Open letter to Prof. Günther Hasinger director of science at ESA, from the fundamental physics in space community.

Dear Prof. Hasinger, 29.11.2022

ESA announced on Nov. 8th 2022 the decisions by its Science Programme Committee for the F- and M-class mission opportunities opened in 2021, and the only candidate from the field of fundamental physics, STE-QUEST[1], was not chosen for further study[2]. It is therefore unlikely that it will be considered for selection as a possible M7 candidate in late 2023.

None of the chosen missions has a connection with fundamental physics, cold atoms or quantum technology, they are all in the fields of astronomy or solar system exploration.

The assessment of STE-QUEST by the Senior Science Committee (SSC) concludes with the following paragraph:

"The mission proposes a factor of 100 improvement over the recent MICROSCOPE results in assessing the validity of the Universality of Free Fall, and offers the opportunity to test Local Lorentz Invariance and the superposition of quantum states, which are founding principles of the Standard Model of Particle Physics and of Quantum Mechanics, respectively. As such, it would provide ground-breaking results in case of a positive detection. However, the scientific return of a, more likely, negative outcome is less convincing, as it will mainly constrain ad-hoc phenomenological theories parameterising possible deviations from the fundamental principles. In conclusion, the mission is considered too limited in its probable scientific return to be justified within the M-class budget, given the present scientific landscape."

The logic of this assessment is deeply worrying for our community. It seems to exclude ESA support for any fundamental physics experiment in space for the foreseeable future, despite the recommendations of the science case by previous assessments such as the ESA-fundamental physics roadmap[3] or the more recent report of the Voyage-2050 senior committee[4] (see sect. 2.5 of the STE-QUEST proposal for a detailed discussion). Whilst previous fundamental physics proposals were not selected on the grounds of a lack of technology readiness and/or because of costs in excess of the ESA envelope, in this case, and contrary to previous assessments, it is the science itself that is deemed unworthy of selection.

Two panels of independent scientists convened by ESA for the F2/M7 call, the SARP and SSC, came to this conclusion. The SARP is composed of members of the AWG (Astronomy Working Group) and SSEWG (Solar System and Exploration Working Group). The SSC is composed of members of the Space Science Advisory Committee (SSAC). None of these ESA advisory structures (AWG, SSEWG, SSAC) include members of the fundamental physics community. In 1994 ESA created the FPAG (Fundamental Physics Advisory Group) to complement AWG and SSWG with expertise

[1] The full STE-QUEST proposal can be found on https://arxiv.org/abs/2211.15412 . It includes a new section (2.5) addressing the significance of the STE-QUEST science, as communicated to the SARP in September 2022.
[2] https://www.cosmos.esa.int/web/call-for-missions-2021/update-on-the-f2-and-m7-mission-opportunity
[3] https://sci.esa.int/web/director-desk/-/47598-fundamental-physics-roadmap
[4] https://www.cosmos.esa.int/documents/1866264/1866292/Voyage2050-Senior-Committee-report-public.pdf

in fundamental physics. However, the FPAG was disbanded by ESA in the 2000s, leaving the science directorate and SSAC without expertise and representation from the fundamental physics community. Limited fundamental physics representation is left in the PSWG (Physical Sciences Working Group), but it is within the PB-HME (Programme Board for Human Spaceflight, Microgravity and Exploration) rather than the science directorate, and none of its members was convened to the SARP or SSC.

We know how difficult it is to select between projects from scientific fields as far apart as testing the equivalence principle, astroseismology, gamma-ray astronomy or the study of Mars. And it is natural to recognise more readily the scientific interest in fields that are closer to one's own activity, so our colleagues who are members of the SARP and SSC, should not be blamed. But the natural conclusion is to realize that no mission in fundamental physics will be selected unless there is representation of the field in the ESA science directorate. We strongly believe that the absence of fundamental physics missions will be highly detrimental to space science, and jeopardize the very real possibility that the next revolution in physics comes from space.

With this open letter we would like to strongly encourage ESA to ensure adequate representation of fundamental physics in the science directorate, e.g., by (re)creating FPAG to complement the two existing advisory bodies (AWG and SSWG), and to ensure a balanced distribution of scientists and expertise on its selection panels.

Signatures:

[will be added after signature registration is closed]