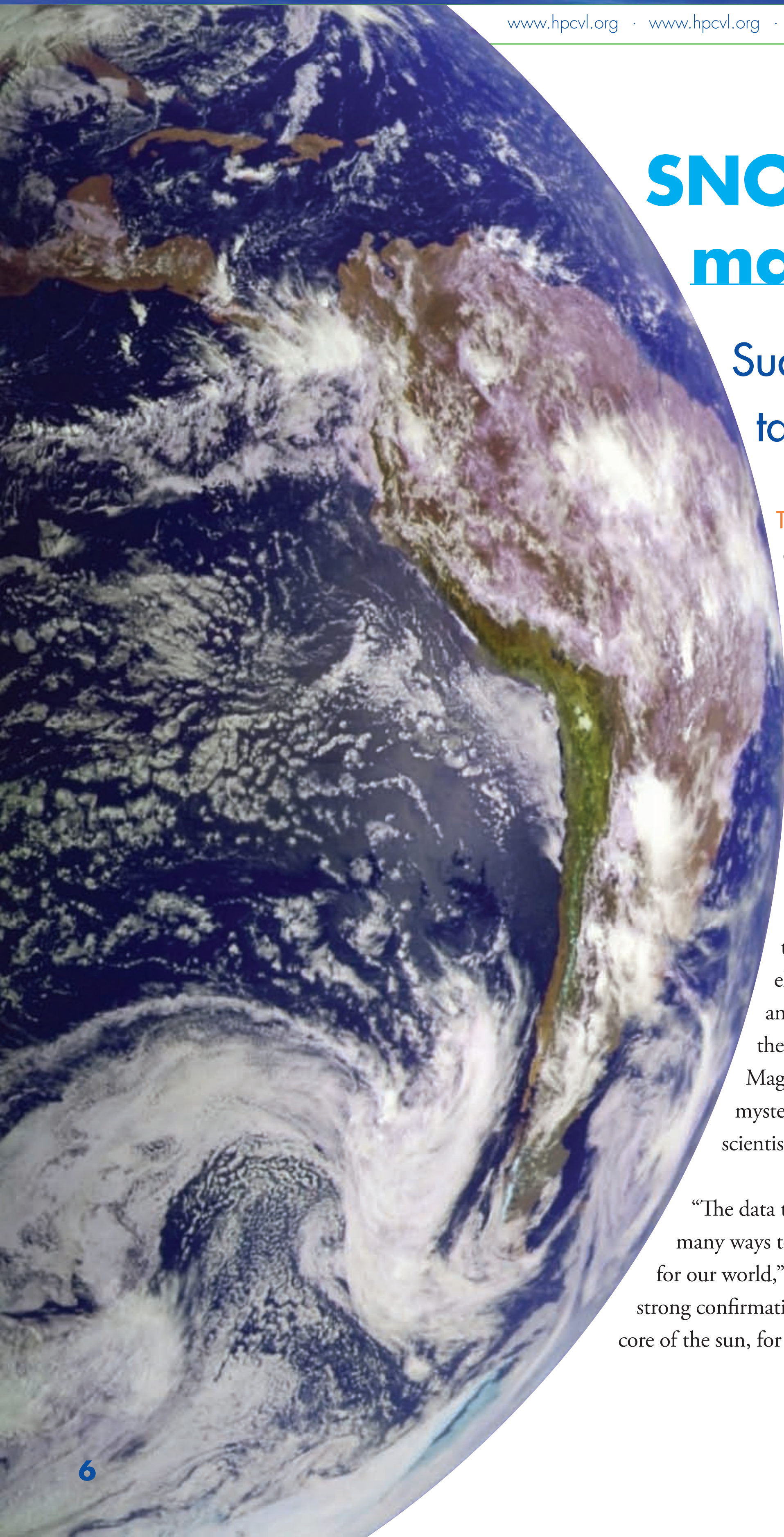

SNOLAB helps unloc many mysteries of

Sudbury Neutrino Observatory takes on new challenges

THE HEAVY WATER MAY BE GONE AND THE original data on neutrinos collected - but the Sudbury Neutrino Observatory (SNO), the world's deepest underground laboratory, is far from retirement. This world-class facility, a jewel among Canada's scientific labs, has been expanded to create SNOLAB, providing an unparalleled experimental environment for students and scientists working to understand everything from dark matter and supernovae to the nature of the Big Bang.

