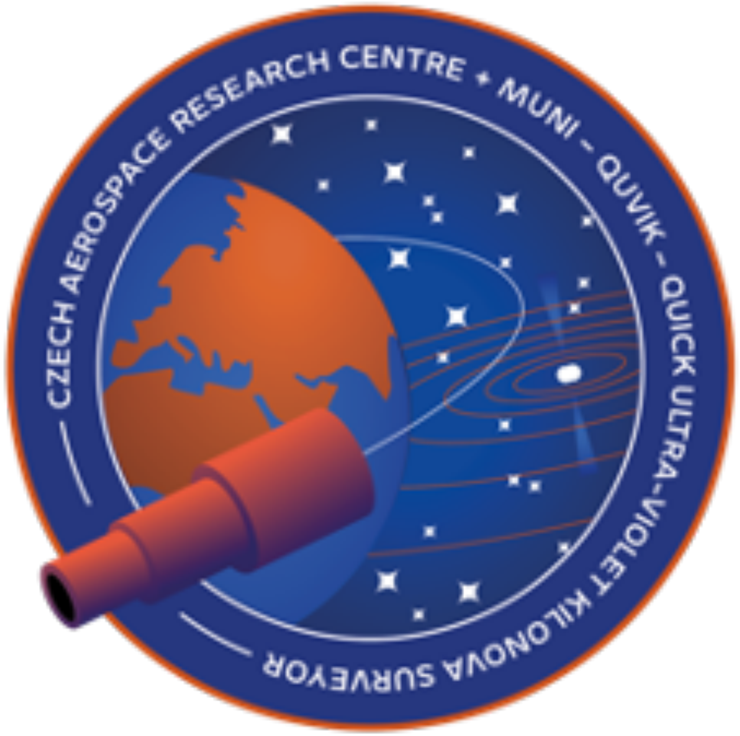


QUVIK = Quick Ultra VIolet Kilonovoa surveyor

Czech Ambitious Mission (CAM) project: “enhance the technical capabilities of the Czech space sector and establish it as a significant contributor to European space activities”

2 satellite missions: AMBIC (Earth observation) and QUVIK (transients in the UV)

Spacecraft is based on the Czech Advanced Platform (CAP)

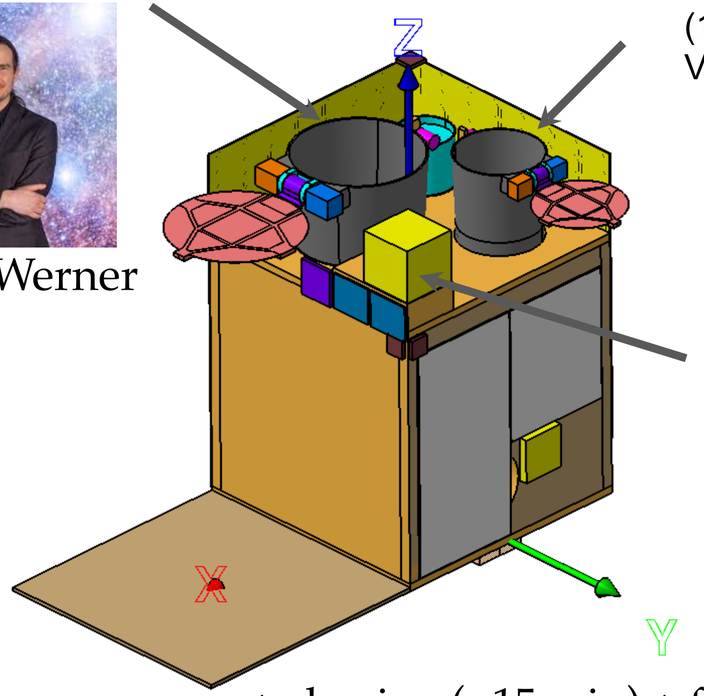
Program supervised by ESA and financed by Czech rep through the Ministry of transportation

QUVIK

Near UV telescope (CZ) (230-290 nm, ~25 cm, V=33x70)

PI - N. Werner

Far UV telescope (IT) (140-230 nm, ~25 cm, V=33x70)



