Lobster Eye Optics
K-B Optics

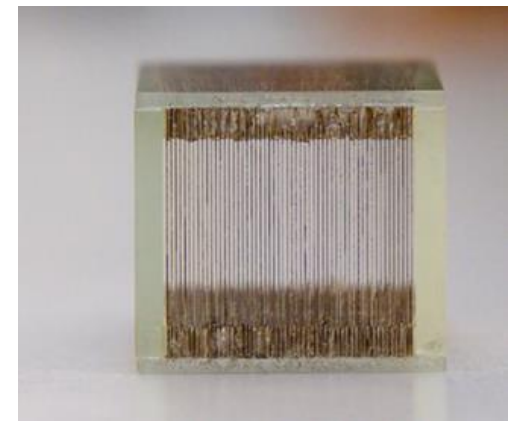


Recent 2016-22

- Participation in AHEAD EU project, KB modules
- LE VZLUSAT1 and 2 (cubesats)
- LE REX (rocket experiment)
- Glass foils/Si substrates
- More in relevant talks/posters



AXRO2022



Czech-US Seminar on Astronomical X-Ray Optics May 2007



Visit to Komorní Hrádek Chateau

Train ride to ON Semiconductor



International Workshop on Astronomical X-ray Optics AXRO2008 Prague Dec 2008



A new tradition is born

AXRO2022

AXRO2009



AXRO2022

AXRO2009 at the Komorní Hrádek Castle



AXRO2010 at Liblice Chateau



AXRO2011:with Prince Lobkowicz at Melnik Castle



AXRO 2012





AXRO2013



AXRO 2014



AXRO2015



AXRO2016



AXRO2017 official photo I



AXRO 2022 Conference Tour and Dinner on Dec 6 Tuesday

- **Guided tour of (some) Prague astronomical historical sites**
- **Led by Prof. Alena Solcova top scientist on Prague astronomical history**
- **Meet 16.30 Metro Staromestska**
- **Dinner in the U Spirku Restaurant 18.30-22**
- **See Conference booklet for details**
- **In emergency call my mobile phone
00420731502542**

AXRO 2022 Conference Evening Event and Dinner on Dec 8 Tuesday

- **Visit to Prague Faust House**
- **Presentation by Prof. Alena Solcova top scientist on Prague astronomical and Faust house history**
- **Meet 18.00 Metro Faust House**
- **18.00-18.30 welcome drink, 18.30-19.15 presentation**
- **Dinner in the Faust house 19.15-22**
- **See Conference booklet for details**
- **In emergency call my mobile phone 00420731502542**

Faust House

- <http://www.prague.net/faust-house>
- Legendary Dr. Faust is known for his pact with the devil and a black magic. Even though real Dr. Faust probably never visited Prague, this house got its name for its mystical history and especially for its eccentric inhabitants



Faust House II



Some logistics

- Breakfast included in accommodation price
- All lunches included in the fee
- Conference evenings events included in the fee
- Guest tickets 45 Euro/1000 CZK each event
- Time of conf photo will be announced later

Places to see in Prague

- **Kepler house and Kepler Museum inside**
- **Thumb of Tycho Brahe in Tyn church,
Staromestske namesti**
- **Astronomical clock, old city hall Staromestske
namesti = place of Christmass market**
- **Monument of Kepler and Brahe at Pohorelec,
Tram station 22 near Prague castle**

Visit to Astronomical Prague



Belveder: Former Observing Place of Tycho de Brahe



Kepler House in Prague (and Kepler museum inside)



<http://www.keplerovomuzeum.cz/en/>



Tycho de Brahe House



**House No. 76 Nový Svět 1
Praha 1 Hradčany (Prague
Castle)**

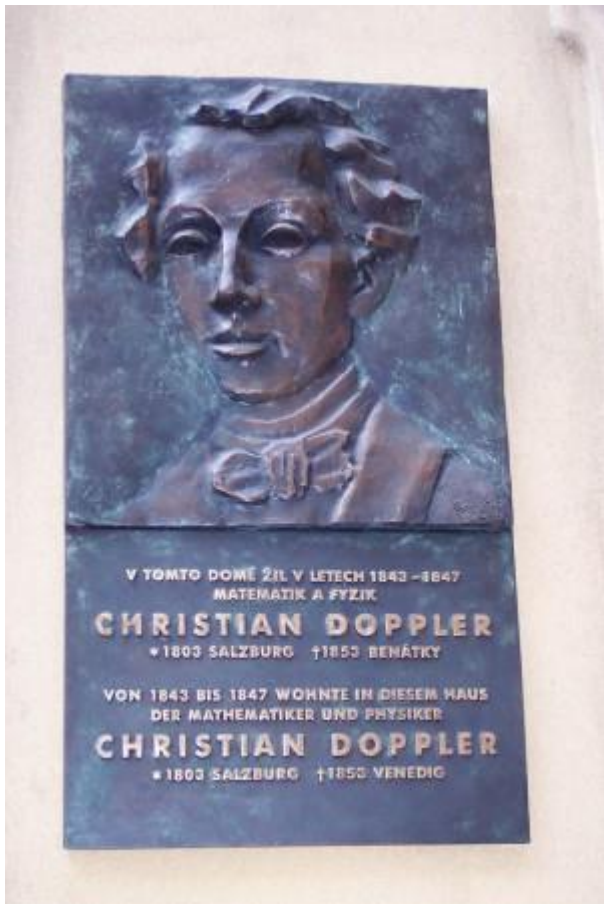


Doppler and Prague

**High school professor in Prague
1835-1847**

Professor in Prague 1835-1847

In 1843, at the proposal of František Palacký, he became a full member of the Royal Czech Society of Science. At the meeting of the science section of the Society, he lectured on May 25, 1842, "On the Color of the Binary Stars", where he described the so-called Doppler phenomenon. However, since he had no experimental evidence, the work did not receive too much attention



