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	**Piet Van Duppen (0000-0002-5053-7370) – KU Leuven**
Contributor name(s) (+ ORCID) & roles	**Stéphane Goriely (0000-0002-9110-941X) – ULB – member of the Project Management Board** **Pascal Quinet (0000-0002-3937-2640) – U Mons - member of the Project Management Board**
Project number [1] & title	3H210785 - Molecular, Atomic, Nuclear and AStrophysics research for heavy eLements stUdies - Manaslu
Funder(s) GrantID [2]	G0I1622N
Affiliation(s)	X KU Leuven ☐ Universiteit Antwerpen ☐ Universiteit Gent ☐ Universiteit Hasselt ☐ Vrije Universiteit Brussel ☐ Other: ROR identifier KU Leuven: 05f950310

[1] "Project number" refers to the institutional project number. This question is optional. Applicants can only provide one project number.

[2] 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	The way the heaviest elements of the table of Mendeleev are constructed from their building blocks (the electrons, protons and neutrons) and how they are formed in the Universe remains puzzling. Also, what can be learned in that repect from the merging of two neutron stars, as recently observed through gravitational and electromagnetic waves, is a highly unexplored terrain. We propose an interlaced experimental and theoretical study related to the region of the heaviest elements to answer contemporary research questions in the field of nuclear, atomic and astrophysics. These will be addressed by developing and using state-of-the-art experimental techniques focused on radioactive ion beam research at ISOLDE-CERN (Switzerland), GSI-FAIR (Germany) and SPIRAL2-GANIL (France) and by novel theoretical approaches. The former includes, among others, high-precision laser spectroscopy studies, including for the first time radioactive molecules. The latter deals with developments of microscopically-based state-of-the-art global nuclear models and corresponding equation of state of dense matter particularly relevant for neutron-star mergers, gravitational waves and the heavy-element nucleosynthesis, and computational methods in atomic-physics pertinent for observational astronomy involving heavy elements, for opacity studies of kilonova emission from neutron-star mergers, and for the laser spectroscopy program to deduce the nuclear observables.

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 [3].

				ONLY FOR DIGITAL DATA	*ONLY FOR DIGITAL DATA*	*ONLY FOR DIGITAL DATA*	*ONLY FOR PHYSICAL DATA*
Dataset Name	Description	New or Reused	Digital or Physical	Digital Data Type	Digital Data Format	Digital Data Volume (MB, GB, TB)	Physical Volume
Spectra	Radiation spectra and laser spectroscopy data	☒ Generate new data ☐ Reuse existing data	☒ Digital ☐ Physical	☐ Audiovisual ☐ Images ☐ Sound ☒ Numerical ☐ Textual ☐ Model ☐ Software ☐ Other:	.root .csv	☐ < 1 GB ☐ < 100 GB ☒ < 1 TB ☐ < 5 TB ☐ > 5 TB ☐ NA	
Simulation	Simulation of ion transport, interaction of energetic particles and radiation. Theoretical simulations	☒ Generate new data ☐ Reuse existing data	☒ Digital ☐ Physical	☐ Audiovisual ☐ Images ☐ Sound ☒ Numerical ☐ Textual ☐ Model ☐ Software ☐ Other:	.csv ascii	☐ < 1 GB ☐ < 100 GB ☒ < 1 TB ☐ < 5 TB ☐ > 5 TB ☐ NA	
Logbooks	Logbooks from experimental campaigns and from data	☒ Generate new data ☐ Reuse existing data	☒ Digital ☐ Physical	☐ Audiovisual ☒ Images ☐ Sound ☒ Numerical	.url	☐ < 1 GB ☒ < 100 GB ☐ < 1 TB ☐ < 5 TB	

[3] Add rows for each dataset you want to describe.

	analysis – one note			☒ Textual ☐ Model ☐ Software ☐ Other:		☐ > 5 TB ☐ NA	
Presentations	Presentations at meetings, workshops and conferences	☒ Generate new data ☐ Reuse existing data	☒ Digital ☐ Physical	☐ Audiovisual ☒ Images ☐ Sound ☒ Numerical ☒ Textual ☐ Model ☐ Software ☐ Other:	.pptx	☒ < 1 GB ☐ < 100 GB ☐ < 1 TB ☐ < 5 TB ☐ > 5 TB ☐ NA	
Scientific report (intermediate)	Intermediate status of the analysis	☒ Generate new data ☐ Reuse existing data	☒ Digital ☐ Physical	☐ Audiovisual ☒ Images ☐ Sound ☒ Numerical ☒ Textual ☐ Model ☐ Software ☐ Other:	.docx	☒ < 1 GB ☐ < 100 GB ☐ < 1 TB ☐ < 5 TB ☐ > 5 TB ☐ 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 described under documentation/metadata.
RDM Guidance on data

