

## FWO DMP Template - Flemish Standard Data Management Plan

### Version KU Leuven

Project supervisors (from application round 2018 onwards) and fellows (from application round 2020 onwards) will, upon being awarded their project or fellowship, be invited to develop their answers to the data management related questions into a DMP. The FWO expects a **completed DMP no later than 6 months after the official start date** of the project or fellowship. The DMP should not be submitted to FWO but to the research co-ordination office of the host institute; FWO may request the DMP in a random check.

At the end of the project, the **final version of the DMP** has to be added to the final report of the project; this should be submitted to FWO by the supervisor-spokesperson through FWO's e-portal. This DMP may of course have been updated since its first version. The DMP is an element in the final evaluation of the project by the relevant expert panel. Both the DMP submitted within the first 6 months after the start date and the final DMP may use this template.

The DMP template used by the Research Foundation Flanders (FWO) corresponds with the Flemish Standard Data Management Plan. This Flemish Standard DMP was developed by the Flemish Research Data Network (FRDN) Task Force DMP which comprises representatives of all Flemish funders and research institutions. This is a standardized DMP template based on the previous FWO template that contains the core requirements for data management planning. To increase understanding and facilitate completion of the DMP, a standardized **glossary** of definitions and abbreviations is available via the following [link](#).

1. General Project Information	
Name Grant Holder & ORCID	<b>Nikolay Bobev (0000-0001-5302-088X)</b>
Contributor name(s) (+ ORCID) & roles	
Project number <sup>1</sup> & title	The holographic universe of string theory
Funder(s) GrantID <sup>2</sup>	G0E2723N
Affiliation(s)	<input checked="" type="checkbox"/> KU Leuven <input type="checkbox"/> Universiteit Antwerpen <input type="checkbox"/> Universiteit Gent <input type="checkbox"/> Universiteit Hasselt <input type="checkbox"/> Vrije Universiteit Brussel <input type="checkbox"/> Other: ROR identifier KU Leuven: 05f950310

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<sup>1</sup> “Project number” refers to the institutional project number. This question is optional. Applicants can only provide one project number.

<sup>2</sup> Funder(s) GrantID refers to the number of the DMP at the funder(s), here one can specify multiple GrantIDs if multiple funding sources were used.

Please provide a short project description	<p>The most challenging problems in theoretical physics are related to the dynamics of strongly coupled systems and the puzzles of black hole horizons. Many of these open questions are brought together in sharp focus by the holographic correspondence which relates the physics of gravitational systems to that of quantum fields. The main objective of this project is to take major steps towards addressing the challenges associated with black holes and strongly coupled physics through an amalgam of newly developed tools in holography, string theory, quantum field theory, and supergravity. To achieve this ambitious goal, I will use the branes of string theory and M-theory together with recently developed analytic and numerical tools in supergravity to construct novel explicit examples of the gauge/gravity correspondence. I will uncover new aspects of the physics of black holes by employing recent insights from supersymmetric localization and together with my team will develop state-of-the-art techniques to go beyond the leading semiclassical approximation. Utilizing new Euclidean gravitational solutions, I will elucidate the properties of the path integral of quantum gravity and study the implications for holography. I will work towards a systematic description of the space of quantum field theories which admit a gravitational dual and will study their deformations and strongly coupled dynamics. This will be achieved by applying a wide array of novel non-perturbative techniques including the conformal bootstrap and supersymmetric localization. The results of this project will yield major new insights into the fundamental properties of strongly coupled quantum fields, black hole physics, and quantum gravity. This in turn will have broad implications for particle and condensed matter physics, astrophysics and cosmology, along with some areas of mathematics.</p>
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## 2. Research Data Summary

List and describe all datasets or research materials that you plan to generate/collect or reuse during your research project. For each dataset or data type (observational, experimental etc.), provide a short name & description (sufficient for yourself to know what data it is about), indicate whether the data are newly generated/collected or reused, digital or physical, also indicate the type of the data (the kind of content), its technical format (file extension), and an estimate of the upper limit of the volume of the data <sup>3</sup>.

