

DATE: 26/07/2021

**To:**  
**Günther Hasinger,**  
**ESA Director of Science**

***Preface concerning the signatories of this letter:***

This letter is signed by 47 representatives of Voyage 2050 White Papers proposing the use of cold atom-based quantum technology in space (see below). In addition to these signatories, 174 members of the cold atom, astrophysics, cosmology, fundamental physics and earth observation communities have co-signed this letter electronically [0].

***Reference: cold atom experiments in space community response to the final recommendations of the Voyage 2050 Senior Science Committee***

Dear Prof. Günther Hasinger,

As members of the communities interested in cold atom (CA) experiments in space, we welcome the final recommendations of the Voyage 2050 Senior Science Committee and stand ready to work with the ESA Executive to implement them. We understand that now is the right time to develop a pathway to raise the TRLs of CA technologies for space as well as the astrophysics, cosmology, fundamental physics, and earth observation cases for their deployment.

A quantum technology development programme coordinated at the Europe-wide level should build upon initial experiments and expertise in Europe and elsewhere to define, together with the interested technology and science communities, a roadmap and milestones to demonstrate the readiness of CA technologies in space, as emphasised in the Voyage 2050 recommendations, and in synergy with EU programmes.

The combined CA, astrophysics, cosmology and fundamental physics, and earth observation communities would like to contribute actively to shaping this development programme, by proposing a joint community roadmap as input to it. With this end in view, we are planning to hold a workshop in September to discuss elements of the roadmap and to write a draft proposal as input for ESA.

This community workshop will build upon one organised two years ago [1], which also reviewed the CA landscape for space. Subsequently, several White Papers were submitted [2-8] in response to the Voyage 2050 call, which outlined possible ultimate goals and reviewed experiments and technical developments underway that could help pave a way towards these goals. Like the previous workshop, this second one would bring

together not only the CA community but also the potential user communities interested in its science goals and lead to a follow-up community White Paper. This would outline technological milestones as well as refine interim and long-term scientific goals.

We would like to invite you and any other ESA representative relevant in this process to participate in the event and give input and advice on how to make this community roadmap most useful.

## References

[0]<https://indico.cern.ch/event/830432/attachments/1867792/3889249/Registered-co-signatories-of-the-community-letter-to-ESAs-Director-of-Science-Guenther-Hasinger-RegistrantsBook-24072021.pdf>

[1]<https://indico.cern.ch/event/830432/>

[2][https://www.cosmos.esa.int/documents/1866264/3219248/BuchmuellerO\\_White-Paper-AEDGE-submitted-02082019.pdf/678dff63-4773-3590-65a8-0494f5b09f8a?t=1565184625388](https://www.cosmos.esa.int/documents/1866264/3219248/BuchmuellerO_White-Paper-AEDGE-submitted-02082019.pdf/678dff63-4773-3590-65a8-0494f5b09f8a?t=1565184625388)  
<https://epjquantumtechnology.springeropen.com/articles/10.1140/epjqt/s40507-020-0080-0>

[3][https://www.cosmos.esa.int/documents/1866264/3219248/WolfP\\_EP\\_Voyage2050\\_V5.pdf/24127ca3-ef2c-3f92-f118-a3a83da19d92?t=1565184757173](https://www.cosmos.esa.int/documents/1866264/3219248/WolfP_EP_Voyage2050_V5.pdf/24127ca3-ef2c-3f92-f118-a3a83da19d92?t=1565184757173)  
<https://arxiv.org/abs/1908.11785>

[4][https://www.cosmos.esa.int/documents/1866264/3219248/BassiA\\_QT\\_In\\_Space\\_-\\_White\\_Paper.pdf/6f50e4bc-9fac-8f72-0ec0-f8e030adc499?t=1565184619333](https://www.cosmos.esa.int/documents/1866264/3219248/BassiA_QT_In_Space_-_White_Paper.pdf/6f50e4bc-9fac-8f72-0ec0-f8e030adc499?t=1565184619333)


[5][https://www.cosmos.esa.int/documents/1866264/3219248/TartagliaA\\_Voyage2050LaDaHaD.pdf/b8cda725-5ea3-5023-a6da-fd2fd60a2806?t=1565184670696](https://www.cosmos.esa.int/documents/1866264/3219248/TartagliaA_Voyage2050LaDaHaD.pdf/b8cda725-5ea3-5023-a6da-fd2fd60a2806?t=1565184670696)

[6][https://www.cosmos.esa.int/documents/1866264/3219248/SchneiderJ\\_ESA-Voyage2050-QM-JS.pdf/517296a4-9698-e5f0-07d4-9f211a039631?t=1565184662937](https://www.cosmos.esa.int/documents/1866264/3219248/SchneiderJ_ESA-Voyage2050-QM-JS.pdf/517296a4-9698-e5f0-07d4-9f211a039631?t=1565184662937)

[7][https://www.cosmos.esa.int/documents/1866264/3219248/BergeJ\\_WP\\_Dark\\_Sector\\_ONERA.pdf/04d0f4f5-921d-69b4-f0e2-ed5ac4eb0c84?t=1565184621729](https://www.cosmos.esa.int/documents/1866264/3219248/BergeJ_WP_Dark_Sector_ONERA.pdf/04d0f4f5-921d-69b4-f0e2-ed5ac4eb0c84?t=1565184621729)

