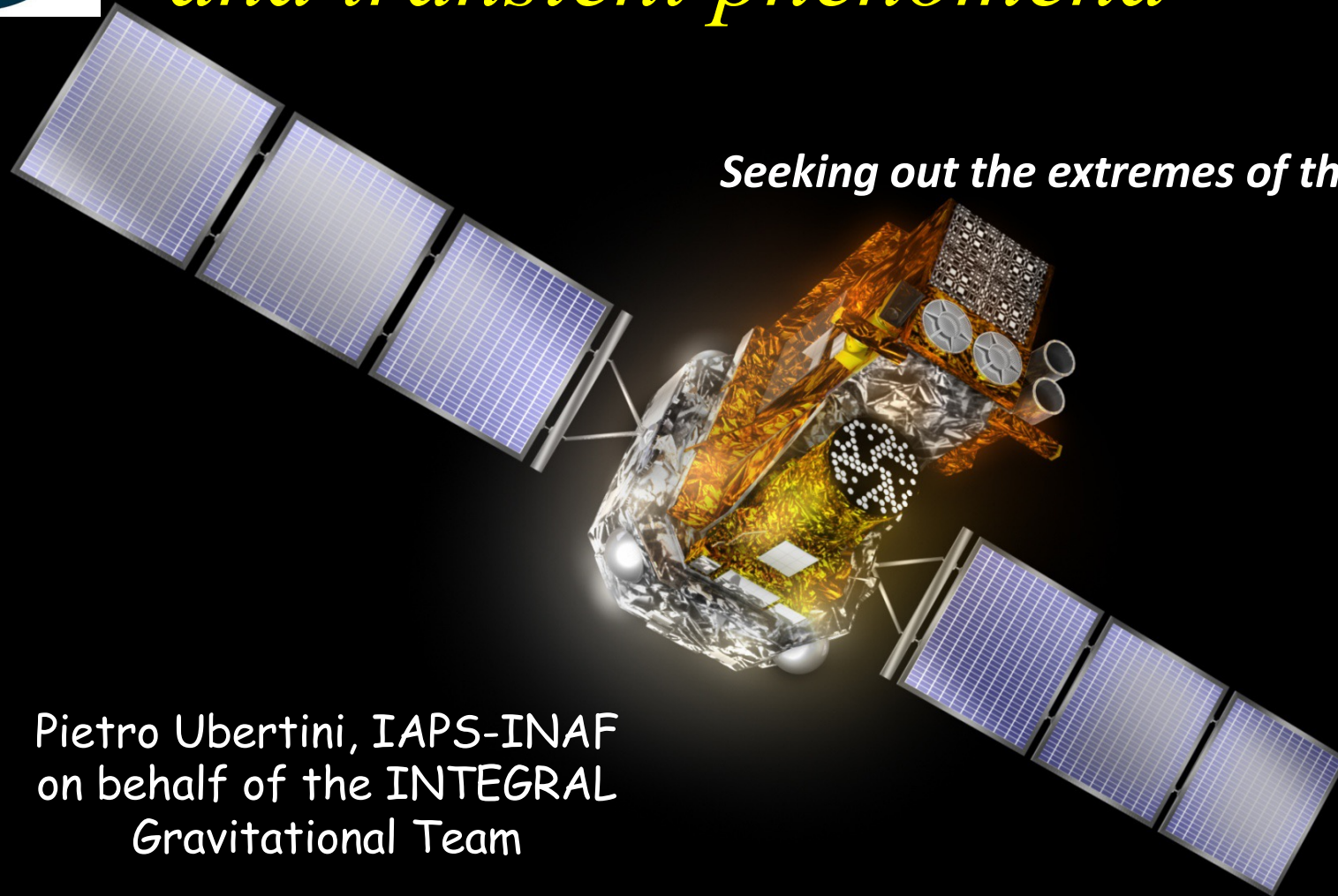




# *Integral observations of GW and transient phenomena*



*Seeking out the extremes of the Universe*

Pietro Ubertini, IAPS-INAF  
on behalf of the INTEGRAL  
Gravitational Team

**XVIII Vulcano Workshop on Frontier Objects in Astrophysics and Particle Physics  
26-September-2022, Elba Island (Tuscany, Italy)**

A grateful memory of **Stavros Katsanevas** for his energetic and effective action to ensure INTEGRAL Observatory in operation during the LVK O4 run.

The INTEGRAL talk was presented at the: XVIII Vulcano Workshop on Frontier Objects in Astrophysics and Particle Physics, 26-September-2022, held at Elba Island (Italy).

