UNIVERSITY OF COPENHAGEN

Danmarks Grundforskningsfond
Danish National Research Foundation

Annual Highlights: Feb 1, 2017 – Jan 31, 2018
Center for Transient Astrophysics, Niels Bohr Institute

This year our group first discovered the optical light from GW170817 and helped lead efforts to interpret the physics behind the observed light. Our team looked for signatures of nucleosynthesis, like the radiation produced by the radioactive decay of heavy elements and our discovery was deemed the Science Breakthrough of the Year by Science Magazine. This discovery provided the first solid evidence that neutron-star smashups are the source of much of the Universe's gold, platinum and other heavy elements in the Universe. The detection of a gamma-ray burst from the source two seconds after the gravitational-wave signal ended by NASA's Fermi space telescope, demonstrated that merging neutron stars also emit gamma rays and that gravitational waves travel at the speed of light, as expected. In addition, this discovery provided us with a novel method for calculating the distance to the gravitational wave source directly. The signal pattern provides us with a precise account of how distant the source is, via general relativity, and its strength is directly proportional to the mass of the objects that created it. This method will allow us to calculate distances for many events to come and will help us to better understand how the universe expanded in the past, and what drives its current, accelerating rate. Gravitational waves offer a unique means to measure the neutron star equation of state, as the deformability of the neutron star will impact the gravitational wave strain signal observed in the final orbits prior to merger, and the deformability depends directly on the equation of state. For astronomers and physicists across disciplines, this is an extremely exciting time to be alive. For our center, the recent discovery of the GW170817 event was a vindication as we have been constructing the theoretical framework behind element synthesis in neutron star mergers and the associated electromagnetic signatures for many years.

During the review period we have authored fifty one papers (12 in Nature and Science) and our work has been recognized nationally, and internationally. While indiviudal accolades, of course, wonderful to receive, we have been even more gratified to see our students and postdocs achieving their own recognition. At NBI, postdocs and students have won the Block Award from the Aspen Center for Physics for transformative work on tidal disruption physics (Jane Dai), SNSF Eccelenza Professorship (Anastasios Fragos), VILLUM Young Investigator (Giorgos Leloudas) and Kavli Fellowship (Sophie Schroder).