GALI (IL) [10keV-1MeV]

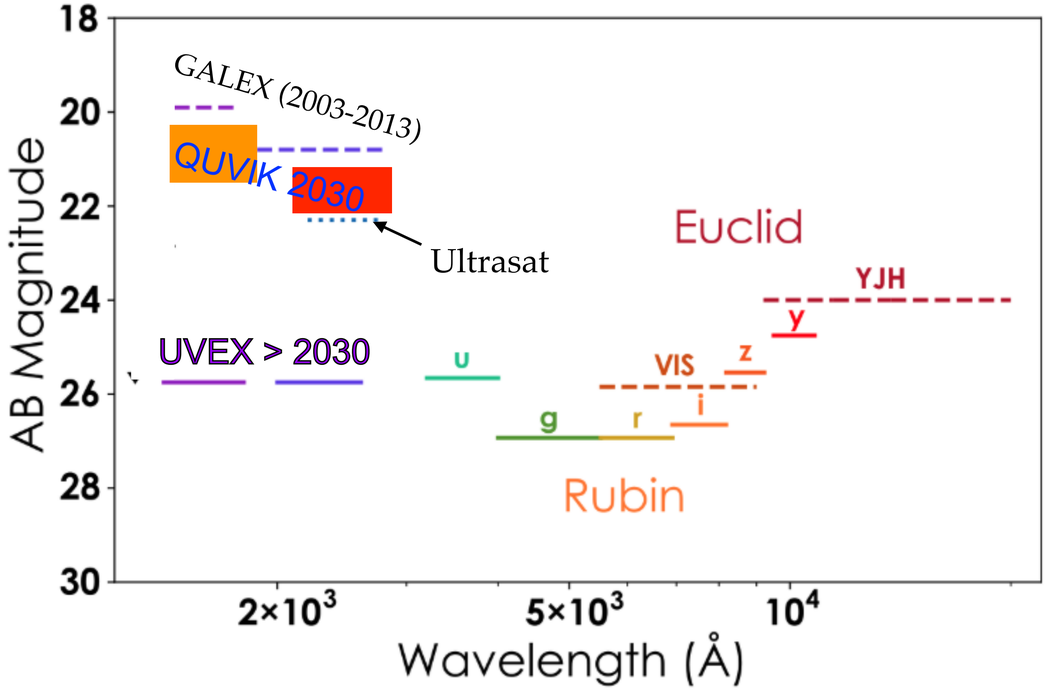
+ slewing (<15 min) + fast communication

Mass: ~200 kg
Size: 0.7 x 0.7 x 1.1 m
Orbit: Low Earth Sun Synchronous Orbit (SSO)
Dowlink: X band (~1600 images per day)
Ready for several launchers (including Vega C and Falcon 9)
Mission duration: 3 years
Status: B1 phase finished, approved for funding in 2023
Past two years QUVIK is undergoing design consolidation

AB < 22.0-21.5
Resolution < 2″

Launch 2030

QUVIK



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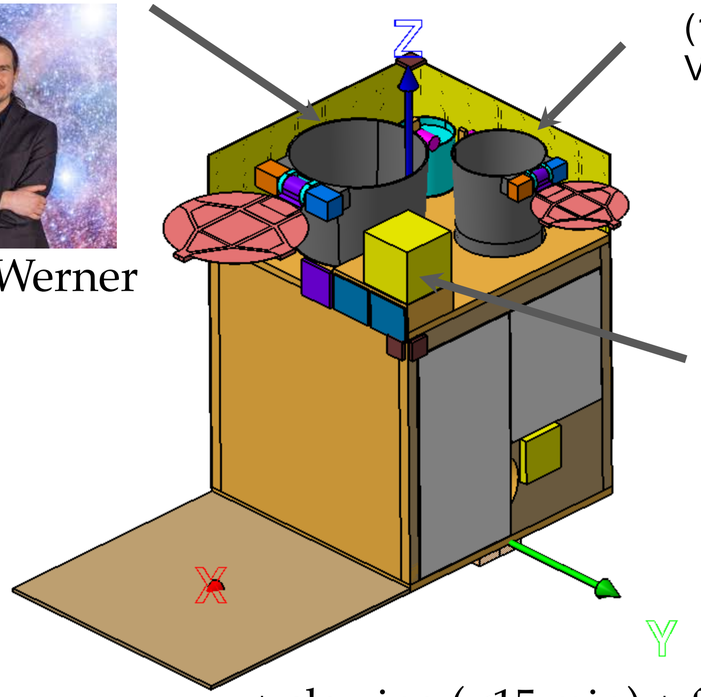