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.	Not applicable
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.	☐ Yes, human subject data; provide SMEC or EC approval number: ☐ Yes, animal data; provide ECD reference number: ☐ Yes, dual use; provide approval number: ☒ No Additional information:
Will you process personal data[4]? 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).	☐ Yes (provide PRET G-number or EC S-number below) ☒ 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.	☐ Yes ☒ 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.	☐ Yes ☒ No If yes, please explain:

[4] See Glossary Flemish Standard Data Management Plan

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.	☐ Yes ☒ No If yes, please explain:

3. Documentation and Metadata

Clearly describe what approach will be followed to capture the accompanying information necessary to keep **data understandable and usable**, 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). *RDM guidance on documentation and metadata*.	1. Simulations: the simulation code version and the actual simulated configuration (detector set-up, beam line configuration, ion trap assembly will be associated with each generated data set. For the beam line simulations, the number of particles generated and their initial profile will also be saved in standard SimIon formats. 2. Offline data: the source of the reference of off-line used material will be systematically noted in the logbooks. If applicable, the laser light generation conditions and laser light operation parameters (laser power, laser wavelength, calibration procedures), the radiation detector settings (bias voltage, connection mode), the isotope separator settings (mass, high voltage, target ion source parameters) will be noted. 3. Online data: the production protocol including target number, target and ion source parameters (including the laser parameters of the ion source if applicable), charge trapping and breeding parameters and accelerator parameters will be recorded for the entire data set. Next to this, where applicable, the laser parameters, the mass separator parameters, the timing sequence, the digital data acquisition parameters, the countrates and dead times, the calibration procedures will be noted in the logbook for every data set generated. The documentation and metadata for points 1 and 2 will be registered in the off-line logbooks and analysis books, for point3 will be collected via the online e-log systems organized with the Institute of Nuclear and Radiation Physics and at CERN. 4. Theoretical simulations: results of theoretical calculations will be stored after publication. This includes the equation of state of dense nuclear matter for different effective interactions and nuclear structure properties as well as neutron-, proton- and alpha-induced reaction rates for about 8000 nuclei. It will also include the atomic opacity tables for all elements between Ca and Lr for neutral up to 3rd ionization stages. Finally, the stellar parameters for benchmarked stars will be provided in a table format. The newly calculated atomic data will be used to update the DREAM and DESIRE atomic databases maintained by the Atomic Physics and Astrophysics group at UMONS.

Will a metadata standard be used to make it easier to **find and reuse the data**? 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. *REPOSITORIES COULD ASK TO DELIVER METADATA IN A CERTAIN FORMAT, WITH SPECIFIED ONTOLOGIES AND VOCABULARIES, I.E. STANDARD LISTS WITH UNIQUE IDENTIFIERS.*	☒ Yes ☐ 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: The data result from many different detector types: Germanium and Silicon semiconductor detectors, photo multipliers, Multi Channel Plate detectors, Photodiodes. They are used in several different configurations. As such there is no existing (industrial) standard for the (wide variety of) data types that is collected. The detailed metadata were described above.

4. Data Storage & Back-up during the Research Project	
Where will the data be stored? *Consult the interactive KU Leuven storage guide to find the most suitable storage solution for your data.*	☐ Shared network drive (J-drive) ☐ Personal network drive (I-drive) ☐ OneDrive (KU Leuven) ☐ Sharepoint online ☐ Sharepoint on-premis ☒ Large Volume Storage ☐ Digital Vault ☒ Other: data generated at KU Leuven will be stored on servers from the department of Physics and Astronomy (Natuurkunde &Sterrenkunde - N&S). Data generated at CERN will be stored on the CASTOR server at CERN. Data from theoretical calculations and simulations will be stored at ULB and U Mons.

How will the data be backed up? *WHAT STORAGE AND BACKUP PROCEDURES WILL BE IN PLACE TO PREVENT DATA LOSS?*	☐ Standard back-up provided by KU Leuven ICTS for my storage solution ☐ Personal back-ups I make (specify) ☒ Other (specify): Data stored at CERN are backed up following the CERN general data management plan. Data stored at KU Leuven are backed up on a daily base by the departmental IT team (N&S)
Is there currently sufficient storage & 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.	☒ Yes ☐ No The N&S IT team continuously upgrades its storage capacity to always accommodate the growing demand for data storage. At CERN, the data generated by this project is negligible compared to the data generated by other experiments (e.g. LHC expeirments) and there is therefore no problem with data storage. If no, please specify:
How will you ensure that the data are securely stored and not accessed or modified by unauthorized persons? *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.* *Guidance on security for research data*	All data are stored on servers with password-protected access. At KU Leuven, only members of the research team have access to the data and a clear Data Management Plan guideline has been deployed within the group to ensure that raw data are never overwritten. At CERN, only members of the relevant experiment have access to the data.

