TIFR

Physicists planning to build a neutrino detector in southern India have run into local opposition.

PHYSICS

Unfounded rumours delay Indian neutrino detector

Fears frustrate physicists in a global competition to understand elusive particles.

BY ELIZABETH GIBNEY

Time is running out for Indian scientists to build a facility that would let them compete in one of the hottest races in physics. The India-based Neutrino Observatory (INO) — an effort to learn about the masses and other properties of mysterious particles called neutrinos — is under threat as a result of baseless rumours about its aims and environmental impact. Despite a government go-ahead in January 2015 to build a massive detector under a mountain in the southern state of Tamil Nadu, opposition from environmentalists and state politicians means that not a single grain of earth has been shifted.

Neutrinos are abundant subatomic particles that are extremely hard to detect. Billions pass through each square centimetre of Earth every second, but barely any leave a trace. The INO would study neutrinos produced when cosmic rays strike the atmosphere, and would seek to reveal the relative masses of the three known types of neutrino. The measurements could lead to Nobel-prize-worthy insights into the relationship between nature's four fundamental forces, as well as the imbalance between matter and antimatter in the Universe.

But if the INO is not built soon, other projects — including one that broke ground in China a year ago — may get there first, says D. Indumathi, a theorist at the Institute of Mathematical Sciences in Chennai who is part of the INO collaboration, and coordinates outreach for it. "Longer than a year of delay and I think it will be difficult to have viable physics goals, at least of the current type," she says.

"They don't know what the truth is, and I can understand that."

Conceived in 2001 and originally slated for completion in 2012, the INO has faced a rocky path to construction. To shield the enormous detector from the confounding zoo of subatomic particles that pummels Earth's surface, the facility needs to be built more than a kilometre underground. The first earmarked site was ruled out in 2009 after a lengthy battle with conservationists over its proximity to an elephant and tiger reserve.

The current site, in the Tamil Nadu district of Theni, faced opposition as soon as it was put forward in 2010. Local villagers worried that the facility would deplete or contaminate their restricted water supply, and cut off access to land for grazing livestock, says Indumathi. But, she says, villagers consented after scientists assured them that the facility would not interfere with their resources.

Since then, however, local environmental organizations and regional politicians have taken up the issue, and the list of objections has swelled to include fears that the lab will emit radiation and store nuclear weapons, and that the excavation will threaten a nearby dam.

The rumours are untrue, says Naba Mondal, a physicist at the Tata Institute of Fundamental Research in Mumbai who leads the INO collaboration. INO scientists have visited schools and held community meetings to counter misconceptions. But many villagers have turned against the project. "They don't know what the truth is, and I can understand that," says Mondal.

At the root of the rumours is mistrust of the state and the scientific establishment, says Govind Krishnan, an Indian journalist who has closely followed the project. He believes that the fears that have been raised lie "in the

realm of fantasy", but are understandable given the poor environmental record of past state-sponsored construction projects. Govind disagrees with activists who say that INO scientists have ignored the project's impact on the poor, but he says that scientists' efforts have been hampered by class and linguistic barriers.

India's government allocated 15 billion rupees (US$225 million) to construction when it gave the INO the green light last year, but the Madras High Court in Chennai brought the project to a standstill in March following a petition from local activists and politicians. The court said that the Tamil Nadu Pollution Control Board must give consent before construction can start. This is normally a routine, 45-day step, but the process has so far taken 9 months, says Mondal.

The politically contentious nature of the project means that the local board may well delay until after state elections in May. "I am confident that it will eventually be approved, but the question is when," says Mondal. The delay is damaging the morale of students and researchers on the project, he adds.

Meanwhile, China expects to complete the Jiangmen Underground Neutrino Observatory in 2019. To remain competitive, the INO must start construction in the next few months, says Mondal. "Science is something you have to do in time. If you are not in time, your results may not be that important."

But neutrino physicists say that even if the INO loses the race, its findings would help to corroborate discoveries at other detectors. The INO takes a unique approach — using 50,000 tonnes of magnetized iron to separate atmospheric neutrino observations from their antineutrino counterparts. That will make its results interesting whenever they come out, says Mark Messier, a physicist at Indiana University Bloomington and co-spokesperson for the NOvA Neutrino Experiment at Fermilab in Batavia, Illinois, which also has a chance of solving the neutrino-mass mystery.

Researchers point to other benefits, too. Putting a physics laboratory deep underground gives India the opportunity to host research into areas such as dark matter, they say — and it is empowering for Indian scientists to bring a major physics facility to fruition. "Already I've seen the tremendous difference it's made to students having an experiment on which they call the shots," says Indumathi. "So I really don't care whether we get a Nobel prize or not." ■

CORRECTIONS

The Editorial 'Fishy limits' (*Nature* **528,** 435; 2015) wrongly implied that the European Commission had set the fishing quotas. They were set by the Council of Ministers. The News story 'Feuding physicists turn to philosophy' (*Nature* **528,** 446–447; 2015) gave the wrong affiliation for Sabine Hossenfelder; she is now at the Frankfurt Institute for Advanced Studies. The News Feature 'How to make the most of carbon dioxide' (*Nature* **526,** 628–630; 2015) said that Carbon Recycling International produces 1.5% of global methanol; in fact, it makes 0.005%. The News Feature 'Space. Time. Entanglement.' (*Nature* **527,** 290–293; 2015) wrongly said that Leonard Susskind began to think about computational complexity ten years ago — his work in the area began around three years ago. The News Feature 'The truth about fetal tissue research' (*Nature* **528,** 178–181; 2015) incorrectly stated that around 5.8 billion people have received vaccines made with the WI-38 and MRC-5 cell lines. In fact, companies have shipped some 5.8 billion vaccines made with these two cell lines. And a printing error meant that an earlier version of the News article 'What to look out for in 2016' (*Nature* **529,** 14–15; 2016) appeared that did not account for the fact that NASA has cancelled the 2016 launch of the Mars InSight probe.