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QUVIK: science objectives

Space Science Reviews (2024) 220:11
https://doi.org/10.1007/s11214-024-01048-3

Science with a Small Two-Band UV-Photometry Mission I: Mission Description and Follow-up Observations of Stellar Transients

N. Werner[1] · J. Řípa[1] · C. Thöne[2] · F. Münz[1] · P. Kurfürst[1] · M. Jelínek[2] · F. Hroch[1] · J. Benáček[3] · M. Topinka[4] · G. Lukes-Gerakopoulos[5] · M. Zajaček[1] · M. Labaj[1] · M. Prišegen[1,6] · J. Krtička[1] · J. Merc[7] · A. Pál[8] · O. Pejcha[9] · V. Dániel[10] · J. Jon[10] · R. Šošovička[10] · J. Gromeš[10] · J. Václavík[11] · L. Steiger[11] · J. Segiňák[12] · E. Behar[13] · S. Tarem[13] · J. Salh[13] · O. Reich[13] · S. Ben-Ami[14] · M.F. Barschke[15] · D. Berge[15,16] · A. Tohuvavohu[17] · S. Sivanandam[17] · M. Bulla[18,19,20] · S. Popov[21] · Hsiang-Kuang Chang[22]

Received: 27 June 2023 / Accepted: 9 January 2024 / Published online: 2 February 2024

Abstract
This is the first in a collection of three papers introducing the science with an ultra-violet (UV) space telescope on an approximately 130 kg small satellite with a moderately fast re-pointing capability and a real-time alert communication system approved for a Czech national space mission. The mission, called *Quick Ultra-Violet Kilonova surveyor—QUVIK*, will provide key follow-up capabilities to increase the discovery potential of gravitational wave observatories and future wide-field multi-wavelength surveys. The primary objective of the mission is the measurement of the UV brightness evolution of kilonovae, resulting from mergers of neutron stars, to distinguish between different explosion scenarios. The mission, which is designed to be complementary to the *Ultraviolet Transient Astronomy Satellite—ULTRASAT*, will also provide unique follow-up capabilities for other transients both in the near- and far-UV bands. Between the observations of transients, the satellite will target other objects described in this collection of papers, which demonstrates that a small and relatively affordable dedicated UV-space telescope can be transformative for many fields of astrophysics.

Keywords UV space observatory · Kilonovae · Gamma-ray bursts · Supernovae

1 Introduction

The first simultaneous detection of gravitational waves and electromagnetic radiation on 2017 August 17 (Abbott et al. 2017b,a), resulting from a coalescence of neutron stars, marked the onset of multi-messenger astrophysics involving gravitational waves. This exciting observation showed that neutron star mergers are of major importance for enriching the Universe with rare heavy elements such as gold and platinum. The radioactive decay of these heavy elements powers a thermal transient at ultra-violet/visible/infrared wavelengths

