Towards a FAIR path for the Einstein Telescope

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ET-PP
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Introduction

The third generation Gravitational Wave detectors such as the Einstein Telescope, and the future instruments for astronomy and astrophysics to be released in the next years will generate an increased amount of data of considerable complexity, that will be available to the astrophysics community. This poses important challenges in order to store, process, integrate, distribute, share and analyze these vast amounts of data in a way that is safe, organized and efficient. The FAIR principles — Findable, Accessible, Interoperable, and Reusable [1] — are therefore crucial for Gravitational Wave science by enhancing good data and software management practices.

Objectives

In the context of Working Package 8 (Computing and Data Access) from the Einstein Telescope Preparatory Phase project (ET-PP), we present our vision of a potential strategy for Research Data and Software Management for the Einstein Telescope based on the FAIR principles.

By leveraging on published resources, we explore how a future FAIR path for ET could be implemented, also identifying topics in which further work is required. Establishment of a solid and curated FAIR path for Gravitational Wave science will ensure that current and future researchers from the field can easily identify, locate, access and reuse open materials and resources for successful implementation of the FAIR principles along the research Data and Software life cycles [2,3], providing them with the robust framework necessary for advancing this transformative area of astrophysics.

Materials

Our proposed approach is based on application of the Elixir Learning Paths protocol [4] already proved successful for the definition and curation of FAIR learning paths in the Life Sciences domain, such as the EOSC Cancer FAIR learning path [5].

To implement this FAIR path building protocol to the Gravitational Wave science domain, we propose to strongly leverage on existing work done by initiatives such as the Gravitational Wave Open Science Cloud (GWOSC, [6]), the International Gravitational Wave Network (IGWN, [7]), the International Virtual Observatory (IVO, [8]) as well as on all the existing experience and materials available from the LIGO-Virgo-Kagra (LVK, [9]) international collaboration of Gravitational Wave observatories, and also relying on reference contributors in the establishment of curated FAIR training material repositories [10].

Methodology

In first place, we propose performing a deep search and review of existing open and publicly available published resources and materials that we identify as potentially relevant for implementation of the FAIR principles in Gravitational Wave science. Concomitantly, this process will also be useful in order to evaluate FAIRness of these materials by themselves.

Afterwards, suitability of these resources will be assessed based on three criteria: the Gravitational Wave Research Data Life Cycle, the researcher competency profile as described by Bloom's cognitive levels [11], and the specific researcher needs as related to his or her topics of scientific research itself.

As a result, a logical and useful sequential FAIR path is obtained, so that it can be used as a roadmap for successful implementation of the FAIR principles applied to Gravitational Wave and astrophysical research.

Bloom's cognitive level

Remember
Understand
Apply

Apply
Analyze
Synthesize

Synthesize
Evaluate
Recommend

Research Data Life Cycle Stage

Plan
Collect
Process
Analyze
Preserve
Share
Reuse

Remember Understand Apply	Apply Analyze Synthesize	Synthesize Evaluate Recommend
Introduction to Data Management Data Management, FAIR and Data Life Cycle basics	Existing Data awareness Browsing Data repositories	Writing your Data Management Plan
Principles of Data Capture & Generation	Best practices for file naming and organization FAIR Metadata	
	Data Processing & Formats Software & Versions Data Normalization Quality Control Metadata	
Understanding FAIR Data Analysis	Making your Data Analysis FAIR Tools for Analysis Reproducibility Best practices for Resaearch Software	
Principles of Data Storage Data Formats & Sizes	Right type of repository for your Data Long time preservation	
	Right type of access for your Data	Setting Embargo periods
	Best practices in Data transfer Finding and reusing existing Data	Science Communitation & Outreach