Stavros, Chairman of the session and director of the EGO consortium, was struggled by the idea that INTEGRAL could have been terminated the same day of the start of LVK run O4. In spite of the fact he was very weak for the severe condition affecting him, he started immediately an energetic activity to collect an incredible number of supporting letters, worldwide, from different communities, and to our feeling, was key for the final ESA decision to extend the mission till end of 2024.

He suddenly passed away on November 27, 2022



# Stavros Katsanevas, a world-class physicist, is gone

Home / Steering Committee / EGO / Stavros Katsanevas, a world-class physicist,...



## A world-class physicist and multifaceted intellectual figure, Stavros Katsanevas, who led the European Gravitational Observatory, EGO, from 2018 till this moment, is dead.

EGO Director, Stavros Katsanevas, is dead. He passed away on November 27, 2022. Our thoughts are with his wife and family, to whom we express our deepest condolences.

A world-class physicist and multifaceted intellectual figure, Stavros Katsanevas led the European Gravitational Observatory, EGO from 2018 to the present, making a fundamental contribution to these years of extraordinary scientific developments in Gravitational and Multimessenger Astronomy.

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The Fermi Gamma-ray Telescope Mission



Oct 2, 2022  
Subject: INTEGRAL Mission Extension request to ESA

Dear Colleagues,

This letter is written on behalf of the FermiAT and GEM Collaborations, in support of the INTEGRAL Mission extension to be decided soon by the ESA Science Programme Committee. We understand that INTEGRAL is currently scheduled until March 2023 with a final decision on further extension expected after November 2022, possibly in March 2023.

The initial discoveries achieved by the synergy between Gravitational Wave and Electromagnetic observations have dramatically altered how we work cooperatively to find and study astrophysical transients. These observations have launched a new era of multi-messenger astronomy. Fermi and INTEGRAL played a central role in gamma-ray transient detection following their joint discovery of gamma-ray burst GRB 170817A and its connection to gravitational wave event GW 170817. These missions continue to serve as key facilities for providing high-energy observations in time domains and multimessenger astrophysics.

Preparations are underway for the next observational run by the gravitational wave interferometers, O4, which is projected to begin in March 2023. This will be a critical time to have all possible eyes on the sky looking for the emergence of electromagnetic emission from binary neutron star mergers. Additionally, these facilities will continue to probe for possible emissions from neutron star black hole binary mergers. Fermi and INTEGRAL's transient capabilities make it a valuable partner to Fermi's gravitational wave counterpart observations in addition to other gamma-ray transient studies.

Moreover, having both INTEGRAL and Fermi in orbit is crucial to improve gamma-ray burst localization using the Interferometry Network (IN) technique. The combination of INTEGRAL's highly elliptical orbit with GEM or other gamma-ray detectors in low earth orbit especially important if a gravitational wave event is detected with two or fewer interferometers.

We wish to share our strong support for the continued operation of INTEGRAL during the full duration of the next O4 scientific run of the gravitational wave observatories. If INTEGRAL is not extended, it will leave a hole in all-sky capabilities supporting the detection and localization of a gamma-ray burst counterpart to the next binary neutron star merger. We consider INTEGRAL a critical part of the network of facilities preparing for the detection of new gravitational signals from binary neutron stars and neutron star black hole, and in general from transient astrophysical events.

Best regards,

*Prof. Peter F. Michelson*  
FermiAT Principal Investigator  
*Dr. Melissa Pecko-Hullman*  
FermiAT Science Coordinator  
*Stephanie King*  
FermiProject Scientist

*Dr. Calvera Wilson-Hodge*  
FermiAT Principal Investigator  
*Deirdre Nevo*  
FermiAT Deputy Scientist  
*Dr. David Hagan*  
FermiAT Deputy Scientist  
*Dr. J. Keith Rany*  
Fermi Deputy

Dr. A. Haungs, Karlsruhe Institute of Technology (KIT), chair of APPEC General Assembly [www.kit.edu](http://www.kit.edu)



Subject: INTEGRAL mission extension request at ESA  
To whom it may concern  
Dear Colleagues,  
I write this letter, on behalf of the Virgo Collaboration, in support of a mission extension of INTEGRAL.

Pisa, September 30<sup>th</sup>, 2022

The Virgo and LIGO detectors have become observatories able to detect gravitational-wave signal since 2015, from the first detection of a signal from a binary black-hole merger in 2015 to the recent detection of a binary black-hole merger forming an intermediate mass black-hole. Interferometric gravitational-wave observations were made in many fields of fundamental physics and astrophysics, from relativistic binary systems of neutron stars which marked the birth of multi-messenger astronomy including gravitational-wave astronomy, nuclear physics, and cosmology. GW170817 is the signal from the merger of two neutron stars which revealed information about the association of binary systems of neutron stars with the role of binary neutron star mergers for the formation of heavy elements in the Universe, to constrain equation of state of neutron star, and to evaluate the expansion rate of the Universe.

