My job is more computer science based rather than astronomy or physics based even though I’m working with the astronomy department in their research. My specific research, which inevitably helps them in the process, consists of learning about and implementing the Graphics Processing Unit (GPU) to optimize the processing time of data coming from the Laser Interferometer Gravitational Wave Observatory (LIGO). Normally the Central Processing Unit (CPU) is used to process the data but each individual core can only do a few sets of code at any given time if the programmer is experienced with threading; each thread executes a selection of code. This is a problem because on average, at total CPU capacity, it takes about 1000 CPU hours, or 120 hours in real-time to analyze a set of data. In essence, the CPU has to calculate a function for each set of data in a huge array set (i.e. 400,000 pieces of data to be used by the sin(x) function). The GPU can solve this problem because it is designed to execute a kernel that launches thousands of threads at the hardware level that simultaneously calculate each piece of data in the array and return it back to the user. In theory this should drastically decrease processing time. The challenge is that since the GPU uses smaller individual CPUs, as compared to the larger main CPU, sometimes the main CPU is more useful in an application than the GPU. Therefore, I will be spending much time analyzing the code and determining which parts will be more effectively optimized by the GPU. The project will be using the relatively new CUDA framework to support GPU coding. It has a successful history in other projects that include video game engine performance increase, studying collective behavior of animals, and improving airspace traffic control.

Overall, the astrophysicist would like to be less dependent on the processing time of the data so they can test their data against predictions in a reasonable time span. The data that they are analyzing comes from Binary Black Hole mergers, see [Vicki Kalogera group](http://faculty.wcas.northwestern.edu/vicky/index.html), and it is used to generate waveforms, of which they analyze and test said predictions. Recent updates to the LIGO observatory is increasing its sensitivity and therefore will make the waveforms even longer. Consequently more data will have to be processed by the CPUs to generate these waveforms and slow down the process even further. This makes the GPU solution even more essential.