Undergraduate
Early Master

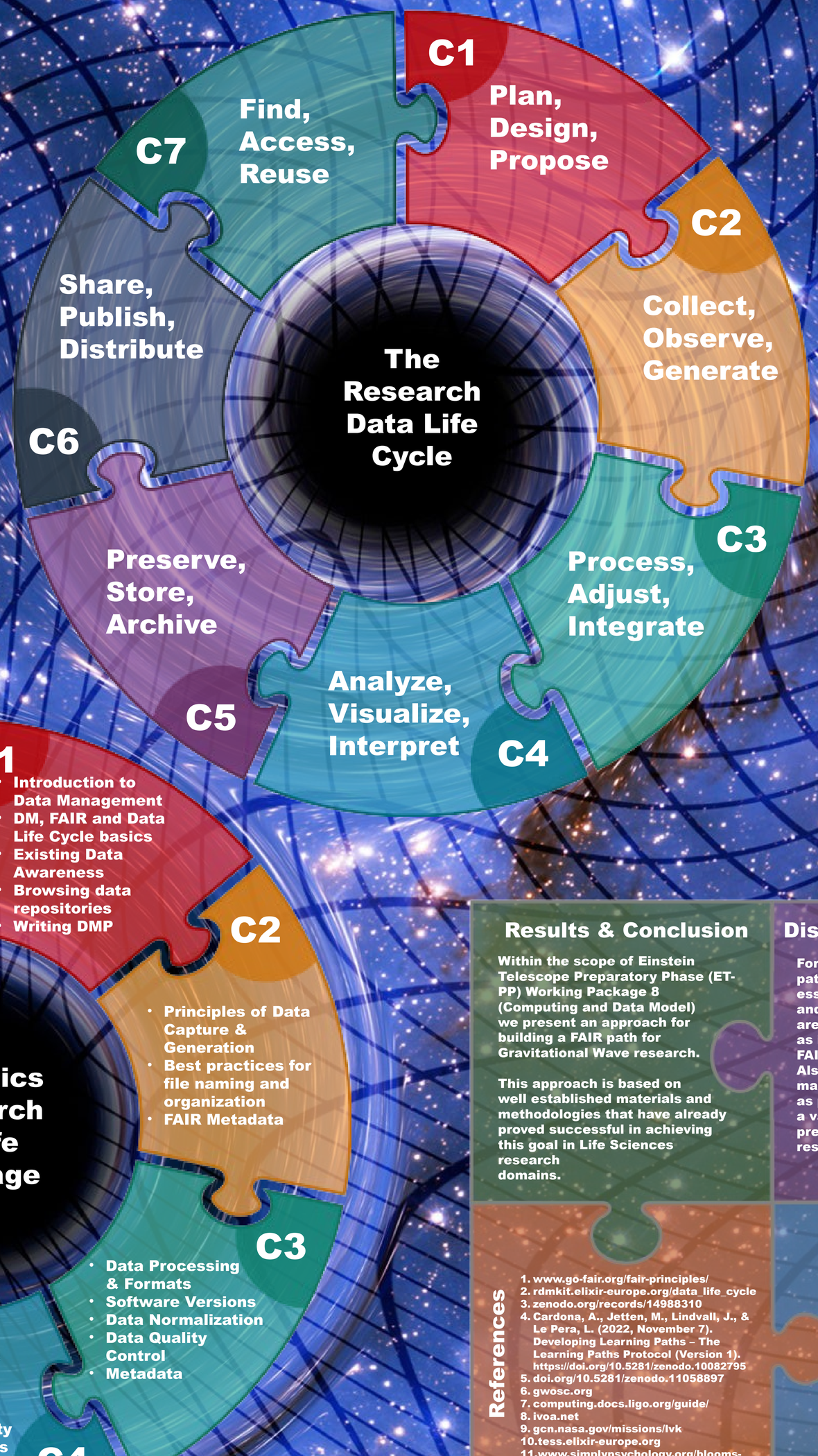
PhD Student
Early Postdoc

Career Postdoc
Principal Investigator

Researcher Stage

Building your own FAIR Learning Path

(From the ELIXIR Learning Paths Protocol, https://elixir-europe.org/focus-groups/learning-paths)



Identify DOMAIN

Identify TARGET AUDIENCE

Identify AREA(s)

Identify TOPICS & STAGES

Connect topics based on PREREQUISITES

Annotate LEARNING OUTCOMES

Results & Conclusion

Within the scope of Einstein Telescope Preparatory Phase (ET-PP) Working Package 8 (Computing and Data Model) we present an approach for building a FAIR path for Gravitational Wave research.

This approach is based on well established materials and methodologies that have already proved successful in achieving this goal in Life Sciences research domains.

Discussion & Next Steps

For the establishment of a valid FAIR path for the Einstein Telescope, it is essential to map existing resources and materials to specific research areas and target audiences, as well as identifying clearly the relevant FAIR topics and research stages. Also, these FAIR paths should be maintained as curated and updated as possible, so that they constitute a valuable and strong FAIR asset for present and future astrophysical research.

References

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Want to contribute ?

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Background image from https://www.ego-gw.it/blog/2021/11/08/35-new-spacetime-quakes-detected-by-virgo-and-ligo/