Have you ever looked up into the night sky, and wondered at the mysteries of the universe? Asked questions about the beginning of all things, about the Big Bang, and what happened after? Wondered how the solar system came into being? How we got here? These are the things that astronomers answer on a daily basis. But how do we know that they have it right? Our understanding of the world around us is intricately and delicately tied with the models we use to describe the universe. If one of these were wrong, the whole thing would collapse like a house of cards.

One well known, and difficult to grasp problem astronomers face is that of missing matter. When they look out at the universe, they notice that in order for the universe to exist as it does, it needs way more stuff in it than there is. Not to be confused with Dark Matter, a phenomenon which is still not entirely characterised, we see about half the amount of regular matter that we expect to see.

Astronomers have built incredibly sophistocated models to describe the evolution of the universe, and we know where our missing matter should be. The struggle is finding it. This where my research comes in, we appeal to the cosmic dawn, the first light to flow through the universe, what we affectionatly call the universe’s baby picture. The afterglow of the Big Bang, this light, the Cosmic Microwave Background, has travelled from the edge of the universe through countless galaxies, and clouds of dust and gas to reach us. As it does so, if it happens to collide with the intervening gas, or in other words, a particularly hot electron, it will absorb some energy, and appear brighter when compared to the light around it.

This is a rare event, which means that in order to detect this signal in a meaningful way, we search for millions and millions of occurences. By adding them all up, they create a picture that allows us to see the missing matter for the first time. We searched for it in the vast cosmic space between galaxies, where our models told us that it should be, and by using high resolution images, we were able to identify the missing matter in the universe to a high degree of precision. Doing so confirms our model of the universe, and passes valuable information to other fields of physics, so that we can probe even further into the mysteries of the universe.