# Open Science by and for HEP

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The process of sharing scientific findings in journals has long been the mode of Open Science (OS) for a few centuries. The advent of the *World Wide Web* 30 years ago accelerated the process of sharing of the knowledge manifold. Currently, we live in an era of a scientific domain with ever increasing open source software, open access to published work and open data for researchers and citizen scientists. Particle physics and Astronomy were among the first fields to embrace OS. Premier particle physics labs like CERN, DESY and Fermilab are leaders in enabling open science. *World Wide Web, Invenio, Indico, Inspire*, *Zenodo, OSG (Open Science Grid)* are examples of some of the tools provided by the domain of particle physics to the scientific community and beyond. CERN provides access to open source hardware, open publishing and open data via *CERN Open Hardware License, Sponsoring Consortium for Open Access Publishing in Particle Physics (SCOAP₃)* and *Open Data Portal for the LHC experiments*. Open Science empowers the ability to collaborate, question and contribute to sustainable scientific knowledge and process, and accelerate future discoveries. Open data from LHC is used openly by educators, students, and self-learners to use and reuse for teaching, learning, and research. OS allows research to maximize its impact by reaching a wider audience of participation and sharing the findings, seeking collaborations without borders, and expanding funding and career advancement opportunities. OS is also greatly enhancing the quality and opportunities for education by making it more affordable and equitable.

The strength of the particle physics HEP community lies in its openness, diversity and access to some of the best creative talent worldwide. This nature has been harnessed in advancing human knowledge in understanding the inner workings of the universe.  With the advent of tools to operate OS, we are poised for an even greater and more significant role and in a more inclusive way. For example, CERN open data is being used for public outreach, scientific work, Machine Learning and much more. The software training in the HEP community is transforming the preparation of our next generation of problem solvers by reaching students beyond HEP.

On the other hand the particle physics community has to be aware and to make the outside world equally aware that there are practical limits, e.g. to making all raw data public. Besides problems of training the public at large to analyse these data, our computing infrastructure would not be able to support many others to access all our raw data. Our community should define, with good arguments, what should be the scope of making our data and resources publicly available.

*The goal of this LOI is to strengthen existing successful methodologies, many of which have been created and developed by the US HEP Community, and explore new ways of translating HEP resources, talent and data into Open Science.  We can advance this powerful framework to create more inclusiveness by Open Software Training and Open Physics teaching that will propel our field and the general public into the next phase of discoveries*.

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[1] https://openscience.com/category/open-access-news/

[2] https://cerncourier.com/a/open-science-a-vision-for-collaborative-reproducible-and-reusable-research/

[3] https://books.openedition.org/obp/3586?lang=es

[4] https://networks.h-net.org/node/73374/announcements/3256248/engaging-open-science-learning-and-teaching-special-issue

[5] https://sparcopen.org/open-education/

[6] https://www.researchgate.net/publication/277330754_Open_science_open_access_and_open_educational_resources_Challenges_and_opportunities

[7] https://www.researchinformation.info/analysis-opinion/accelerating-open-science-physics

[8] https://opensciencegrid.org/about/organization/

[9] https://news.fnal.gov/2020/04/fighting-covid-with-computing-fermilab-brookhaven-and-open-science-grid-dedicate-computational-power-to-covid-19-research/