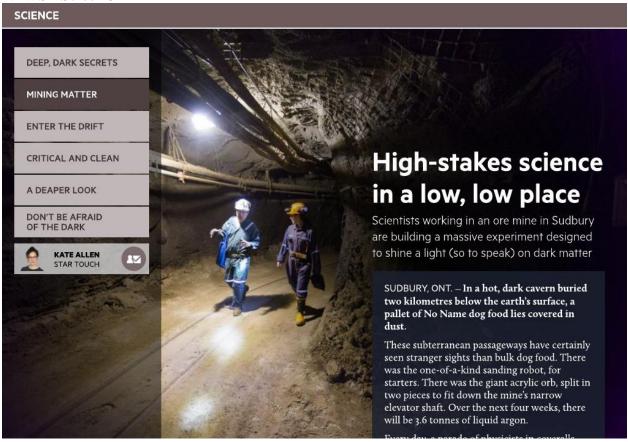


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High-stakes science in a low, low place

Scientists working in an ore mine in Sudbury are building a massive experiment designed to shine a light (so to speak) on dark matter

Kate Allen Star Touch

SUDBURY, ONT. — In a hot, dark cavern buried two kilometres below the earth's surface, a pallet of No Name dog food lies covered in dust.

These subterranean passageways have certainly seen stranger sights than bulk dog food. There was the one-of-a-kind sanding robot, for starters. There was the giant acrylic orb, split in two pieces to fit down the mine's narrow elevator shaft. Over the next four weeks, there will be 3.6 tonnes of liquid argon.

Every day, a parade of physicists in coveralls and head lamps rattles down the elevator and tramps through these passages — plus engineers, welders, machinists, grad students, the occasional journalist. Stephen Hawking was here.

But to grasp the scale and ambition of what's happening at SNOLAB, it helps to think about that pallet of dog food.

The scientists down here are building a massive experiment, DEAP-3600, designed to capture faint signals from dark matter, one of the greatest unresolved mysteries in physics. Whatever dark matter is, it accounts for the vast majority of the matter in the universe. Physicists have described the ordinary, visible matter we know — galaxies, comets, planets, us — as the froth on top of a deep, dark ocean. But we don't know what that ocean is made of. Dark matter is invisible: its existence is inferred, never seen.

At SNOLAB, scientists want to change that. They are building the world's most sensitive dark matter detector of its kind, going to painstaking lengths — burying the lab in an ore mine in Sudbury, for instance — to avoid anything that might mask a signal.

An experiment of this scale is a scientific feat involving 65 researchers at 10 institutions in three countries. It is also a logistical nightmare.

"We're pushing right at the edge of technical capabilities of different scientific techniques," says Mark Boulay, an experimental particle astrophysicist at Carleton and Queen's universities and project director for DEAP. "But we're also building a large construction project."

On top of the behaviour of subatomic particles, Boulay and his DEAP collaborators must contend with Ministry of Labour approvals, missing wrenches and budgets, budgets, budgets. Someone at SNOLAB must maintain that large supply of dog food. The lab hosts dozens of

workers daily, but usually not enough to satisfy the microbes that keep the sewer treatment plant functional. Dog food supplements the microbes' diet.

These prosaic demands can seem jarring in contrast to the lab's and the experiment's ambitions. On Thursday, Queen's University physicist Arthur McDonald will accept a Nobel Prize for his work on the Sudbury Neutrino Observatory (SNO).

SNO was the precursor to the expanded SNOLAB, where 10 experiments are now underway in addition to DEAP. Boulay was part of the SNO team; DEAP is the inheritance of the expertise accumulated as a direct result of its success.

"Certainly with the facility we have at SNOLAB, and all the expertise we have built up in Canada in particle astrophysics, we are at the leading edge of the field. What we are doing is of that calibre," says Boulay. "We have excellent potential for discovery and for scientific impact, and we are right around the corner from turning on."

But experimental particle physics is big, high-stakes science. Other ambitious dark matter detectors have found nothing, which is helpful for defining where to look next, but not the result researchers dream about. If theorists' current best guess for what dark matter is made of is wrong, DEAP won't find anything either.

Then again, if the theorists are right, the world's best shot at discovering dark matter may be sitting in an ore mine in Sudbury.

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