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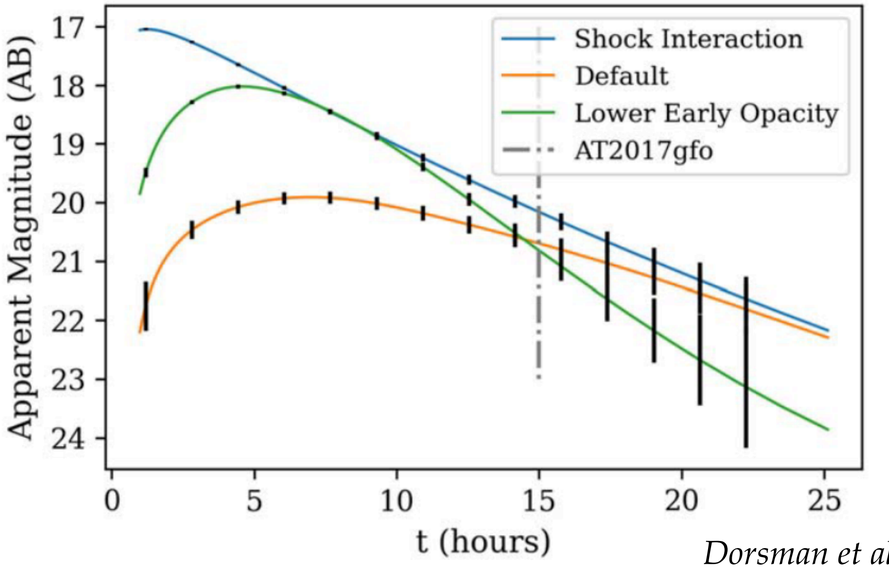
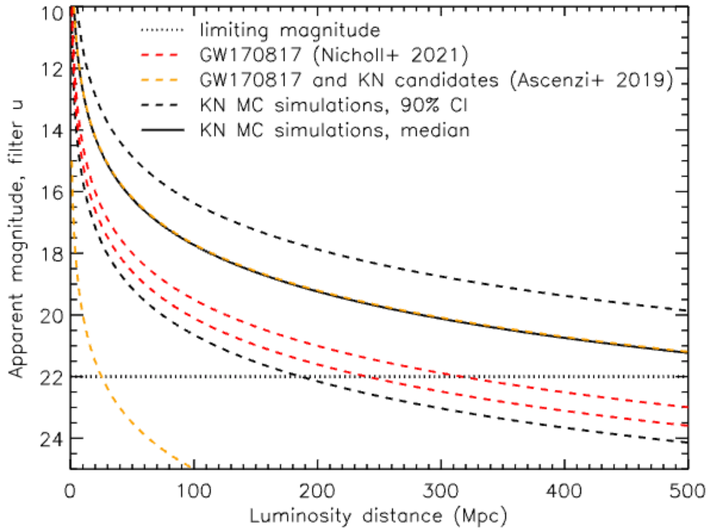
Kilonovae



Dorsman et al 2023



G. Ghirlanda

QUVIK: science objectives

Space Science Reviews (2024) 220:11
https://doi.org/10.1007/s11214-024-01048-3

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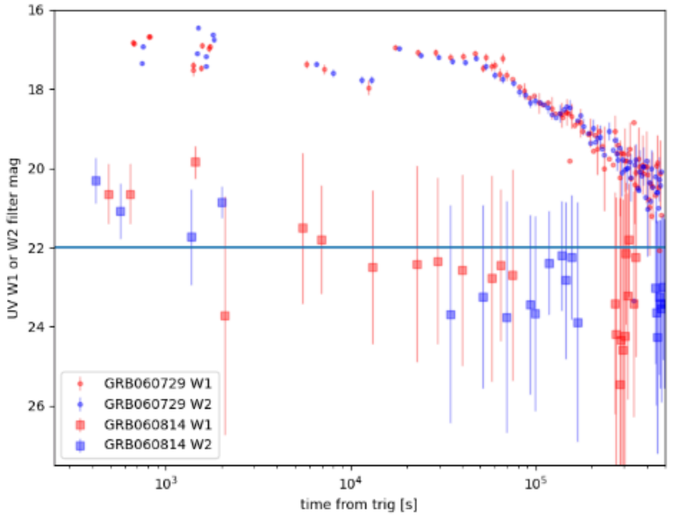
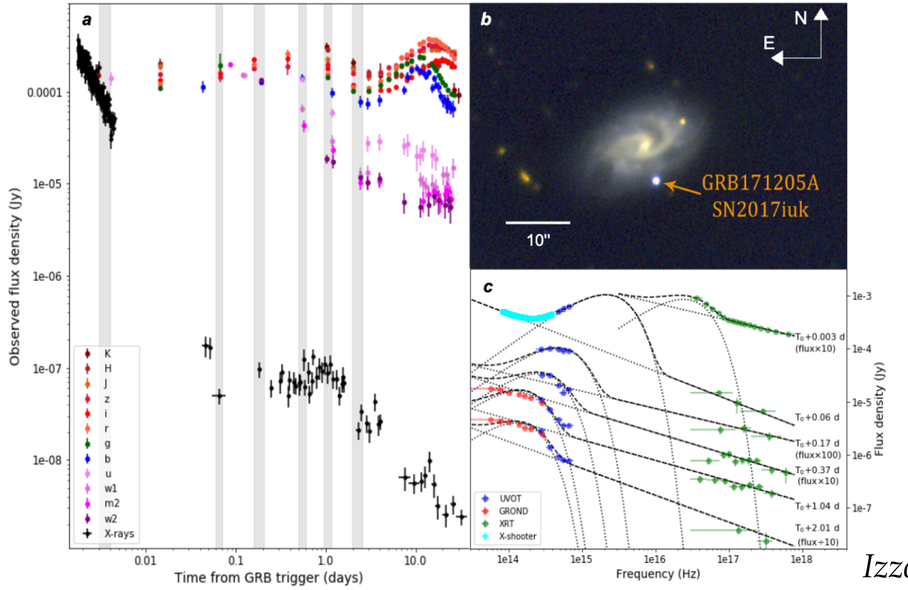
Extended author information available on the last page of the article