The Virgo Collaboration recognizes that to maintain the science return of each gravitational-wave detector an enormous importance, the electromagnetic counterpart for a counterpart. For this reason the LIGO-Virgo collaborations send public alerts in low latency to enable the electromagnetic follow-up. Since 2015, the short gamma-ray burst associated with GW170817, for almost all the candidate events sent in three lines of instrument sensitivity, and multiple observations, a powerful mean to study weak signals from background functions. These discoveries heralded the field of multimessenger astronomy and INTEGRAL has proved to be a key facility in the high-energy domain.

We therefore recommend the continuation of the INTEGRAL operation during the full duration of the scientific runs of gravitational wave observatories, when hundreds of gravitational signals are expected each year from binary neutron stars or black holes.

Best regards,  
Giovanni Loeb, Spokesperson  
On behalf of the Virgo Collaboration



To whom it may concern  
Dear Colleagues,  
This letter is written on behalf of the LIGO, Virgo, KAGRA collaborations and corresponding laboratories, in support of the INTEGRAL Mission extension to be decided soon by the ESA Science Programme Committee.

To our knowledge, INTEGRAL is extended, at the moment, until March 2023 while a final decision on further extension is expected after November 2022, possibly in March 2023. As you may know the forthcoming GW interferometers O4 runs with LIGO, Virgo and KAGRA are now planned to start on March 2023. In this framework, the joint detection of gravitational-wave and a short gamma-ray burst from GW170817 enabled breakthrough achievements which were made possible through an international space-based and ground-based physics and astrophysics, relativistic astrophysics, nuclear physics, and cosmology. Starting the new field of multi-messenger astronomy, INTEGRAL has proved to be a key facility in the high-energy domain. INTEGRAL is part of the mentioned network and, if not extended, will not provide the gamma-ray fundamental all-sky detection capability that made the discovery of GW170817/GRB170817A.

We are aware INTEGRAL is the only European Space Observatory covering the high energy domain with a suite of detectors providing, 20 years after its launch, sky coverage of 85% full duration of the next O4 scientific runs of gravitational wave observatories, when new gravitational signals are expected from binary neutron stars and neutron star-black hole, with unique polarimetric capability for transient events investigation.

Best Regards  
LIGO Laboratory Director  
Patrick Brady  
David Reitze  
LIGO Scientific Collaboration Spokesperson

Subject: Request to ESA for the INTEGRAL mission extension  
Dear Colleagues,  
This letter is written on behalf of the AMEAD2020 Collaborations in support of the INTEGRAL Mission extension to be decided soon by the ESA Science Programme Committee. We understand that INTEGRAL is currently scheduled until March 2023 with a final decision on further extension expected after November 2022, possibly in March 2023.

The AMEAD2020 Collaborations in support of the INTEGRAL Mission extension to be decided soon by the ESA Science Programme Committee. We understand that INTEGRAL is currently scheduled until March 2023 with a final decision on further extension expected after November 2022, possibly in March 2023. As you may know the forthcoming GW interferometers O4 runs with LIGO, Virgo and KAGRA are now planned to start on March 2023. In this framework, the joint detection of gravitational-wave and a short gamma-ray burst from GW170817 enabled breakthrough achievements which were made possible through an international space-based and ground-based physics and astrophysics, relativistic astrophysics, nuclear physics, and cosmology. Starting the new field of multi-messenger astronomy, INTEGRAL has proved to be a key facility in the high-energy domain. INTEGRAL is part of the mentioned network and, if not extended, will not provide the gamma-ray fundamental all-sky detection capability that made the discovery of GW170817/GRB170817A.

Subject: INTEGRAL Mission Extension request to ESA

To whom it may concern

Dear Colleagues,

This letter is written on behalf of the EGO Collaboration, in support of the Integral Mission extension to be decided soon by the ESA Science Programme Committee. In fact, we understand that INTEGRAL is extended, at the moment, until March 2023 while a final decision on further extension is expected after November 2022, possibly in March 2023.

As you may know the forthcoming GW interferometers O4 runs with Ligo, Virgo and Kagra, are now planned to start on March 2023. In this framework, following the breakthrough achieved with the contemporary detection of gravitational wave and a short gamma-ray burst from GW170817, it was established an international observatories network to achieve a forward step in many fields: fundamental physics and astrophysics, relativistic astrophysics, astroparticles physics, nucleosynthesis, nuclear physics and cosmology. The initial discoveries achieved by the synergy between GW and Electromagnetic Astrophysics have started the new field of multi-messenger astronomy, and INTEGRAL has proved to be a key facility in the high-energy domain. INTEGRAL is part of the mentioned network and, if not extended, will not provide the gamma-ray fundamental all-sky detection capability that made the discovery of GW170817/GRB170817A a unique event, mainly due to the lack of other facilities; being the ground interferometers undergoing a sensitivity upgrade phase.

