Manchester Nuclear Physics Consolidated Grant 2020

A Data Management Plan created using DMPonline

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Project abstract:

Nuclear Physics aims to understand the structure and dynamics of nuclear systems. It is the key to understanding the Universe from the first microseconds of its inception when the quark-gluon plasma prevailed, through its history of star and galaxy formation where nuclear reactions play an essential role both in the generation of energy and the creation of elements. The field also has applications that benefit society in diverse areas, from medicine and security to power production, and a strong impact on other fields of science. This request underpins nuclear physics activities at Manchester.

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Manchester Data Management Outline

- Funder
- Yes - Part of a collaboration and owning or handling data
- Acquire new data
- Other storage system (please list below)
- University of Manchester Research Data Storage

Local storage.
Repositories at international experimental facilities used in the proposal.

- 1 - 8 TB
- Yes

Repositories at international experimental facilities used in the proposal such as the CASTOR system at CERN.

- 11 - 20 years
- No sensitive or personal data

No personal information is collected or stored as part of this proposal.

- Not applicable
- Not applicable
- Not applicable
- No

Data custodians are the principal and co-investigators: Sean J Freeman, Michael Birse, David M Cullen, Kieran Flanagan, Paul Campbell, Judith McGovern, A. Gavin Smith and N. Walet.

2019-11-26

Data types

The proposed research projects encompassed by our themes will yield a variety of experimental data sets that differ in character, size and complexity as well as results of theoretical calculations. All experiments produce raw event-by-event data, the nature of which various considerably. Very detailed information would be required for a non-collaborating external user to access such data; for example, event formats, detailed information on experimental setups, signal processing and data acquisition. Whilst such data will be stored, either locally in the University repository or at similar repositories at the associated experimental facility (such as the CASTOR system at CERN), it is envisaged that requests for such "raw data" are likely to be one-off and information and access supported by the group at that time. Software codes for sorting raw data will be archived along with the raw data itself. In some cases, there are intermediate "data structures" in the form of spectra or matrices that can be more generally provided. In some cases, there are "reduced data results" (such as cross sections or isotope shifts) that are the result of relatively straightforward, model-independent analyses. Such data will be included in publication, or made available in associated supplementary information and/or parallel submission to a variety of data bases. Wherever a model-dependent analysis is undertaken (such as in the case of spectroscopic factors or charge radii and moments) we will always enable access to input data to enable future researchers to perform satisfactory reanalyses with improved models.

In laser spectroscopy, the reduced data is generally small in size and quantity: spins, atomic hyperfine coefficients and isotope shifts. Such data is easily made available as part of the usual academic publishing, accessible to independent users by publishing in open access journals or by submission of manuscripts to the Physics archive (http://arxiv.org/archive/nucl-ex). In circumstances when publication does not occur, data will be made available on the Manchester group website for at least ten years. Such reduced data are used to extract other quantities using atomic models such as changes in charge radii and electromagnetic moments; the availability of the reduced data will allow possible future refinements of such models to be applied.

In transfer reactions, extensive sets of cross sections are deduced for each reaction to a series of excited states as a function of angle and sometimes as a function of beam polarisation. These are used to make spin-parity assignments and, in a model-dependent fashion, to extract spectroscopic factors. We have ourselves been frustrated by the lack of availability of detailed cross section data sets from old experiments for reanalysis with modern reaction modelling. In the past papers in the literature often only summarise cross section data in the form of figures of angular distributions or, indeed, many only quote the model-dependent spectroscopic factors results, from which it is very difficult to reconstruct cross sections accurately. As a result, we have for the past ten years been assiduously submitting all our cross-section data to the National Nuclear Data Centre at Brookhaven National Laboratory (http://www.nndc.bnl.gov/) at the point at which associated manuscripts are accepted for publication. More recently, we have additionally taken advantage of the wider use of "supplementary information" by journals to record extensive sets of cross section and polarisation data. Such storage is indefinite, enabling future generations of reaction models to be applied to our data and feeds many different data bases such as NNDC.

In γ-ray spectroscopy, extensive high-fold event-by-event data is used to construct dimensional coincidence structures, such as matrices or cubes, which carry coincidence information used to deduce γ-ray decay schemes. Sometimes these are a function of angle, where angular correlation information can be deduced. Such data structures may contain information on isotopes which are not the focus of the project in hand, but which may be of interest to subsequent users. Such data structures will be made available via local storage or the University repository. These will be made available after the publication of the main results, which will contain a description of the data structures used as information for subsequent users. The decay schemes (level energies, γ-ray energies, spin-parities and γ-ray intensities) are usually stored in "gls" files that can be read with freely available software (http://radware.phy.ornl.gov/); we will made these available for all reaction products analysed, which may include side channels that are not the subject of formal publications.

In decay spectroscopy, energies and lifetimes of decay modes (e.g. α, β, proton decay) are deduced. In a similar fashion to the results of laser spectroscopy, there are generally sufficiently small in number that the data can be made available by open access publishing. Any deduced data that we do not publish will be made available via website or NNDC submission (see above).

In the applied nuclear physics work which measures aspects of nuclear reaction data requested by the nuclear industry, a vast quantity of data is required (reaction cross sections, resonance parameters, covariance matrices, decay data etc.) which can be accessed by both industry and academia. These data are stored in various formats within nuclear data libraries across the world (e.g. ENDF, JEFF, JENDL). The individual data evaluators from each library take care of transforming the data to the relevant format, and their main route to acquiring the data is through the EXFOR database, coordinated by the IAEA. Thus, it is vital that the nuclear data taken from experiments is accurately and fully represented in EXFOR. The best way to facilitate this is by dealing with EXFOR directly, rather than allowing them to interpret the data from publications. Furthermore, by working in collaboration with the data evaluators themselves, be it individually or through a body such as the UK Nuclear Science Forum (UKNSF) one can be sure that the nuclear data available gets optimally included in the global data libraries.

In general, it is expected that the results of the theoretical calculations performed as part of this application are not complex or extensive enough in size to require significantly different management plans to those described above for "reduced" experimental data. Storage can be accommodated within the University repository, if needed beyond that provided for results within publications or within their supplementary material.

The resources required for the current data management plan are not extensive and can be incorporated into the normal research activities for the research theme leaders with the help of the University repository for smaller data sets (<8TB) and facility provision for more extensive experimental data. Generally speaking, the data will be made publicly available shortly after the main academic publications associated with project have been published to allow the teams to be the first to exploit the results of the research.

No personal information is collected or stored as part of this proposal.

Data will be retained for a minimum of ten years.

Data will normally be made available as described above within six months of publication.

Data preservation

Please see description in the "data types" section for detailed discussion.

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Data sharing

Please see description in the "data types" section for detailed discussion.

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Resources

Please see description in the "data types" section for detailed discussion.