GRBs

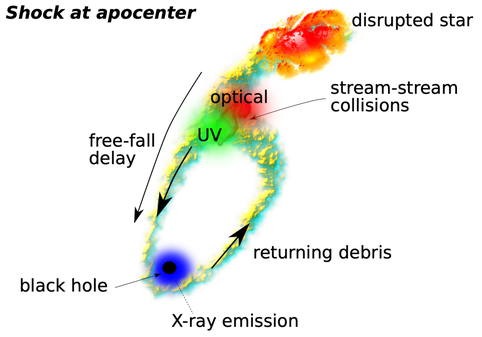


Roaming et al. 2017



Izzo et al. 2017

QUVIK: science objectives



Space Science Reviews (2024) 220:29
https://doi.org/10.1007/s11214-024-01062-5

Science with a Small Two-Band UV-Photometry Mission III: Active Galactic Nuclei and Nuclear Transients

M. Zajaček[1] · B. Czerny[2] · V.K. Jaiswal[2] · M. Štolc[3,4] · V. Karas[3] · A. Pandey[2] · D.R. Pasham[5] · M. Śniegowska[6] · V. Witzany[7] · P. Suková[3] · F. Münz[1] · N. Werner[1] · J. Řípa[1] · J. Merc[4] · M. Labaj[1] · P. Kurfürst[1] · J. Krtička[1]

Received: 27 June 2023 / Accepted: 12 March 2024

Abstract
In this review, the third one in the series focused on a small two-band UV-photometry mission, we assess possibilities for a small UV two-band photometry mission in studying accreting supermassive black holes (SMBHs; mass range $\sim 10^6$–$10^{10}\,M_\odot$). We focus on the following observational concepts: (i) dedicated monitoring of selected type-I Active Galactic Nuclei (AGN) in order to measure the time delay between the far-UV, the near-UV, and other wavebands (X-ray and optical), (ii) nuclear transients including (partial) tidal disruption events and repetitive nuclear transients, and (iii) the study of peculiar sources, such as changing-look AGN, hollows and gaps in accretion disks, low-luminosity AGN, and candidates for Intermediate-Mass Black Holes (IMBHs; mass range $\sim 10^2$–$10^5\,M_\odot$) in galactic nuclei. The importance of a small UV mission for the observing program (i) is to provide intense, high-cadence monitoring of selected sources, which will be beneficial for, e.g. reverberation-mapping of accretion disks and subsequently confronting accretion-disk models with observations. For program (ii), a relatively small UV space telescope is versatile enough to start monitoring a transient event within $\lesssim 20$ minutes after receiving the trigger; such a moderately fast repointing capability will be highly beneficial. Peculiar sources within the program (iii) will be of interest to a wider community and will create an environment for competitive observing proposals. For tidal disruption events (TDEs), high-cadence UV monitoring is crucial for distinguishing among different scenarios for the origin of the UV emission. The small two-band UV space telescope will also provide information about the near- and far-UV continuum variability for rare transients, such as repetitive partial TDEs and jetted TDEs. We also discuss the possibilities to study and analyze sources with non-standard accretion flows, such as AGN with gappy disks, low-luminosity active galactic nuclei with intermittent accretion, and SMBH binaries potentially involving intermediate-mass black holes.

