

they preferentially align,” he says.

The upgrades have boosted the sensitivity of LIGO’s machine in Livingston, Louisiana — already the most sensitive detector — by 40%. The other LIGO interferometer, in Hanford, Washington, and Virgo near Pisa were hampered by technical snags in 2017 but have now partially caught up. Since 2017, Virgo has roughly doubled the distance within which it can detect events, says Alessio Rocchi, its commissioning coordinator and a physicist at the National Institute for Nuclear Physics in Rome.

LASER UPDATES

The sensitivity boosts result largely from two changes in the lasers at the heart of the observatories. Each LIGO detector is an L-shaped vacuum system that stretches over two 4-kilometre-long arms; the Virgo machine is similar, but has 3-kilometre arms. Inside, laser beams

bounce between mirrors at both ends. When gravitational ripples pass through Earth, they cause the beams to change slightly in length.

To make signals stand out better from noise, LIGO and Virgo physicists have ramped up the lasers’ power and have for the first time deployed a technique called squeezed light, which is based on a quirk of quantum mechanics.

Empty space bubbles with elementary particles that continually come into existence only to disappear moments later. These random fluctuations cause photons in the laser beams of gravitational-wave detectors to hit the mirrors at unpredictable times. At LIGO and Virgo, this has been the main hurdle to detecting gravitational waves of a high frequency, or pitch. But physicists can use squeezed light to shift some fluctuations towards lower frequencies to improve the detection of high-frequency waves.

The technique could particularly improve

the detection of waves created by merging binary neutron stars or small black holes. That’s because, as the objects spiral into each other, the lighter ones circle each other up to 500 times per second right before they collide, and their waves become so high-pitched that they fall out of the interferometers’ range. Higher sensitivity could enable the detectors to track the objects all the way to their fiery end.

Astronomers around the world are also preparing to follow up on wave detections and to examine the same events using conventional facilities — including radio and X-ray observatories — thanks to the alert system, which will also be available through a smartphone app. In previous runs, teams that wanted to do such follow-ups had to sign memoranda of understanding with the LIGO–Virgo collaboration to receive confidential alerts. Now, there is no restriction, Reitze says. “That’s a big change.” ■

ENVIRONMENT

Iranian spying trial prompts global outcry

Reports allege that wildlife experts charged with espionage are being denied legal rights.

BY MICHELE CATANZARO

A controversy surrounding eight environmental researchers charged with spying in Iran is escalating. Leading conservation groups, human-rights organizations and European politicians are urging Iranian authorities to give the researchers a fair trial, after reports emerged that the defendants’ legal rights have been breached. Meanwhile, secretive trials of the scientists — who say they are innocent — have begun in Iran’s revolutionary court system, which usually deals with economic, corruption and security crimes, according to sources close to the defendants. Four of the researchers face extra charges of “sowing corruption on Earth”, which can carry the death penalty.

The sources, who asked to remain anonymous for fear of retaliation, say that hearings have been held for two defendants, after an initial session in which the indictment was read to the whole group. The sources also say that two researchers are having health problems because they haven’t received proper care in prison.

The case comes amid increasing scrutiny by the Iranian government of environmental-research activities. Critics say the government fears that other nations might be using environmental monitoring as a cover for spying, and according to the Center for Human Rights



An Asiatic cheetah. Researchers studying these endangered cats in Iran have been arrested and jailed.

in Iran, a non-governmental organization headquartered in New York City, tens of people involved in conservation have been arrested in Iran in the past year.

“Environment was a safe space in Iran, because it’s apolitical,” says Kaveh Madani, an environmental-policy specialist at Imperial College London. But increasing interest in the

nation’s worsening environmental issues from both the Iranian public and Western conservation organizations has changed that, he says.

Many conservation researchers now fear working in Iran, says Madani, who is Iranian and was invited back to Iran from London in 2017 to serve as head of the government’s environment department. But he resigned ►

► and left the country seven months later, after being arrested and interrogated by Iranian authorities amid the crackdown on conservationists.

When the eight imprisoned researchers were arrested in January 2018, they were using camera traps to study endangered wildlife, including the Asiatic cheetah (*Acinonyx jubatus venaticus*), in national parks and other locations in Iran. Authorities accused them of spying on sensitive infrastructure, according to press reports, but the researchers maintain their innocence. Iran's environment ministry had authorized their research activities, according to the anonymous sources.

Trials began even though several Iranian government agencies, including a special committee appointed by President Hassan Rouhani, concluded in May 2018 that there is no evidence supporting the charges. All of the researchers worked with the Persian Wildlife Heritage Foundation, a respected non-governmental organization in Tehran.

The case has prompted an outcry from the international community. Reports that some detainees might not have adequate access to legal counsel are “deeply troubling”, the United Nations Environment Programme said in a statement on 5 March. “We urge the Iranian authorities to ensure that [the researchers] are guaranteed a fair, transparent

and independent trial,” it said.

Human-rights group Amnesty International released a similar statement on the same day. And in a February letter to Iran's president, 26 members of the European Parliament voiced concerns that the proceedings fall short of fair-trial standards. Statements from wildlife charity WWF and the Wildlife Conservation Society say that the researchers are highly regarded and that camera traps are commonly used by to monitor species. “We stand by the innocence of these men and women,” wrote the WWF.

CALL FOR JUSTICE

The anonymous sources allege that during the defendants' year-long detention, their rights have been breached. The sources say that the researchers were forced to change the lawyers they originally appointed, and that one, Niloufar Bayani, was barred from attending trial hearings after she said in February in front of the revolutionary court's judge that a false confession had been extorted from her in prison.

A ninth researcher, Kavous Seyed-Emami, 64, was arrested along with the eight experts but died in jail about a month later in unclear circumstances. Seyed-Emami's family told

Nature that his autopsy results haven't been released to them.

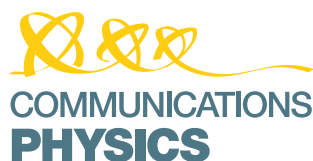
Nasser Karami, an Iranian climatologist at the University of Bergen in Norway, agrees with the international conservation community that the accused are not environmental activists, but reputable experts in wildlife. Karami fled Iran in 2012 after being fired from his academic positions for publishing criticisms about the government's role in conservation.

Karami and Madani say that environmental problems have increased and the public has become unhappy about the government's handling of the issues. Mounting criticisms of the authorities have made it a security issue for the government, says Madani. ■

CORRECTIONS

The News Feature ‘The secret conversations inside cells’ (*Nature* **567**, 162–164; 2019) did not make clear that the 2017 study from DeCamilli was actually co-led by cell biologist Karin Reinisch at Yale University.

The News story ‘Data on mining the deep sea’ (*Nature* **567**, 294; 2019) erroneously affiliated Matthias Haeckel with Germany's University of Kiel. He is, in fact, at the GEOMAR Helmholtz Centre for Ocean Research Kiel.



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