

# Job Title: Internal Research Fellow (PostDoc) in Modelling of Autonomous Target of Opportunity Operations

Req ID 2402 - Posted 27/09/2017



## EUROPEAN SPACE AGENCY

Research Fellowship Opportunity in the Directorate of Operations.

ESA is an equal opportunity employer, committed to achieving diversity within the workforce and creating an inclusive working environment. Applications from women are encouraged.

### Post

#### Internal Research Fellow (PostDoc) in Modelling of Autonomous Target of Opportunity Operations

This post is classified F2.

### Location

ESOC, Darmstadt, Germany

### Our Division and Mission

The postholder will be based at the Operations Department at ESOC and will work for two Divisions in particular:

The Astronomy and Fundamental Physics Mission Division (OPS-OA), responsible for the definition and preparation of operational ground segment and the execution of astrophysics and fundamental physics missions. This includes, on the one hand, defining requirements for the ground segment needed for individual missions and verifying correct implementation; on the other hand, planning and executing all mission operations from launch to end-of-mission. The Division covers a variety of missions which are either in preparation, like Euclid, or in operations phase, like XMM-Newton, INTEGRAL and Gaia. XMM-Newton, for example, is an X-ray observatory that combines the largest mirror assembly ever flown with advanced detector technology such as CCD cameras and high-resolution grating spectrometers together with an optical monitor. It observes cosmic objects like black holes, active galaxies and supernova remnants.

The Studies and Special Projects Division (OPS-OS), responsible for Definition Phase studies for ESA missions and managing services provided to external customers. It also prepares and executes specific special projects, developing innovative operation concepts and technologies for future missions and coordinating cooperative activities with Member States in the flight operations field.

The research topic of this vacancy falls under the joint responsibility of OPS-OA and OPS-OS, since the topic benefits from input from future missions and long-term experience from current ESOC-operated missions. As such, it will be supervised jointly by both Divisions. It is also expected that interaction with ESTEC projects, Science Operations and industry may be required.

Candidates interested are encouraged to visit the ESA website: [www.esa.int](http://www.esa.int)

### Field(s) of activities/research

**Modelling of incremental increase of autonomous Target of Opportunity operations (ToO) for astrophysical missions and its implications for exploration mission operations.**

Target of Opportunity (ToO) operations are a classic mission operations topic applicable to different types of astronomy mission. Execution of ToOs currently involves various operational software systems that need to be used to evaluate, replan, reorganise and execute unplanned operations requests at short notice. Similar issues also exist for other mission families. This study aims to evaluate different options for an incremental increase of autonomy in the full end-to-end process, eventually including all mission data system components (i.e. SOC, MOC FCT, MPS, FDS) as well as ground stations and satellite systems. A concept and suitable mathematical computer models will be developed for

this purpose. As a first test case, the model could then be applied to an Athena/XIPE ToO study (or other suitable missions). Experience from other missions like Swift and INTEGRAL, which have implemented partially automated ToO operations, might also be used as a baseline for further gradual automation of spacecraft and/or ground processes. This could ultimately lead to a fully autonomous decision-making process triggered by an external ToO and/or, potentially, an onboard all-sky monitor.

The models developed could be initially tested on existing operational S/C and subsystem hardware simulators, which currently do not include ToO functionality, with the aim of acting as a development environment for future simulators.

The research should also take into consideration integrating a 'crowd' consortium ground-satellite network, analysing its feasibility and the potential reduction in reaction time for the ToO.

Continuous interfacing between currently operated missions, future mission preparation and mission development down to spacecraft and ground subsystem level should support the growth of this study. Various iterations are intended to actively increase the flexibility and reliability of the models.

The model finally developed should also attempt to address the fundamental practical limit to which the autonomous ToO can be reasonably implemented, based on resources and technical constraints, and trade off the various levels of autonomy achieved by each iteration. This could then, selectively, be followed up and more rigorously detailed by individual projects and Divisions.

## Technical competencies

Knowledge relevant to the field of research

Research/publication record

Ability to conduct research autonomously

Breadth of exposure coming from past and/or current research/activities

Interest in space and space research

Ability to gather and share relevant information

Background in one or more of the following domains: solar systems science, astrophysics, space science

Experience in mission, spacecraft and/or payload operations

Knowledge and experience of ground segment, simulators and early operations

Mathematical software development

Understanding of space system architectures

## Behavioural competencies

Innovation & Creativity

Continuous Learning

Communication

Relationship Management

Self Motivation

Problem Solving

Cross-Cultural Sensitivity

## Education

Applicants should have recently completed, or be close to completion of a PhD (or equivalent qualification) in a related technical or scientific discipline, in particular Physics, Mathematics, Aerospace Engineering. Preference will be given to applications submitted by candidates within five years of receiving their PhD.

## Additional requirements

Applicants should have strong mathematical and programming skills as well as some background in spacecraft operations and ground segment architecture. They should be system minded and preferably have experience in mission control systems, spacecraft simulators, mission planning systems and automation systems for mission operations.

The working languages of the Agency are English and French. A good knowledge of one of these is required. Knowledge of another Member State language would be an asset.

## Other information

For behavioural competencies expected from ESA staff in general, please refer to the [ESA Competency Framework](#).

The Agency may require applicants to undergo selection tests.

**The closing date for applications is 25 October 2017.**

In addition to your CV and your motivation letter, please add your proposal of no more than 5 pages outlining your proposed research in the "additional documents" field of the "application information" section. Candidates are asked to arrange for 3 reference letters, to be sent by the referees themselves, before the closing date to [temp.htr@esa.int](mailto:temp.htr@esa.int). Please ensure your name is mentioned in the subject of the e-mail.

If you require support with your application due to a disability, please email [contact.human.resources@esa.int](mailto:contact.human.resources@esa.int).

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Please note that applications are only considered from nationals of one of the following States: Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, Switzerland, the United Kingdom and Canada and Slovenia as well as Bulgaria, Cyprus, Latvia, Lithuania, Slovakia as European Cooperating States (ECS).

Priority will first be given to candidates from under-represented Member States.

In accordance with the European Space Agency's security procedures and as part of the selection process, successful candidates will be required to undergo basic screening before appointment