SMMA MUSICS project
The Significance of solar flares and CME research

- The Earth’s magnetic field protects us from most of the Sun’s plasma.
- This magnetic field doesn’t protect us entirely, a CME could be big enough to cause a geomagnetic storm.
- Particles can get stuck in the magnetic field, especially around the magnetic fields, and give off radiation to the atmosphere which is what causes aurora (Northern and Southern lights).
- Satellites do not have a protective magnetic field, and can get charged from the CMEs causing parts of the satellite to short circuit. This particularly affects satellites at high orbits.
Solar Flares

- Solar flares usually occur just before CMEs and are releases of matter and light.
- Solar flares are the “flash” before the CME “bullet”.
- The biggest flares are known as "X-class flares" based on a classification system that divides solar flares according to their strength. The smallest are A-class (near background levels), followed by B, C, M and X. Each letter represents a 10-fold increase in energy output. So an X is ten times an M and 100 times a C. Within each letter class there is a finer scale from 1 to 9.
Video of CME formation

Coronal Mass Ejections: the breakdown

- They happen on average 3 times a day at solar maxima, and around once every 5 days at solar minima.
- They very often follow solar flares.
- The magnetised plasma ejected is composed of mostly electrons and protons and take on average 3 days to reach Earth.
- When CMEs reach Earth they can cause geomagnetic storms, and can affect Earth’s magnetosphere, compressing it on the day side, and extending the tail on the night side.
The data

- 6 years of magnetosonic waves compressed into 6 minutes per year.
- Magnetosonic waves are sound waves in plasma - can show both transverse and longitudinal qualities.
- Received data through magnetometers which measure changes to the magnetospheric magnetic field. The G13 and G15 names that you see refer to the different satellites and both are recording the same magnetosonic waves.
- With use of noise reduction we noticed four peaks spanning across two days (10th and 11th of September).
Our Research

- We started by finding a CME.
- We then found the time in the audio files and reduced the interference.
- This highlighted four peaks across 2 days.
- We decided to investigate further to see if these peaks were CMEs.
Our Research

- G13: First peak
- 09/09/2011
- UT 16:27:46 - 19:40:27
Our Research

- G15: first peak
- 09/09/2011
- UT 18:35:43 - 21:33:21
Our Research

- G13: second peak
- 10/09/2011
- UT 00:35:29 - 02:25:22
Our Research

- G15: second peak
- 10/09/2011
- UT 01:23:39 - 02:47:57
Our Research

- G13: third peak
- 10/09/2011
- UT 5:12:27 - 7:03:51
Our Research

- G15: third peak
- 10/09/2011
- UT 5:50:05 - 8:43:12
Our Research

- G13: fourth peak
- 10/09/2011
Our Research

- G15: fourth peak
- UT 21:57:59 - 00:51:05
WOWZA!! We were right!!!!!!!!!!!!JEEPERS!!!!!!!!!!JINKY!!!!!!!!!!

- Sunspot 1283 produced 4 solar flares.
- A M5.3 on Sept. 6 at 00 UTC - 470,000 - 490,000 m/s.
- Then a X2.1 on Sept. 6 at 20:20 UTC - 520000 - 540000 m/s.
- Then a X1.8 Sept. 7 at 20:37 UTC - 509000 - 516000 m/s.
- Then a M6.7 Sept. 8 at 15:36 UTC - 755000 - 784000 m/s.
Our Research - Animation to show the September 7, 2011, CME
What this could mean??

Slide or no??
References and questions???

- http://earthsky.org/space/two-solar-flares-one-an-x-class-within-22-hours