SNO, built within Canada's Creighton Nickel Mine, was originally designed as an optimal environment to detect and measure the properties of neutrinos, elementary particles of matter with no electric charge and very little mass emitted by the sun. Hailed as one of the top ten scientific breakthroughs of 2001 by Science Magazine, SNO's experiments have unlocked many mysteries of the universe, and provided valuable data to help scientists understand the sun and how it burns.

"The data that we've collected over the years has been used in many ways to build new theories about our universe and new ideas for our world," says Art McDonald, SNO's Project Director. "Our strong confirmation of models for nuclear energy generation in the core of the sun, for example, helps efforts to develop new fusion energy

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the universe

sources on Earth. Neutrinos are one of the basic building blocks of our universe and our observations of their properties are guiding modifications to the Standard Model of Elementary Particles at the most basic level."

SNO has also fostered valuable collaborations with over a dozen institutions across the world and provided educational opportunities for hundreds of students across a range of disciplines, contributing to over 130 graduate theses and leading to new ideas in pure and applied science.

But that's just the beginning. SNOLAB, an expansion of the original facilities, has added another 5,000 square metres of ultra-clean laboratory space two kilometres underground to accommodate a wide range of major experiments in astrophysics and other related fields that require an environment with greatly reduced radioactive backgrounds. SNO itself is being converted to a next generation experiment named "SNO+" led by Queen's Professor Mark Chen, this project features world-leading sensitivity for detecting neutrinos from the sun and the earth, as well as rare but very fundamental forms of radioactivity.

Over the years, SNO has relied on HPCVL's resources to store and help analyze the vast amounts of data required for this type of work – and has recently begun transferring the full set of SNO data to HPCVL to act as a backup and accessible archive for ongoing analyses of the data. "HPCVL has provided a critical evolution of computing power to meet our needs," says Dr. McDonald. "We are continuing to analyze the SNO data with ever- increasing accuracy. HPCVL has allowed us to remain at the frontier of physics –and the leading edge of discovery."