[8][https://www.cosmos.esa.int/documents/1866264/3219248/BerryC\\_High\\_frequency\\_Voyage\\_2050\\_white\\_paper\\_submit.pdf/d68ddea0-15f4-5fd2-7fb7-9bdeeb28abbf?t=1565184622145](https://www.cosmos.esa.int/documents/1866264/3219248/BerryC_High_frequency_Voyage_2050_white_paper_submit.pdf/d68ddea0-15f4-5fd2-7fb7-9bdeeb28abbf?t=1565184622145)

## Signatures of White Paper authors of the Voyage 2050 call



Prof. Angelo Bassi, Physics Department, University of Trieste, Italy



Dr Baptiste Battelier, CNRS, Institut d'Optique, France



Dr. Andrea Bertoldi, Institut d'Optique, Talence, France



Ing. Paolo Bianco, Airbus Defence and Space Ltd, UK



Prof. Kai Bongs, University of Birmingham, UK



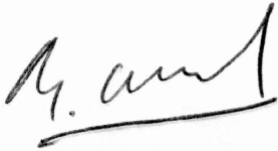
Dr. Philippe Bouyer, CNRS, Institut d'Optique, France

*Claus Braxmaier*

Prof. Dr. Claus Braxmaier, University of Ulm and DLR Institute of Quantum Technologies, Germany



Prof. Oliver Buchmueller, Imperial College London, UK



Dr. Benjamin Canuel, CNRS, Institut d'Optique, France



Dr. Laurentiu-Ioan Caramete, Institute of Space Science, Magurele, Romania

*Maria Luisa Chiofalo*

Prof. Maria Luisa Chiofalo, University of Pisa, IT



Prof. Albert De Roeck, CERN, Geneva, Switzerland, and University of Antwerp, Belgium



Prof. John Ellis, King's College London, UK



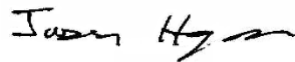
Dr. Naceur Gaaloul, Leibniz Universität Hannover, Germany



Prof. Peter W. Graham, Stanford University, USA



Prof. Martin Haehnelt, University of Cambridge, UK



Prof. Jason M. Hogan, Stanford University, USA



Prof. Philippe Jetzer, Department of Physics, University of Zurich, Switzerland



Assoc. Prof. Rainer Kaltenbaek, University of Ljubljana, Faculty of Mathematics and Physics, Slovenia



Dr Wolf von Klitzing, IESL-FORTH, Greece



Prof. Shimon Kolkowitz, University of Wisconsin - Madison, USA



Dr. Markus Krutzik, Humboldt-Universität zu Berlin & Ferdinand-Braun-Institut gGmbH



Prof. Christophe Le Poncin-Lafitte, Observatoire de Paris-PSL, Paris, France



Dr. Marek Lewicki, University of Warsaw, Poland



Dr. Christopher McCabe, King's College London, UK



Prof. Guido Mueller, University of Florida, USA



Prof. Mauro Paternostro, School of Mathematics and Physics, Queen's University Belfast, UK



Prof. Igor Pikovski, Stockholm University, Sweden



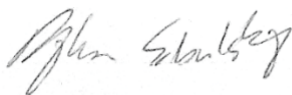
Prof. Dr. Ernst M. Rasel, Leibniz Universität Hannover, Germany



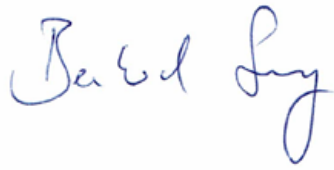
Prof. Markus Rothacher, Institute of Geodesy and Photogrammetry, ETH Zurich, Switzerland



Dr. Albert Roura, German Aerospace Center (DLR), Germany



Dr. Dylan O. Sabulsky, LP2N, France



Bernhard Sang, OHB-System AG, Germany



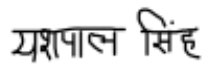
Prof. Stephan Schiller, Heinrich-Heine-Universität Düsseldorf, Germany



Dr. Christian Schubert, German Aerospace Center (DLR), Institute for Satellite Geodesy and Inertial Sensing, Germany



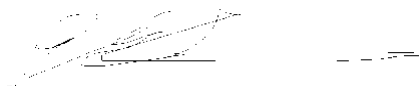
Dr. Carla Signorini, INFN Pisa, Italy



Dr Yeshpal Singh, University of Birmingham, Uk

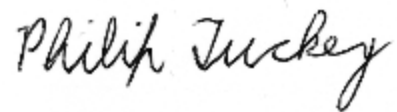


Dr. Carlos F. Sopaerta, Institute of Space Sciences (ICE, CSIC and IEEC), Spain



Prof. Guglielmo M. Tino, Università di Firenze and LENS, Italy





Dr. Philip Tuckey, Observatoire de Paris-PSL, Paris, France



Prof. Hendrik Ulbricht, School of Physics and Astronomy, University of Southampton, UK



Dr. Rupert Ursin, Quantum Technology Laboratories GmbH, Vienna Austria



Dr. Mathias van den Bossche, Thales Alenia Space SAS, France



Dr. Ville Vaskonen, IFAE, Barcelona, Spain



Dr. Peter Wolf, Observatoire de Paris-PSL, Paris, France

Handwritten signature of Lisa Wörner in black ink, featuring a stylized 'L' and 'W'.

Dr. Lisa Wörner, DLR Institute of Quantum Technologies, Germany

Handwritten signature of Martin Zelan in black ink, featuring a stylized 'M' and 'Z'.

Dr. Martin Zelan, RISE Research Institutes of Sweden, Sweden