symmetry
dimensions of particle physics

Physicists crowdsource pandemic problem-solving

05/04/20 | By Diana Kwon

The group Science Responds harnesses physicists' expertise in fields like data science, statistics and software development to support efforts to fight COVID-19.

The COVID-19 pandemic has mobilized researchers all around the world. Virologists, epidemiologists and others in health and biological sciences are scrambling to evaluate the extent of the virus' spread and to develop tests, treatments and vaccines. Behavioral scientists are surveying people's attitudes and actions to anticipate and respond to risks.

Physicists, too, are contributing to the fight.

"We're not biomedical researchers, but we have a number of capabilities we can bring to the table," says Peter Elmer, a particle physicist from Princeton University based at CERN.

Elmer is part of the CMS experiment at the Large Hadron Collider. In recent years, he has also been the principal investigator of the Institute for Research and Innovation in Software for High Energy Physics, IRIS-HEP, which was established to coordinate research and development for software upgrades for the next phase of the LHC.

As the number of novel coronavirus infections began rising rapidly around the world in early 2020, Elmer and his colleagues at IRIS-HEP and CERN began considering what they could do to

help.

After putting their heads together, they realized that they possessed expertise in areas that could be useful, such as data science, statistics and software development, and that they also had experience coordinating massive projects that involve thousands of people around the globe.

They decided to form a group, "Science Responds," to connect researchers in particle physics and related fields to projects that they could pursue. Elmer's team was accustomed to community-wide efforts, since they were engaged in such activities as part of IRIS-HEP, which includes researchers from 17 different institutions around the United States. "For me, this was a natural extension of the things that I had been doing," Elmer says.

Several members of IRIS-HEP joined the effort. One of the first was postdoctoral researcher Savannah Thais.

Thais says that when Elmer mentioned plans to start mobilizing people who were interested in helping to combat the pandemic, she was immediately ready to get on board. "I was really excited to hear that," she says.

Thais has long been interested in finding ways to apply data science for social good. Prior to the pandemic, she was working on a side project that involved using machine learning to examine opioid abuse in the Appalachian region of the US.

Around 200 people have signed up for the Science Responds Slack online workspace. Science Responds tracks relevant projects on their website (https://science-responds.org/), and a core group of organizers meet on a daily basis.

For many members of Science Responds, usual day-to-day work such as data analysis and software development continue, only now from home. Elmer says that many members—including himself—are trying to juggle work and childcare, along with making the sudden transition to virtual teaching. Science Responds makes it easier for scientists who can find the time to do more to connect with projects that need them.

"When the pandemic came, everybody wanted to help," says Markus Elsing, leader of the CERN Data Processing Group for the ATLAS experiment at the LHC and a member of Science Responds. "We've seen a lot of people who came to us, took the information we provided, and then got inspired."

Science Responds has thus far focused on playing a supporting role in existing ventures rather than developing home-grown ones. For example, their "Think Globally, Connect Locally"

initiative aims to forge links between people at the same university or within the same community or between people working on similar projects.

"We try to foster connections between researchers who are working on these things rather than do full project management," Thais says. "We know there are a lot of projects that already exist that we can contribute to—we don't necessarily need to be starting up a bunch more within our community."

One project that Science Responds members have contributed to is Folding@Home (https://foldingathome.org/covid19/), an initiative that uses computer simulations to map out the detailed structures of proteins. The group is currently working on analyzing proteins from SARS-CoV-2, the virus behind the pandemic, to understand how it works and help design therapeutics. The simulations require huge amounts of computing power, so Folding@Home crowdsources from a large network of computers to carry out the work.

Other projects include efforts to develop vulnerability indexes to identify at-risk people and regions using publicly available data related to health and the accessibility of physical infrastructure such as roads, groceries and other essential facilities.

Currently, most members of Science Responds are particle physicists, Elmer says, "but we're working to slowly to engage beyond that."

The group has been connecting members with experts on topics such as computational molecular modeling and contact tracing. Thais notes it is important for those involved in Science Responds to remember the importance of subject-specific knowledge and to engage in interdisciplinary work with relevant experts. "We've talked as an organization about how we can try to make sure that we're not adding to the noise, or doing things like amateur epidemiology," she says.

The involvement of people across various areas is "what excited me about this," says Alessandra Forti, who manages a large computing center at the University of Manchester in the UK and is part of the ATLAS experiment's distributed computing coordination team. "Everyone is finding their own niche."

Forti has helped set up the computing network for Folding@Home, which is now being run across 45 sites using ATLAS's infrastructure. Forti's computing center at Manchester, which is used by the LHC and other experiments, is one of the sites that has redirected their resources to COVID-19-related activities.

Science Responds should stay active as long as efforts to deal with the virus continue, Elmer says. "We set this up not for the next six weeks, but for the next year and a half. Because that's what it's going to take."

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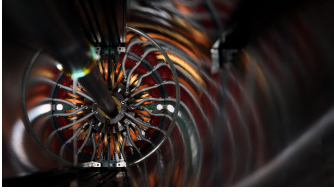
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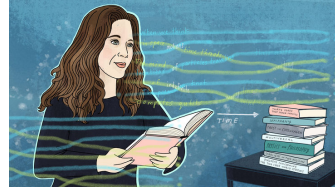Scientists study rare, one-in-a-trillion heavy boson collisions happening inside the LHC.

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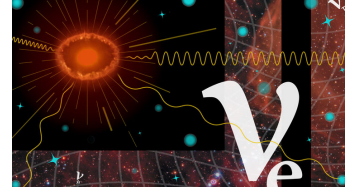Antimatter has fueled many a supernatural tale. It's also fascinating all by itself.

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