What are the expected costs for data storage and backup during the research project? How will these costs be covered?	The costs for data storage at N&S KU Leuven are covered centrally with budgets from all research institutes of the department, including the ZAP from IKS. They are therefore not evaluated per project. When necessary, the expansion of the storage capacity is performed with funding from the active projects and from the departmental budget line. At CERN, access to storage is completely free for CERN generated data, offered as part of the basic infrastructure that CERN provides for research. The costs for data storage of the theoretical calculations and simulations is very limited and will be supplied by ULB and U Mons services.

5. Data Preservation after the end of the Research Project	
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...). *Guidance on data preservation*	☒ All data will be preserved for 10 years according to KU Leuven RDM policy ☐ 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 ☐ Certain data cannot be kept for 10 years (explain) At KU Leuven, the raw data and the secondary data are kept in a shared folder for the research team - accessible even after the end of contract of temporary personnel (PhD, post-doc). At CERN, data is kept on CASTOR for 15 years. At ULB and U Mons, data from the theoretical calculations and simulations will be kept at the resp. research team
Where will these data be archived (stored and curated for the long-term)? *Dedicated data repositories 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 interactive KU Leuven storage guide.*	☐ KU Leuven RDR ☒ Large Volume Storage (longterm for large volumes) ☐ Shared network drive (J-drive) ☐ Other (specifiy):

What are the expected costs for data preservation during the expected retention period? How will these costs be covered?	Preservation is considered part of the general investment in data storage by the N&S IT policy as such these costs are included in the prognoses of the departmental budget lines as well as in the budget lines of the research institutes.

6. Data Sharing and Reuse	
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. *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 & RESTRICTED ACCESS. FOR MORE INFORMATION: HTTPS://WIKI.SURFNET.NL/DISPLAY/STANDARDS/INFO-EU-REPO/#INFOEUREPO-ACCESSRIGHTS*	☒ Yes, as open data ☐ Yes, as embargoed data (temporary restriction) ☐ Yes, as restricted data (upon approval, or institutional access only) ☐ No (closed access) ☐ Other, please specify: Note: the primary data follow an experiment specific format that is not appropriate for sharing broadly but may be shared upon request to the PI. Secondary data of relevance to the community will be shared.
If access is restricted, please specify who will be able to access the data and under what conditions.	

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.	☐ Yes, privacy aspects ☒ Yes, intellectual property rights ☐ Yes, ethical aspects ☐ Yes, aspects of dual use ☐ Yes, other ☐ No If yes, please specify: some data might falls under intellectual property rights, but the major part of the data set is freely available.
Where will the data be made available? If already known, please provide a repository per dataset or data type.	☐ KU Leuven RDR ☐ Other data repository (specify) ☐ Other (specify)
When will the data be made available?	☒ Upon publication of research results ☐ Specific date (specify) ☐ Other (specify)
Which data usage licenses are you going to provide? If none, please explain why. *A DATA USAGE LICENSE INDICATES WHETHER THE DATA CAN BE REUSED OR NOT AND UNDER WHAT CONDITIONS. IF NO LICENCE 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.* *Check the RDR guidance on licences for data and software sources code or consult the License selector tool to help you choose.*	☒ CC-BY 4.0 (data) ☐ Data Transfer Agreement (restricted data) ☐ MIT licence (code) ☐ GNU GPL-3.0 (code) ☐ Other (specify)

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

7. Responsibilities	
Who will manage data documentation and metadata during the research project?	For offline studies (simulations, designs, scheme research), the documentation and metadata are the responsible of the researcher (PhD, post-doc) who performs the research. For online investigation, the experiment is running 24/7 in shifts of 8h. For each shift, a person within the team is named responsible for the logging of all information, including documentation and metadata.
Who will manage data storage and backup during the research project?	At N&S KU Leuven, the data server is maintained and backed up by the N&S ICT team, composed of 4 FTE. At CERN, the data storage and back up to CASTOR is the responsibility of the PI of the relevant experiment. At ULB and U Mons, the data storage is maintained by the PI of the group.
Who will manage data preservation and sharing?	Reuse of the data is the responsibility of the PI of the relevant part of the project.
Who will update and implement this DMP?	The PI bears the end responsibility of updating & implementing this DMP