



## Some Thoughts and Impressions about the Arrival of GW150914

### **Nutsinee Kijbunchoo**

*Operations Specialist, LIGO Hanford Observatory*



Courtesy N. Kijbunchoo

The post-midnight hours on September 14 were quiet in the LHO control room, just like every other graveyard shift. The H1 detector was locked and running smoothly. I was so focused on some work I was doing that at one point during the shift I ignored a teleconference conversation that was playing over the speaker; it was LIGO Livingston personnel. I stayed for the 8:30am LIGO Hanford weekly meeting and nothing was mentioned about an event. I went home with no idea that something big had happened. When I woke up on the evening of September 14 a friend sent me a text from LIGO Livingston and jokingly asked if I had walked around with a slide whistle during my shift. That's when I knew.

This event (that I TOTALLY MISSED) could be a life-changer for me. I decided to become an operator before going to graduate school in order to participate in observing runs. This discovery will shape the nature of my graduate studies when I return to school for my Ph.D.

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### **Peter Saulson**

*Martin A. Pomerantz '37 Professor of Physics, Syracuse University*



Courtesy Syracuse University

I spent Monday September 14 in prayer at my synagogue, in observance of Rosh Hashanah, the Jewish New Year. (And no, I wasn't praying for a beautiful gravitational wave signal to arrive . . .) My computer remained completely shut down until the end of the day. I ought to also have observed the second day of the holiday on Tuesday, but I didn't feel that I could do that, so after sunset on Monday evening I decided to catch up on my email. I couldn't believe my eyes when I saw all of the email traffic about the event!

We're all optimists in this business, otherwise we wouldn't be here. Here's proof that I'm an optimist. In 1983, while I was a postdoctoral scholar with Rai Weiss, I asked him how long it was likely to take before we discovered a gravitational wave signal. Rai worked it out for me: one year to convince the NSF to fund LIGO, two years for construction, one year for commissioning to design sensitivity, and one more year to observe until we found signals.

Thus, we should expect to discover gravitational waves before the end of the 1980s. And I believed him. It is thrilling to see that optimism finally justified!

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### **Daniel Holz**

*Associate Professor, Physics Department, Enrico Fermi Institute, and Kavli Institute for Cosmological Physics, University of Chicago*



Courtesy D. Holz

It was a Monday morning, the beginning of a beautiful fall day in Chicago. I scanned my cell phone before getting out of bed and saw an email about a "very interesting event" in LIGO. I assumed it was a false alarm or injection, especially since the other search pipelines hadn't noticed it. I didn't take it very seriously, and went to the office in no particular hurry. By the time I got there it had already become apparent that this was a high mass event, which meant LIGO's other online searches weren't looking for it. At that point I allowed myself a little excitement. This continued to build as it became apparent that the interferometers were operating well, that the data was clean, and that the signal was strong. But the first time I genuinely thought this might be \*real\* was when I saw the time-frequency plots. The event

looked just like the signal we had dreamed about for all those years; it sent shivers down my spine. (It \*still\* sends shivers down my spine!) Now the excitement was approaching a fever pitch, but it was still tempered



by the possibility that this was a blind injection. Then I heard that there were no blind injections during the engineering run and the excitement changed to complete delirium. And here I am, months later, and this feeling hasn't subsided. Every day I have to pinch myself that this is really happening, and we have truly heard the echoes of two black holes swallowing each other at hundreds of millions of light years away. This has been an insanely intense and marvelous experience, and I feel so lucky to be a part of it.

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**Keith Riles**

*Professor of Physics, University of Michigan*



Courtesy K. Riles

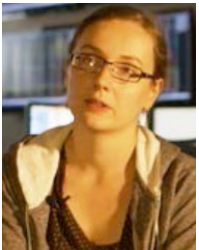
My first news of GW150914 came from checking my smartphone on the morning of September 14. Sergey Klimenko had just sent an email inquiring about a loud event in the data several hours before. The tone of Sergey's message got my attention; it was clear he thought the data quality looked fine and that this event was very significant. My immediate conclusion was that a hardware injection had been made but had not been flagged. I thought that Eric Thrane might have inserted the injection, but he reported a short time later that he did not. I concluded that the blind injection team must have done a test without telling the rest of us. This surprised me, given that they provided no advance warning, but it seemed within their prerogative to do such a thing.

Shortly into the weekly detector characterization call at noon, Andy Lundgren announced that the blind injection team had stated definitively they had done no injections. I sat upright at that point and listened (in a bit of a daze) as Alan Weinstein asked -- very slowly -- for confirmation: "Do you mean to say that this was not a blind injection?" When Andy confirmed that yes, there had been no injection, I realized that we had just entered uncharted territory.

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**Anamaria Effler**

*Caltech Postdoctoral Scholar stationed at LIGO Livingston Observatory*



LIGO/Kai Staats

Robert Schofield and I were testing the L1 detector's sensitivity to environmental noise at LIGO Livingston on the night of September 13. Our tests were part of LIGO's preparations for the O1 run. We were still working at 2am on Monday, September 14. Pausing until about 4am to evaluate our data, we debated whether or not to do "car injections" in which one of us would drive a large car near the main detector building and apply the brakes violently every five seconds to see if the seismic noise from the car would appear in the interferometer data. But the GPS wristwatch that we needed for the test had become disconnected from the satellite signal. This was the last straw. We said, "Fine, we can live without this test." I distinctly remember (because I was asked many times during the next few days) looking at my car clock

as I was driving away from the site and seeing that the time was 4:35am. I knew that my clock was three minutes in error, which annoyed me.

The next day or the following, I saw some email traffic on GW150914 and my heart stopped because of the possibility that it occurred during our tests (although this couldn't have happened because we keep the detector out of observation mode while we're testing). Nevertheless I experienced a second or two of "oh no . . ." (the polite version of what I thought). Then I breathed a giant sigh of relief knowing that we were off-site by the time of the event and that we didn't do the last few tests. But knowing how close we were . . .

I didn't expect a detection during this run and I didn't believe that GW150914 was real for quite a while. Not until it was established that no injections had occurred and that the signal didn't appear in other data channels; even then I didn't dare believe. The realization slowly seeped in over time. The event was too big and I can't imagine how people feel who have been in the field for a long time.