Dataset Name	Description	New or Reused	Digital or Physical	ONLY FOR DIGITAL DATA	ONLY FOR DIGITAL DATA	ONLY FOR DIGITAL DATA	ONLY FOR PHYSICAL DATA
				Digital Data Type	Digital Data Format	Digital Data Volume (MB, GB, TB)	Physical Volume
Numerical calculations	Symbolic numerical calculations with the Mathematica software	<input checked="" type="checkbox"/> Generate new data <input type="checkbox"/> Reuse existing data	<input checked="" type="checkbox"/> Digital <input type="checkbox"/> Physical	<input type="checkbox"/> Audiovisual <input type="checkbox"/> Images <input type="checkbox"/> Sound <input checked="" type="checkbox"/> Numerical <input type="checkbox"/> Textual <input type="checkbox"/> Model <input type="checkbox"/> Software <input type="checkbox"/> Other:	Mathematica files (.nb extension)	<input type="checkbox"/> < 1 GB <input checked="" type="checkbox"/> < 100 GB <input type="checkbox"/> < 1 TB <input type="checkbox"/> < 5 TB <input type="checkbox"/> > 5 TB <input type="checkbox"/> NA	

### GUIDANCE:

The data description forms the basis of your entire DMP, so make sure it is detailed and complete. It includes digital and physical data and encompasses the whole spectrum ranging from raw data to processed and analysed data including analysis scripts and code. Physical data are all materials that need proper management because they are valuable, difficult to replace and/or ethical issues are associated. Materials that are not considered data in an RDM context include your own manuscripts, theses and presentations; documentation is an integral part of your datasets and should be described under documentation/metadata.

[RDM Guidance on data](#)

<sup>3</sup> Add rows for each dataset you want to describe.

If you reuse existing data, please specify the source, preferably by using a persistent identifier (e.g. DOI, Handle, URL etc.) per dataset or data type.	NA
Are there any ethical issues concerning the creation and/or use of the data (e.g. experiments on humans or animals, dual use)? If so, refer to specific datasets or data types when appropriate and provide the relevant ethical approval number.	<input type="checkbox"/> Yes, human subject data; provide SMEC or EC approval number: <input type="checkbox"/> Yes, animal data; provide ECD reference number: <input type="checkbox"/> Yes, dual use; provide approval number: <input checked="" type="checkbox"/> No Additional information:
Will you process personal data <sup>4</sup> ? If so, please refer to specific datasets or data types when appropriate and provide the KU Leuven or UZ Leuven privacy register number (G or S number).	<input type="checkbox"/> Yes (provide PRET G-number or EC S-number below) <input checked="" type="checkbox"/> No Additional information:
Does your work have potential for commercial valorization (e.g. tech transfer, for example spin-offs, commercial exploitation, ...)? If so, please comment per dataset or data type where appropriate.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If yes, please comment:
Do existing 3rd party agreements restrict exploitation or dissemination of the data you (re)use (e.g. Material/Data transfer agreements, research collaboration agreements)? If so, please explain to what data they relate and what restrictions are in place.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If yes, please explain:

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<sup>4</sup> See Glossary Flemish Standard Data Management Plan

<p>Are there any other legal issues, such as intellectual property rights and ownership, to be managed related to the data you (re)use? If so, please explain to what data they relate and which restrictions will be asserted.</p>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If yes, please explain:
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3. Documentation and Metadata	
<p>Clearly describe what approach will be followed to capture the accompanying information necessary to keep <b>data understandable and usable</b>, for yourself and others, now and in the future (e.g. in terms of documentation levels and types required, procedures used, Electronic Lab Notebooks, README.txt files, Codebook.tsv etc. where this information is recorded).</p> <p><a href="#"><i>RDM guidance on documentation and metadata.</i></a></p>	<p>The data associate with this research will consists of standardized Mathematica software code for symbolic calculations in theoretical physics. This software package is quite standard among researchers in my scientific field and the shared code files will be easily accessible. In addition, together with my research team, we will strive to document well all publicly available code files so that they can be easily used by fellow researchers.</p>
<p>Will a metadata standard be used to make it easier to <b>find and reuse the data</b>?</p> <p>If so, please specify which metadata standard will be used. If not, please specify which metadata will be created to make the data easier to find and reuse.</p> <p><i>REPOSITORIES COULD ASK TO DELIVER METADATA IN A CERTAIN FORMAT, WITH SPECIFIED ONTOLOGIES AND VOCABULARIES, I.E. STANDARD LISTS WITH UNIQUE IDENTIFIERS.</i></p>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If yes, please specify (where appropriate per dataset or data type) which metadata standard will be used:  If no, please specify (where appropriate per dataset or data type) which metadata will be created:

#### 4. Data Storage & Back-up during the Research Project

<p>Where will the data be stored?</p> <p><i>Consult the <a href="#">interactive KU Leuven storage guide</a> to find the most suitable storage solution for your data.</i></p>	<p> <input type="checkbox"/> Shared network drive (J-drive)  <input type="checkbox"/> Personal network drive (I-drive)  <input checked="" type="checkbox"/> OneDrive (KU Leuven)  <input type="checkbox"/> Sharepoint online  <input type="checkbox"/> Sharepoint on-premis  <input type="checkbox"/> Large Volume Storage  <input type="checkbox"/> Digital Vault  <input type="checkbox"/> Other:         </p>
<p>How will the data be backed up?</p> <p><i>WHAT STORAGE AND BACKUP PROCEDURES WILL BE IN PLACE TO PREVENT DATA LOSS?</i></p>	<p> <input checked="" type="checkbox"/> Standard back-up provided by KU Leuven ICTS for my storage solution  <input type="checkbox"/> Personal back-ups I make (specify)  <input type="checkbox"/> Other (specify)         </p>
<p>Is there currently sufficient storage &amp; backup capacity during the project? If yes, specify concisely. If no or insufficient storage or backup capacities are available, then explain how this will be taken care of.</p>	<p> <input checked="" type="checkbox"/> Yes  <input type="checkbox"/> No         </p> <p>If no, please specify:</p>

<p>How will you ensure that the data are securely stored and not accessed or modified by unauthorized persons?</p> <p><i>CLEARLY DESCRIBE THE MEASURES (IN TERMS OF PHYSICAL SECURITY, NETWORK SECURITY, AND SECURITY OF COMPUTER SYSTEMS AND FILES) THAT WILL BE TAKEN TO ENSURE THAT STORED AND TRANSFERRED DATA ARE SAFE.</i></p> <p><a href="#"><u>Guidance on security for research data</u></a></p>	<p>The Mathematica files will be shared (via One-Drive) only with members of the research team.</p>
<p>What are the expected costs for data storage and backup during the research project? How will these costs be covered?</p>	<p>There will be no extra costs associated with this since KU Leuven provides access and maintenance of One-Drive free of charge.</p>

5. Data Preservation after the end of the Research Project	
<p>Which data will be retained for at least five years (or longer, in agreement with other retention policies that are applicable) after the end of the project? In case some data cannot be preserved, clearly state the reasons for this (e.g. legal or contractual restrictions, storage/budget issues, institutional policies...).</p> <p><a href="#"><u>Guidance on data preservation</u></a></p>	<p><input checked="" type="checkbox"/> All data will be preserved for 10 years according to KU Leuven RDM policy</p> <p><input type="checkbox"/> All data will be preserved for 25 years according to CTC recommendations for clinical trials with medicinal products for human use and for clinical experiments on humans</p> <p><input type="checkbox"/> Certain data cannot be kept for 10 years (explain)</p>



<p>Where will these data be archived (stored and curated for the long-term)?</p> <p><i><u>Dedicated data repositories</u> are often the best place to preserve your data. Data not suitable for preservation in a repository can be stored using a KU Leuven storage solution, consult the <u>interactive KU Leuven storage guide</u>.</i></p>	<p><input checked="" type="checkbox"/> KU Leuven RDR</p> <p><input type="checkbox"/> Large Volume Storage (longterm for large volumes)</p> <p><input type="checkbox"/> Shared network drive (J-drive)</p> <p><input type="checkbox"/> Other (specify):</p>
<p>What are the expected costs for data preservation during the expected retention period? How will these costs be covered?</p>	<p><b>NA</b></p>

