LOOKING FOR DARK MATTER IN A GOLDMINE

Construction begins this month on the $3.5 million subterranean laboratory that will draw teams of scientists from across the globe down a tunnel that is literally large enough to drive a truck through.

'This experiment is truly groundbreaking and it will place Stawell at the forefront of one of the biggest quests in science' says Astrophysicist **Alan Duffy**

The underground laboratory is reached by four-wheel drive, with only the headlights to illuminate the tunnel's dusty darkness. It takes 20 minutes to get to the cavernous site that will host the lab – assuming the truck doesn't have to give way to an oncoming traffic working at the still-operating gold mine. At 600 metres underground, it starts getting warm. By one kilometre down, the temperature is hovering between 35 and 40 degrees. The dust in the air is as fine as talcum powder. It's humid. But it won't be like that inside the purpose-built lab, which will be set at a comfortable 18 degrees, all-year-round.

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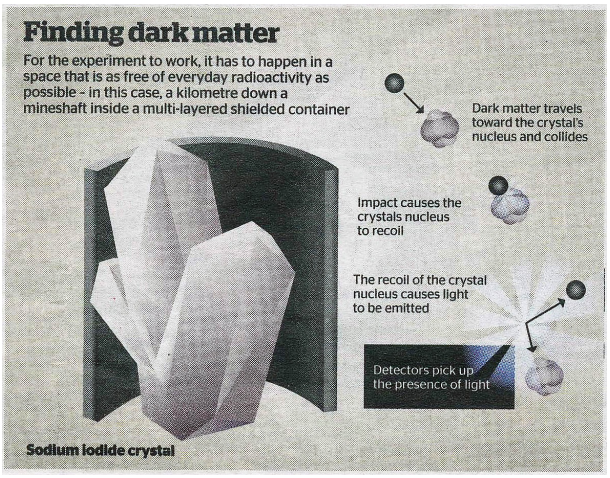
In the four decades since American astronomer **Vera Rubin** first proposed there was another form of matter binding the universe, Dark Matter has stubbornly remained one of modern physics' most important and tantalising questions. What we do know is that dark matter is the reason galaxies exist the way they do. It provides the gravitational seed for the galaxy to grow. It gets its name because it does not interact with light. It's the dark side of the universe. If the international team of scientists do strike gold in their mine lab in Stawell, Melbourne University's **Professor Barberio** has no doubt it will be Nobel prize-winning work. “What we know about what the universe is made of is the tip of the iceberg. If we understand Dark Matter, we will understand how the big bang occurred and how the universe evolved and how it might continue to evolve,” she says.

But why a mine? Why does the hunt for the elusive dark matter that holds the universe together have to be undertaken a kilometre underground by researchers trucking to and from the lab, wearing hard-hats and high-vis vests? Simple. **It's a way of escaping the constant stream of cosmic radiation arriving on Earth from space. The kilometre of volcanic rock between the mine's surface and the cavernous laboratory acts as a natural barrier, blocking most radiation within the first few hundred metres**. However having gone to some trouble to escape cosmic radiation, scientists still have to consider other sources. For a start the laboratory's basalt rock walls are a source of radiation, albeit at very low-levels. Ditto for the scientists. Even at the lowest levels radiation is enough to contaminate the supersensitive experiment, which relies on materials being extremely pure to eliminate radioactive "noise".



A collection of seven ultra-pure sodium iodide crystals inside a multi·layered shielded container, each weighing six kilograms, will act as a target for the ghostly dark matter that has made it underground. Dark matter travelling through the crystal collides with the crystal’s nucleus. The recoil of the nucleus causes light to be emitted. This energy the researchers are looking for – it will tell them about the mass of dark matter particles.

Of the more than 10 laboratories in the northern hemisphere already hunting for dark matter so far only one has detected strong evidence of dark matter. That was in 1998. Physicists have long wondered if there are seasonal differences in the amount of Dark Matter that reaches Earth. The Stawell laboratory is the best candidate to settle this dark matter dilemma because it is so far the only laboratory in the southern hemisphere.

Grampians **Shire Mayor Cr Murray Emerson** has advocated strongly on behalf of council and the community for the underground physics laboratory to receive support from both the state and federal governments.

AK, with Notes from the Sunday Age