Keywords Galactic nuclei · Accretion flows · Tidal disruption events · Transients · Photometry · Time series

1 Introduction

The growth of supermassive black holes (hereafter SMBHs) residing in the centres of galaxies is a crucial topic in modern astrophysics (Di Matteo 2019). SMBHs can grow by accre-

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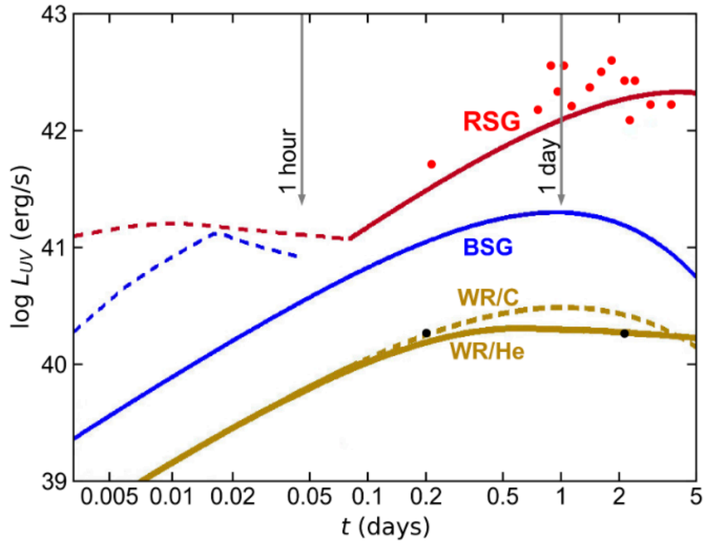
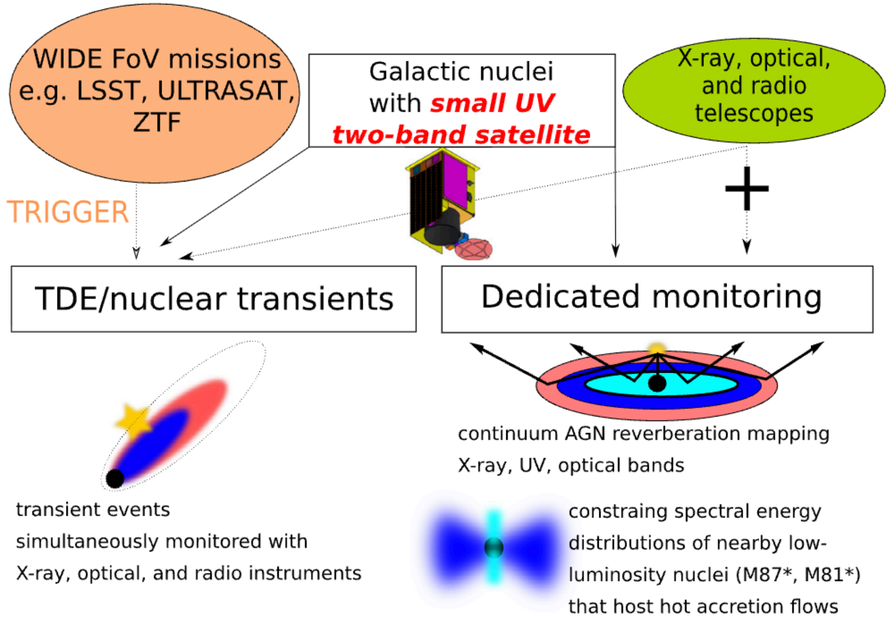
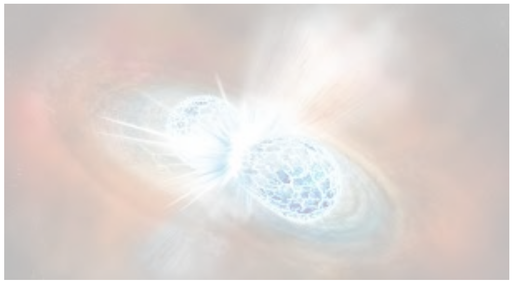
Published online: 29 March 2024