www.hpcvl.org

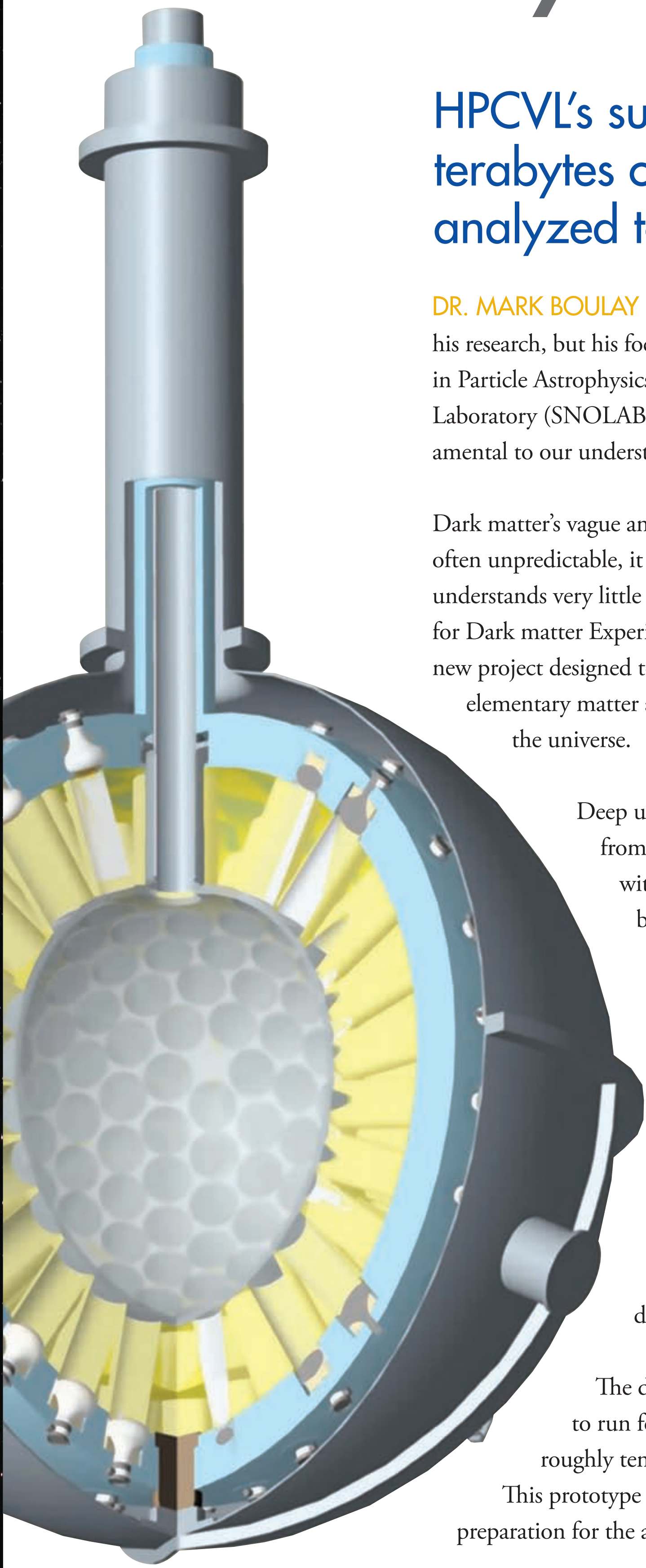
SNOLAB director awarded 2010 Killam Prize

Art McDonald,
Physicist

Queen's University Physics Professor and SNOLAB Project Director Art McDonald has been awarded a 2010 Killam Prize, one of Canada's most distinguished awards for outstanding career achievements in health sciences, engineering, humanities, natural sciences and social sciences.

A world-renowned expert in nuclear and particle physics, Dr. McDonald returned to Canada from Princeton in 1989 to head up SNO and lead an international team in the detection and analysis of neutrinos.

Going DEAP to see beyond the stars



HPCVL's support is critical, allowing terabytes of data to be stored and analyzed to detect the interactions

DR. MARK BOULAY MAY BE VENTURING DEEP INTO EARTH TO CONDUCT his research, but his focus is clearly not on this planet. Boulay, the Canada Research Chair in Particle Astrophysics at Queen's University, is using the Sudbury Neutrino Observatory Laboratory (SNOLAB) to detect dark matter and hopefully discover a new particle fund-amental to our understanding of physics.

Dark matter's vague and ominous moniker is highly reflective of its nature. Mysterious and often unpredictable, it makes up a quarter of our universe, yet the scientific community understands very little about its composition and purpose. DEAP, a loosely-based acronym for Dark matter Experiment using Argon Pulse-shape discrimination, is a groundbreaking new project designed to detect and study dark matter through its interaction with normal, elementary matter and potentially discover a new particle critical to our knowledge of the universe.

Deep underground at SNOLAB, Dr. Boulay and a team of astrophysicists from across North America are building a dark matter detector filled with almost four tonnes of liquid argon and featuring an ultra low background to filter out other events that may affect the experiment. The particles they hope to detect will likely be weakly interacting but should scatter off the nuclei during collisions in the experiment.

"The SNOLAB facility allows us to run the experiment in an environment that's virtually free of cosmic rays and background radiation that can interfere with our observations," says Dr. Boulay. "We expect only a handful of interactions each year, so it's important to watch carefully and under the most optimal conditions." HPCVL's support of the project is also critical; the lab is allowing terabytes of data to be carefully stored and analyzed to detect the interactions.

The detector, which should be completed by the end of 2012, is expected to run for five years. In the meantime, a prototype detector containing roughly ten kilograms of liquid argon is currently being used as a test model. This prototype will give scientists time to tweak the experiment's parameters in preparation for the actual project.