

DELVING INTO UNEXPLORED MECHANISMS DRIVING THE MASS LOSS OF RED SUPERGIANTS

FWO DMP (Flemish Standard DMP)

1. 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.

				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
		<i>Please choose from the following options:</i> <ul style="list-style-type: none"> • Generate new data • Reuse existing data 	<i>Please choose from the following options:</i> <ul style="list-style-type: none"> • Digital • Physical 	<i>Please choose from the following options:</i> <ul style="list-style-type: none"> • Observational • Experimental • Compiled/aggregated data • Simulation data • Software • Other • NA 	<i>Please choose from the following options:</i> <ul style="list-style-type: none"> • .por, .xml, .tab, .csv, .pdf, .txt, .rtf, .dwg, .gml, ... • NA 	<i>Please choose from the following options:</i> <ul style="list-style-type: none"> • <100MB • <1GB • <100GB • <1TB • <5TB • <10TB • <50TB • >50TB • NA 	
D1a	Opacity tables	Generate new data	Digital	Simulation data	.txt	<10GB	
D1b	2D-3D models	Generate new data	Digital	Simulation data	.txt, .fits	<5TB	
D2a	Emulator coupling	Generate new data, Reuse existing data	Digital	Software	MACE (python)/PHANTOM (Python,C++) codes	<1TB	
D2b	2D-3D models	Generate new data	Digital	Simulation data	.txt, .fits	<5TB	
D3	Model grid simulations	Generate new data, Reuse existing data	Digital	Simulation data	.txt, .fits, MPI-AMRVAC (Fortran) code	<5TB	

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:

MPI-AMRVAC code: https://amrvac.org/md_doc_radiative_cooling.html

MACE code: <https://mace-code.readthedocs.io/en/latest/>

PHANTOM code: <https://phantomsph.github.io>

Are there any ethical issues concerning the creation and/or use of the data (e.g. experiments on humans or animals, dual use)? Describe these issues in the comment section. Please refer to specific datasets or data types when appropriate.

- No

Will you process personal data? If so, briefly describe the kind of personal data you will use in the comment section. Please refer to specific datasets or data types when appropriate.

- No

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.

- No

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 in the comment section to what data they relate and what restrictions are in place.

- No

Existing software tools such as Phantom, MACE and MPI-AMRVAC will be used to calculate model simulations. These codes can be freely used as long as the necessary citations/acknowledgements are given.

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 in the comment section to what data they relate and which restrictions will be asserted.

- No

2. 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).

Detailed description of the full scientific process (theoretical derivations, model development and setup, scientific deliverables) will be documented in text files, PDFs and digital notebooks in the working directories of the host institute and published in regular scientific publications.

Software code/tools and Jupiter notebooks/scripts will include readme files on Github and will be commented inline in the code to describe the aim of the code and details on the input/out variables. Furthermore, GitHub deliverables will be added to the KU Leuven data repository RDR to allow for adding the output to Lirias via dedicated DOI.

All modelling output will be saved in a well-documented local directory structure with readme.txt files.

Will a metadata standard be used to make it easier to find and reuse the data? If so, please specify (where appropriate per dataset or data type) which metadata standard will be used. If not, please specify (where appropriate per dataset or data type) which metadata will be created to make the data easier to find and reuse.

- Yes

- For model simulations the astronomy standard FITS format will be used (<https://fits.gsfc.nasa.gov>).
- Journal publications will use dedicated journal standards (e.g. keywords) to identify research context.

3. Data storage & back-up during the research project

Where will the data be stored?

Locally (personal device+institute servers+backups) :

- Newly-made simulations and theoretical derivations
- Models, parameters and retrievals
- Analysis tools/software codes

Externally:

- Software codes and tools (Github, KU Leuven RDR)
- Scientific publications (journal websites, KU Leuven Lirias)

How will the data be backed up?

The host institute has a well-developed in-house storage and backup system which will allow for continuous data preservation.

**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

Necessary additional storage facilities are calculated in the project budget. If even more storage is needed, these can be taken on by the research group working budget.

How will you ensure that the data are securely stored and not accessed or modified by unauthorized persons?

Raw and processed data are stored on institute network servers and backup following KU Leuven and in-house security standards: all data are secured with access

What are the expected costs for data storage and backup during the research project? How will these costs be covered?

All costs for local storage, servers for computations and backup are covered in the project budget:

- 12TB fast local storage for computations: 3x 4TB SSD PCI-e NVMe (Intel SSD DC P4500) : budget: 3 x 2300 euro = total of 6900 euro
- 30TB server for storage and back-up: budget: 30x 100 euro = total 3000 euro

If even more storage is needed, these can be taken on by the research group working budget.

4. 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...).

All data (raw, processed, models, retrievals, publications) will be stored for at least 10 years, in practice currently indefinitely.

Where will these data be archived (stored and curated for the long-term)?

All data (data reduction, analysis, model, retrievals, publications) will be stored locally on the servers of the host institute. Model simulations in FITS format will be made available via the SAO/NASA Astrophysics Data System (<https://ui.adsabs.harvard.edu/>) All publications will be archived on the website of the scientific journal. All code output will be stored on GitHub and the KU Leuven RDR.

What are the expected costs for data preservation during the expected retention period? How will these costs be covered?

Costs for backup and storage on local institute servers has been included in the project budget and the general working budget of the host institute.

5. Data sharing and reuse

Will the data (or part of the data) be made available for reuse after/during the project? In the comment section please explain per dataset or data type which data will be made available.

- Yes, in an Open Access repository

Scientific publications with description of the full scientific process, methods and model output parameters will be made available via journal websites and KU Leuven Lirias.

Model simulations in FITS format will be made available via the SAO/NASA Astrophysics Data System (<https://ui.adsabs.harvard.edu/>)

Software tools and scripts will be made available via Github

If access is restricted, please specify who will be able to access the data and under what conditions.

NA

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 in the comment section per dataset or data type where appropriate.

- No

Where will the data be made available? If already known, please provide a repository per dataset or data type.

Scientific publications with description of the full scientific process, methods and model output parameters will be made available via journal websites and KU Leuven Lirias.

Model simulations in FITS format will be made available via the SAO/NASA Astrophysics Data System (<https://ui.adsabs.harvard.edu/>)

Software tools and scripts will be made available via Github.

When will the data be made available?

After publication in the scientific journals.

Which data usage licenses are you going to provide? If none, please explain why.

Results and data in scientific journals are published under CC-BY 4.0

Software on Github are published under GPL-3.0 license

Do you intend to add a PID/DOI/accession number to your dataset(s)? If already available, you have the option to provide it in the comment section.

- Yes

Scientific publications will get a DOI assigned as per journal standards.

Code output on GitHub will be assigned a DOI via the KU Leuven RDR.

What are the expected costs for data sharing? How will these costs be covered?

We budget ~1000euro per publication for gold open access. There are no costs associated with Github or other public access repositories such as ArXiv or Lirias.

6. Responsibilities

Who will manage data documentation and metadata during the research project?

The PI and team members together with assistance from the institute's project coordinator and IT team.

Who will manage data storage and backup during the research project?

The PI and institute's IT team will be responsible for proper working of server storage and backup.

Who will manage data preservation and sharing?

The PI and team members will make sure the data is correctly set up for server storage and open access sharing.

Who will update and implement this DMP?

The PI and institute's project coordinator.