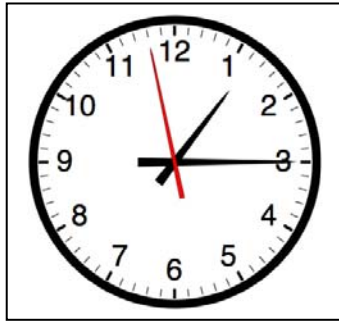


## Time Intervals



Astronomers are often interested in how long a particular event took. This can be used to explore how fast something is moving, or how rapidly it is changing in time. Here are some 'far out' examples!

1 – The gamma-ray burst from the galaxy TXS1510-089 was detected on July 24, 2007 by the AGILE satellite. The burst began at 23:25:07 and ended at 23:25:57 How many seconds did it last?

2 – The black hole orbiting the star A0620-00 in the constellation Monoceros produced a micro-flare on September 29, 2002 visible at radio wavelengths as it swallowed some of the gas falling into it. If the flare began at 01:50:00 and ended at 01:53:20 how many seconds elapsed?

3 – On September 1, 1859 the sun released a cloud of plasma called a Coronal Mass Ejection at 11:18 AM If the cloud reached Earth on September 2 at 04:54 AM how many hours did it take the cloud to travel from the sun to earth?

4 – Full Moon occurred on July 18, 2008 and August 16, 2008. How many days elapsed between the two lunar phases?

5 – A massive star in the Eta Carina cluster erupted in a giant flare in 1843. How many years has it been since this eruption if the current year is 2008?

6 – The Crab Nebula was formed by a supernova in the year 1054 AD. If the next supernova spotted by humans occurred in 1987, how many years elapsed between these events?

7 - The earth was formed 4.5 billion years ago. The asteroid bombardment of its surface ended 3.9 billion years ago. How many million years did the asteroid bombardment era last?

8 - The universe came into existence in the Big Bang 13.7 billion years ago .The most ancient galaxy astronomers have detected so far is A1689-zD1, which was probably formed about 13.0 billion years ago. How many millions of years was the universe in existence before this galaxy began to form?

## Answer Key

1 – Answer:  $23:25:57 - 23:25:07 = 50 \text{ seconds}$

2 – Answer: 
$$\begin{array}{r} 01:53:20 \\ - 01:50:00 \\ \hline 3:20 \end{array}$$

The burst lasted 3 minutes and 20 seconds.

3 – Answer: 
$$\begin{array}{r} \text{September 2} \quad 04:54 \\ - \text{September 1} \quad 11:18 \\ \hline \end{array} \quad \begin{array}{l} \text{add 24h} \\ 28:54 \\ - 11:18 \\ \hline 17:36 \end{array}$$

The CME took 17 hours and 36 minutes to arrive.

4 – Answer: 
$$\begin{array}{r} \text{August 16, 2008} \\ - \text{July 18, 2008} \\ \hline \end{array}$$

You can use a calendar to count the days, or from 31 days in July, there are  $31 - 18 = 13$  days plus the 16 days in August the sum is  $13 + 16 = 29 \text{ days}$ .

5 – Answer:  $2008 - 1843 = 165 \text{ years}$ .

6 – Answer:  $1987 - 1054 = 933 \text{ years}$ .

7 – Answer:  $4.5 \text{ billion} - 3.9 \text{ billion} = 0.6 \text{ billion years}$  or  $600 \text{ million years}$ .

8 – Answer:  $13.7 \text{ billion} - 13.0 \text{ billion} = 0.7 \text{ billion years}$  or  $700 \text{ million years}$ .