U obecního dvora 5, Praha 1
Staré Město

Tycho de Brahe Thumb



Astronomical Clock



Klementinum Old Prague Observatory



Jesuit College

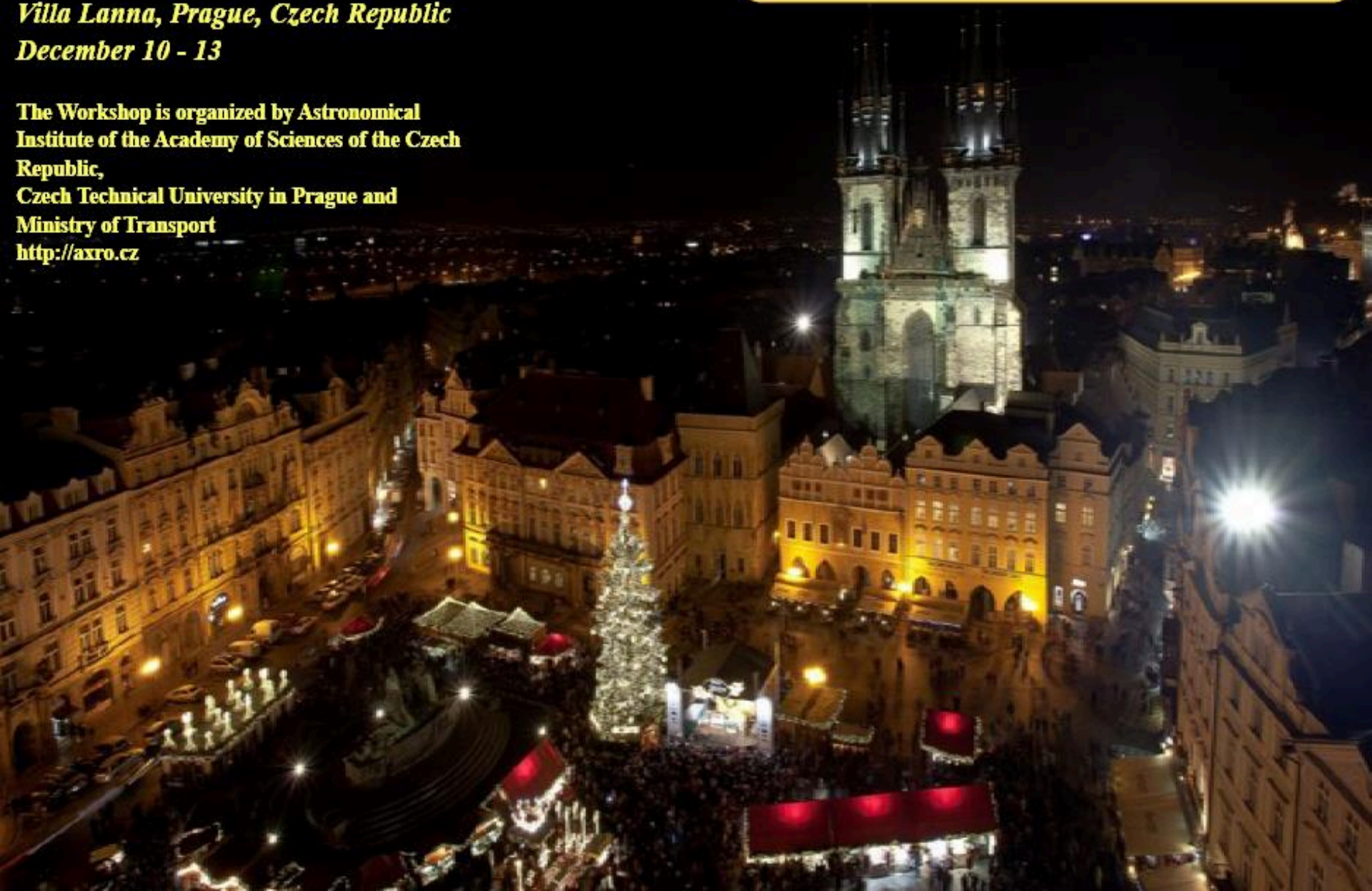
**1st Prague Observatory
Observatory tower from 1722
Today National Library**

AXRO2022

V. International Workshop on Astronomical X-Ray Optics 2012

***Villa Lanna, Prague, Czech Republic
December 10 - 13***

**The Workshop is organized by Astronomical
Institute of the Academy of Sciences of the Czech
Republic,
Czech Technical University in Prague and
Ministry of Transport
<http://axro.cz>**





**The X mass market
starts on Dec 1,
2018**



AXRO2022



Enjoy the meeting ... and Prague