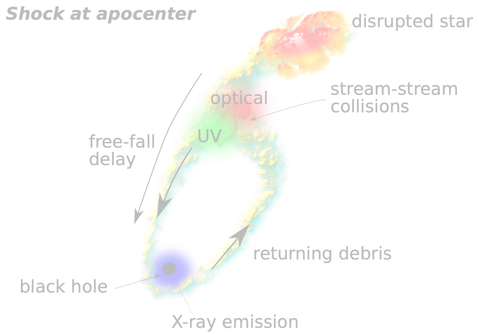
Any transient (e.g. SN, TDE, …)

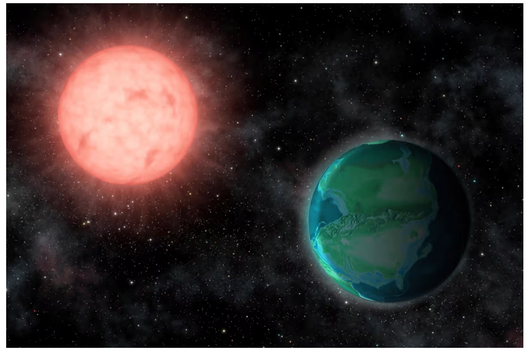




QUVIK: science objectives







Space Science Reviews (2024) 220:24
https://doi.org/10.1007/s11214-024-01058-1

Science with a Small Two-Band UV-Photometry Mission II: Observations of Stars and Stellar Systems

Jiří Krtička[1] · Jan Benáček[2,3] · Jan Budaj[4] · Daniela Korčáková[5] · András Pál[6] · Martin Piecka[7] · Miloslav Zejda[1] · Volkan Bakış[8] · Miroslav Brož[5] · Hsiang-Kuang Chang[9] · Nikola Faltová[1] · Rudolf Gális[10] · Daniel Jadlovský[1] · Jan Janík[1] · Jan Kára[5] · Jakub Kolář[1] · Iva Krtičková[1] · Jiří Kubát[11] · Brankica Kubátová[11] · Petr Kurfürst[1] · Matúš Labaj[1] · Jaroslav Merc[5] · Zdeněk Mikulášek[1] · Filip Münz[1] · Ernst Paunzen[1] · Michal Prišegen[12,1] · Tahereh Ramezani[1] · Tatiana Rievajová[1] · Jakub Řípa[1] · Linda Schmidtobreick[13] · Marek Skarka[1,11] · Gabriel Szász[1] · Werner Weiss[7] · Michal Zajaček[1] · Norbert Werner[1]

Received: 26 June 2023 / Accepted: 23 February 2024 / Published online: 13 March 2024

Abstract
We outline the impact of a small two-band UV-photometry satellite mission on the field of stellar physics, magnetospheres of stars, binaries, stellar clusters, interstellar matter, and exoplanets. On specific examples of different types of stars and stellar systems, we discuss particular requirements for such a satellite mission in terms of specific mission parameters such as bandpass, precision, cadence, and mission duration. We show that such a mission may provide crucial data not only for hot stars that emit most of their light in UV, but also for cool stars, where UV traces their activity. This is important, for instance, for exoplanetary studies, because the level of stellar activity influences habitability. While the main asset of the two-band UV mission rests in time-domain astronomy, an example of open clusters proves that such a mission would be important also for the study of stellar populations. Properties of the interstellar dust are best explored when combining optical and IR information with observations in UV.

It is well known that dust absorbs UV radiation efficiently. Consequently, we outline how such a UV mission can be used to detect eclipses of sufficiently hot stars by various dusty objects and study disks, rings, clouds, disintegrating exoplanets or exoasteroids. Furthermore, UV radiation can be used to study the cooling of neutron stars providing information about the extreme states of matter in the interiors of neutron stars and used for mapping heated spots on their surfaces.

