DJORGOVSKI: I have couple more minutes left, and just let me tell you about a non-electromagnetic messengers. And they come in several different flavors.

First the high-energy cosmic rays, which are detected in the same principle as high-energy gamma rays, except that, here, you have a whole lot of particle detectors on the ground. And they detect secondary and tertiary and unitary products of cosmic rays as the fast particles decay and as you have the slower ones.

This is actually quite amazing because cosmic rays arrive to us over a large range of energies. And the most energetic ones are about 10 to the 21 electron volts. That is a kinetic energy of a baseball moving at 100 miles an hour. And in one particle. So no wonder did they can actually leave substantial signature in the atmosphere.

The biggest cosmic ray observatory now is in Argentina. It's called Pierre Auger, named after a nuclear physicist, and does both of these things -- looks for Cherenkov radiation as well as particles from these showers that are collected and detected in particle detectors. There are others. There is one called Milagro in New Mexico. And I'm going to Mexico Mexico, which is essentially a big swimming pool of super-clear water with a lot of photomultipliers looking for flashes.

The same principle is now used to find neutrinos. Neutrinos don't interact very much, but occasionally they do. And the way this is done is you get large tank of some fluid, which tends to be pure water, deep underground. And this is to shield from all other particles. And haul out the photomultiplier tubes looking at that volume. So every once in awhile, a really energetic neutrino knocks something, interacts with the nucleus. And that then behaves just the detection of a cosmic ray.

So the big sphere on the left is in Canada in Sudbury Mine. And the one on the right's even bigger. It's called Super-Kamiokande. It's in Japan. You can see there are these technicians in a little rubber dinghy fixing the individual photomultiplier tubes. These things are big. OK? And the reason why they have to be big is because neutrinos don't interact very much, so you need a lot of targets. And they work with detected neutrinos from the sun from supernova 1987A and maybe even some other things.

But the queen of this is called the IceCube Neutrino Observatory, which uses a chunk, a few kilometers of purest ice available -- very transparent, right, and supple. So they drill panels, put photomultiplier tubes on strings, then let it freeze again. Neutrinos come, knock out electrons or something. And by series of which photomultipliers light up and also how far the cone spreads, you can tell the direction. You can tell the energy.

Now here is a cute thing about this. They don't count anything coming from above. They're only looking for neutrinos coming from below, because the only thing that can go through planet Earth would be neutrinos. Cosmic rays can generate fake signals coming from above, so you actually use whole planet Earth as shielding the telescope tube.

And one final thing is another part of Caltech's glory, which is opening of gravitational wave astronomy. And Caltech and MIT are principal players in the first gravitational observatory, which is working on some level. Not finding anything yet, people expect to see things in next few years and getting quite ready for that.

The way this is done is, again, top-notch experimental physics. Essentially, you have some heavy mirrors hanging in long vacuum tubes. And you bounce laser around them to measure their positions with high precision. Gravitational waves come through, jiggle space-time, move those mirrors back and forth a little bit. And that has to be then detected and all spurious signals filtered out. The precision with which these things are measured is many orders of magnitude smaller than size of individual atoms, and they're like many, many kilograms in size. So this really is fantastically precise physics experiment.