We are aware INTEGRAL is the only European Space Observatory covering the high energy domain with a suite of detectors providing, 20 years after its launch, sky coverage of 85% live time all sky field of view, unprecedented sensitivity, extreme time and spectral resolution with unique polarimetric capability for transient events investigation.

Urgency

De: Stavros Katsanevas stavros.katsanevas@ego-gw.it  
Oggetto: Re: INTEGRAL extension support letter?  
Data: 3 ottobre 2022, 10:08 AM  
A: Pietro Ubertini pietro.ubertini@inaf.it  
Cc: Erik Kuulkers Erik.Kuulkers@esa.int, Angela Bazzano angela.bazzano@inaf.it

Dear Pietro,

Out, finally, we have made it. last signature 30 minutes ago.

See my next mail

Stavros

Prof. Stavros Katsanevas,  
Director  
European Gravitational Observatory, EGO, <http://www.ego-gw.it>  
Via Edoardo Amaldi  
56021 S. Stefano a Macerata (Pisa), Italy  
Tel: +39 058 752 300  
Mob: +39 395 7321 385  
Zoom link: <https://us02web.zoom.us/j/8948962430?pwd=SjZvZDZpYjRlRjY2aXk3c0Y1Wk4lODZlQ0Q09>  
ID: 894 896 2430, password:stavros



To  
ESA  
whom it may concern

Support for INTEGRAL Mission Extension  
The Astroparticle Physics European Consortium (APPEC) is a consortium of funding national government institutions and institutes from different countries that bring representatives of European astroparticle science communities. APPEC has recently agreed to be in operation until March 2023 and a decision on further extension is expected after November 2022.

APPEC is currently working on a midterm update of its "European Astroparticle Physics 2017-2025", also considering developments and experiments from neighboring physics. APPEC, the European astroparticle community and in particular the gamma-ray and multi-messenger communities strongly support a variety of significant interests that will complement current and future ground-based observations.

We are aware that INTEGRAL is the only European space observatory covering a range with a suite of detectors that provide excellent sky coverage sensitivity and high resolution, even 20 years after launch. For multi-messenger observations of high-energy processes in our Universe.

Sincerely yours,  
Andreas Haungs

04/10/2022



Subject: INTEGRAL Mission Extension request to ESA  
Dear colleagues,  
This letter is written on behalf of the EGO Collaboration, in support of the INTEGRAL Mission extension to be decided soon by the ESA Science Programme Committee. We understand that INTEGRAL is currently scheduled until March 2023 with a final decision on further extension expected after November 2022, possibly in March 2023.

The EGO Collaboration in support of the INTEGRAL Mission extension to be decided soon by the ESA Science Programme Committee. We understand that INTEGRAL is currently scheduled until March 2023 with a final decision on further extension expected after November 2022, possibly in March 2023. As you may know the forthcoming GW interferometers O4 runs with Ligo, Virgo and Kagra, are now planned to start on March 2023. In this framework, following the breakthrough achieved with the contemporary detection of gravitational wave and a short gamma-ray burst from GW170817, it was established an international observatories network to achieve a forward step in many fields: fundamental physics and astrophysics, relativistic astrophysics, astroparticles physics, nucleosynthesis, nuclear physics and cosmology. The initial discoveries achieved by the synergy between GW and Electromagnetic Astrophysics have started the new field of multi-messenger astronomy, and INTEGRAL has proved to be a key facility in the high-energy domain. INTEGRAL is part of the mentioned network and, if not extended, will not provide the gamma-ray fundamental all-sky detection capability that made the discovery of GW170817/GRB170817A a unique event, mainly due to the lack of other facilities; being the ground interferometers undergoing a sensitivity upgrade phase.

Best regards,  
Stavros Katsanevas



De: Stavros Katsanevas stavros.katsanevas@ego-gw.it  
Oggetto: Re: INTEGRAL extension support letter?  
Data: 3 ottobre 2022, 10:08 AM  
A: Pietro Ubertini pietro.ubertini@inaf.it  
Cc: Erik Kuulkers Erik.Kuulkers@esa.int, Angela Bazzano angela.bazzano@inaf.it

Dear Pietro,

Out, finally, we have made it. last signature 30 minutes ago.

See my next mail

Stavros

Prof. Stavros Katsanevas,  
Director  
European Gravitational Observatory, EGO, <http://www.ego-gw.it>  
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56021 S. Stefano a Macerata (Pisa), Italy  
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ID: 894 896 2430, password:stavros