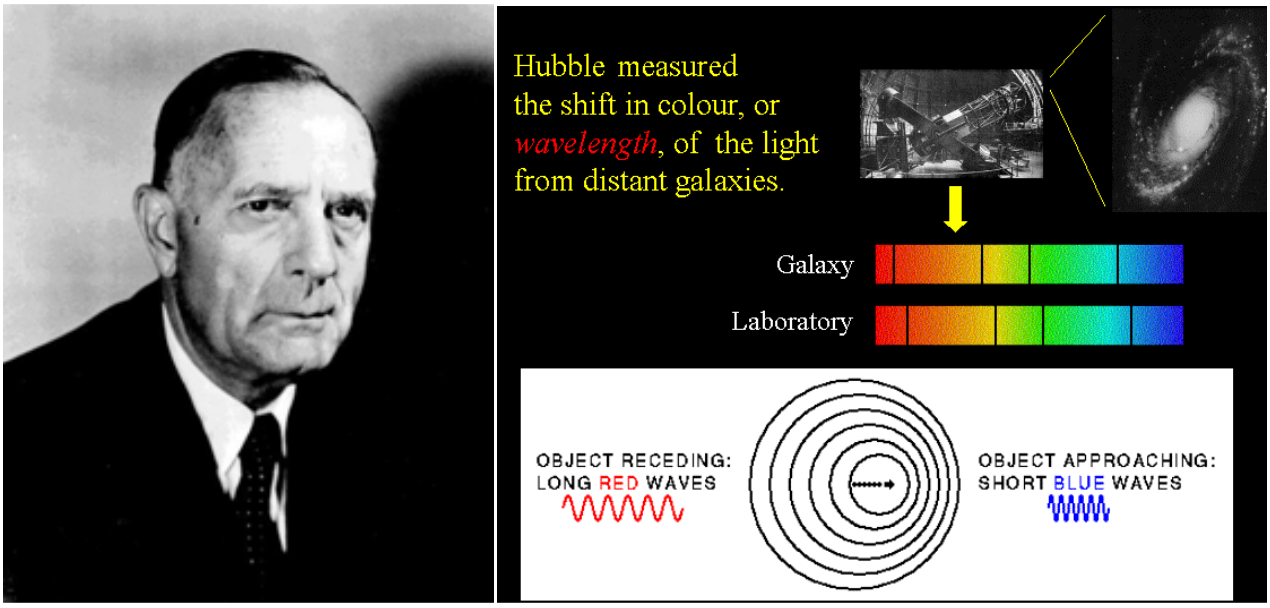
EXAMEN : BACCALAURÉAT GÉNÉRAL	SESSION 2013
ÉPREUVE : Évaluation spécifique de langue en section européenne	
PHYSIQUE-CHIMIE en langue ANGLAISE	**SUJET N°1**
Thème : « Ondes et matière »	

The expansion of the Universe



Hubble is known for showing that the universe is expanding.

The **Doppler shift** is readily observed in everyday life as the change in pitch* of sound waves, depending on whether they travel towards us or away from us. Approaching waves are "squashed" together, causing an increase in frequency and (in the case of light) a shift towards bluer colours; receding waves are "stretched" apart, causing a decrease in frequency and a shift towards redder colours.
Hubble's results were quite surprising. He found that, with the exception of a few, very systems, all galaxies were moving away from us - i.e. their spectral lines were always **redshifted**. Moreover, when one plotted the recession velocity versus distance of the galaxies a clear pattern emerged. The recession velocity appeared to be proportional to distance - i.e. one could fit a straight line through the data. There was considerable scatter in the relation, but the trend was clear; one simply didn't find nearby spirals with large recession velocities or distant spirals with small recession velocities.
Hubble interpreted his results not as evidence that galaxies were moving away from us through space, but due to the **expansion** of space between galaxies.

Source: http://www.astro.gla.ac.uk/users/martin/ase/runaway_ase.htm

pitch = hauteur du son

QUESTIONS

1. a. Present and comment this document.
1. b. Do not forget to focus on at least one physics and/or chemistry topic such as the explanation of the Doppler shift.
2. Do you know other applications of the Doppler shift in everyday life?