## 6. Data Sharing and Reuse

<p>Will the data (or part of the data) be made available for reuse after/during the project? Please explain per dataset or data type which data will be made available.</p> <p><i>NOTE THAT 'AVAILABLE' DOES NOT NECESSARILY MEAN THAT THE DATA SET BECOMES OPENLY AVAILABLE, CONDITIONS FOR ACCESS AND USE MAY APPLY. AVAILABILITY IN THIS QUESTION THUS ENTAILS BOTH OPEN &amp; RESTRICTED ACCESS. FOR MORE INFORMATION: <a href="https://wiki.surfnet.nl/display/STANDARDS/INFO-EU-REPO/#INFOEU-REPO-ACCESSRIGHTS">HTTPS://WIKI.SURFNET.NL/DISPLAY/STANDARDS/INFO-EU-REPO/#INFOEU-REPO-ACCESSRIGHTS</a></i></p>	<p><input type="checkbox"/> Yes, as open data</p> <p><input type="checkbox"/> Yes, as embargoed data (temporary restriction)</p> <p><input type="checkbox"/> Yes, as restricted data (upon approval, or institutional access only)</p> <p><input type="checkbox"/> No (closed access)</p> <p><input checked="" type="checkbox"/> Other, please specify: The Mathematica files developed during this research will be made available upon request to researchers working in this scientific field. Since the files are expected to be relatively small in size they can be submitted with the arXiv submission of the research publications associated with the project as ancillary files (standard practice in my research field).</p>
<p>If access is restricted, please specify who will be able to access the data and under what conditions.</p>	<p>All interested researchers.</p>

<p>Are there any factors that restrict or prevent the sharing of (some of) the data (e.g. as defined in an agreement with a 3rd party, legal restrictions)? Please explain per dataset or data type where appropriate.</p>	<p> <input type="checkbox"/> Yes, privacy aspects  <input type="checkbox"/> Yes, intellectual property rights  <input type="checkbox"/> Yes, ethical aspects  <input type="checkbox"/> Yes, aspects of dual use  <input type="checkbox"/> Yes, other  <input checked="" type="checkbox"/> No         </p> <p>If yes, please specify:</p>
<p>Where will the data be made available? If already known, please provide a repository per dataset or data type.</p>	<p> <input type="checkbox"/> KU Leuven RDR  <input type="checkbox"/> Other data repository (specify)  <input checked="" type="checkbox"/> Other (specify) arxiv.org as anicallary files         </p>
<p>When will the data be made available?</p>	<p> <input checked="" type="checkbox"/> Upon publication of research results  <input type="checkbox"/> Specific date (specify)  <input type="checkbox"/> Other (specify)         </p>
<p>Which data usage licenses are you going to provide? If none, please explain why.</p> <p><i>A DATA USAGE LICENSE INDICATES WHETHER THE DATA CAN BE REUSED OR NOT AND UNDER WHAT CONDITIONS. IF NO LICENSE IS GRANTED, THE DATA ARE IN A GREY ZONE AND CANNOT BE LEGALLY REUSED. DO NOTE THAT YOU MAY ONLY RELEASE DATA UNDER A LICENCE CHOSEN BY YOURSELF IF IT DOES NOT ALREADY FALL UNDER ANOTHER LICENCE THAT MIGHT PROHIBIT THAT.</i></p> <p>Check the <a href="#">RDR guidance on licences</a> for data and software sources code or consult the <a href="#">License selector tool</a> to help you choose.</p>	<p> <input type="checkbox"/> CC-BY 4.0 (data)  <input type="checkbox"/> Data Transfer Agreement (restricted data)  <input type="checkbox"/> MIT licence (code)  <input checked="" type="checkbox"/> GNU GPL-3.0 (code)  <input type="checkbox"/> Other (specify)         </p>

<p>Do you intend to add a PID/DOI/accession number to your dataset(s)? If already available, please provide it here.</p> <p><i>INDICATE WHETHER YOU INTEND TO ADD A PERSISTENT AND UNIQUE IDENTIFIER IN ORDER TO IDENTIFY AND RETRIEVE THE DATA.</i></p>	<p><input type="checkbox"/> Yes, a PID will be added upon deposit in a data repository</p> <p><input type="checkbox"/> My dataset already has a PID</p> <p><input checked="" type="checkbox"/> No</p>
<p>What are the expected costs for data sharing? How will these costs be covered?</p>	<p><b>NA</b></p>

7. Responsibilities	
Who will manage data documentation and metadata during the research project?	<b>Nikolay Bobev</b>
Who will manage data storage and backup during the research project?	<b>Nikolay Bobev</b>
Who will manage data preservation and sharing?	<b>Nikolay Bobev</b>
Who will update and implement this DMP?	<b>Nikolay Bobev</b>