Keywords Techniques: photometric · Ultraviolet: stars · Stars: variables: general · Binaries: general · Open clusters and associations: general · Planetary systems

1 Introduction

The new discoveries in astrophysics during the last few decades were frequently connected with the opening of new observational windows into invisible parts of the spectrum. Recently, the advent of observatories working outside the electromagnetic domain founded a

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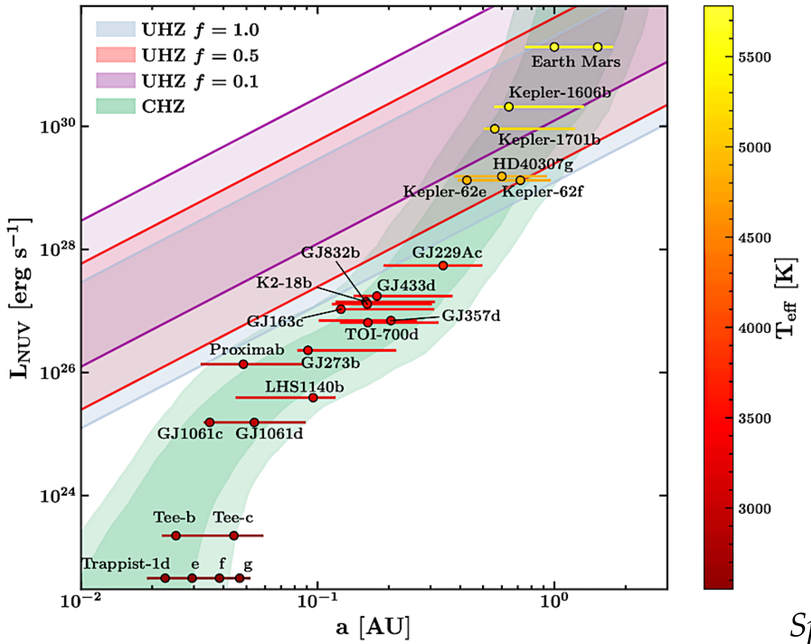
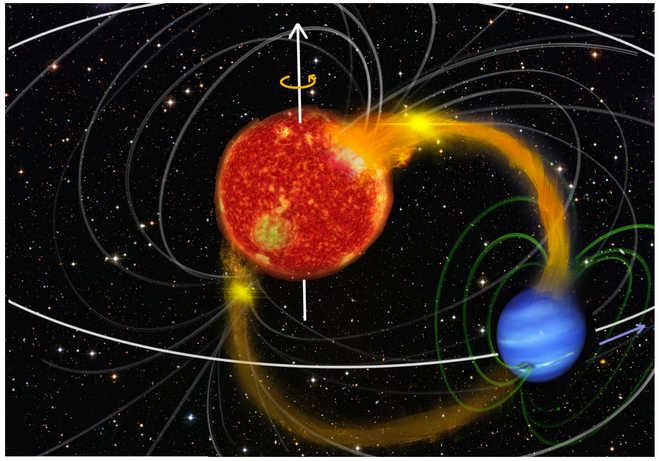


Spinelli et al. 2023



QUVIK: synergies

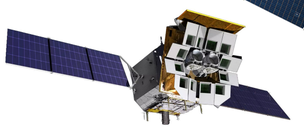
LVK

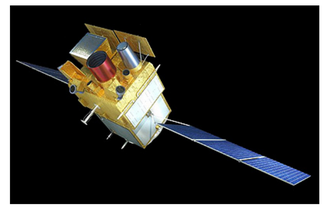
40 BNS /yr
< 200 Mpc

KNae ~15/yr

KNae ~10/yr

Ultrasat





QUVIK

80 GRBs /yr

\+ **Internal GALI**

QUVIK: the Italian contribution —> Far Ultraviolet Telescope

- **April 2025**: the ASI board of directors formally approved the support to QUVIK: industrial contract of an expected duration of **30 months** and a maximum amount of **3.5 M€**
- **June 2025**: public call asking the Italian industries their availability to execute the activities
- **January 2026**: request for quotation to Optec company

- **Nov. 2024**: INAF (OAB) preliminary contacts for mirror contribution
- **June 2025** INAF Invited by Prime
- **Dec 2025** INAF decision to join

Expect spring 2026 FUV KO

R&D on filter and optical design