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| ccc-logo | **12 ATAR Physics**  **Hubble’s Law Investigation Data Gathering 2016 (2%)**   |  |  | | --- | --- | | Student name: |  | |

**The Big Bang Theory & Hubble’s Law**

The Big Bang [theory](https://en.wikipedia.org/wiki/Scientific_theory) is the prevailing [cosmological](https://en.wikipedia.org/wiki/Physical_cosmology) [model](https://en.wikipedia.org/wiki/Scientific_model) for the [universe](https://en.wikipedia.org/wiki/Universe) from the earliest known periods through its subsequent large-scale evolution. The model accounts for the fact that the universe [expanded](https://en.wikipedia.org/wiki/Metric_expansion_of_space) from a very high density and high temperature state, and offers a comprehensive explanation for a broad range of phenomena, including the abundance of [light elements](https://en.wikipedia.org/wiki/Light_element), the [cosmic microwave background](https://en.wikipedia.org/wiki/Cosmic_microwave_background), large scale structure and [Hubble's Law](https://en.wikipedia.org/wiki/Hubble%27s_Law).

Since Georges Le Maître first noted, in 1927, that an expanding universe might be traced back in time to an originating single point, scientists have built on his idea of cosmic expansion. In 1929, from analysis of galactic redshifts, Edwin Hubble concluded that galaxies are drifting apart; this is important observational evidence consistent with the hypothesis of an expanding universe.

**1.** Show how the mathematics of Hubble’s Law can be used to calculate the age of the universe. **[3 marks]**

**2.** Explain how the recessional velocity data is collected. **[4 marks]**

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**3.** Use the table below and your digital device, to collect your data. This data will then be required for completion of the second stage of this investigation. Leave you data table with your teacher, you will be able to collect it at the start of part 2. **[10 marks]**

<https://en.wikipedia.org/wiki/NGC_5001>

**New General Catalogue (NGC) Table**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **5408** | **5364** | **5248** | **5236** | **5170** | **5112** | **5090** | **5078** | **5068** | **5055** | **5010** | **5005** | **NGC #** |
| Irregular Galaxy | Spiral Galaxy | Spiral Galaxy | Spiral Galaxy | Spiral Galaxy | Spiral Galaxy | Elliptical Galaxy | Spiral Galaxy | Spiral Galaxy | Spiral Galaxy | Lenticular Galaxy | Spiral Galaxy | **Type of object** |
| 0.002 | 0.004 | 0.004 | 0.002 | 0.005 | 0.003 | 0.011 | 0.007 | 0.002 | 0.002 | 0.2 | 0.0032 | **Redshift (z)** |
| 15.7 x 106 | 54.5 x 106 | 59 x 106 | 15.21 x 106 | 96 x 106 | 62 x 106 | 150 x 106 | 94 x 106 | 22 x 106 | 37 x 106 | 140 x 106 | 65 x 106 | **Distance (Lyrs)** |
| 506 | 1241 | 1151 | 513 | 1500 | 900 | 3420 | 2168 | 600 | 484 | 2975 | 946 | **Recessional Speed**  **(kms-1)** |
| 5 | 17 | 18 | 5 | 29 | 19 | 46 | 29 | 7 | 11 | 43 | 20 | **Distance (MPc)** |

Now watch this you-tube video and make notes for the next part of this investigation:

<https://www.youtube.com/watch?v=UwW_FbPE1R8>

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