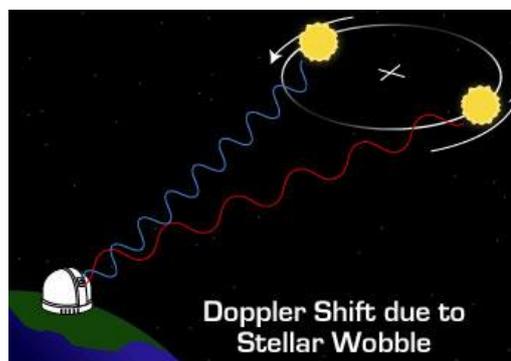


|  |         |
|--|---------|
| EXAMEN : BACCALAUREAT GENERAL                                |         |
| EPREUVE : Evaluation spécifique de langue section européenne |         |
| PHYSIQUE-CHIMIE en langue ANGLAISE                           | Sujet 4 |

## 20 years of exoplanets

5 Even though it seems likely that the galaxy is teeming with exoplanets, finding them isn't easy. Planets are millions of times dimmer than the stars they orbit and incredibly distant. (...) For example, if there were a planet orbiting Proxima Centauri, the nearest star, it would be 7,000 times more distant than Pluto. Trying to observe this planet would be like standing in Boston and looking for a moth near a spotlight in San Diego.

10 Precise measurement of the velocity or change of position of stars tells us the extent of the star's movement induced by a planet's gravitational pull. From that information, scientists can deduce the planet's mass and orbit.



15 Why does a planet cause a star to sway? If a star has a single companion, both move in nearly circular orbits around their common center of mass. Even if one body is much smaller, the laws of physics dictate that both will orbit the center of the combined star and planet system. The center of mass is the point at which the two bodies balance each other.

20 The radial velocity method measures slight changes in a star's velocity as the star and the planet move about their common center of mass. In this case, however, the motion detected is toward the observer and away from the observer. Astronomers can detect these variances by analyzing the spectrum of starlight. In an effect known as Doppler shift, light waves from a star moving toward us are shifted toward the blue end of the spectrum. If the star is moving away, the light waves shift toward the red end of the spectrum.

25 This happens because the waves become compressed when the star is approaching the observer and spread out when the star is receding. The effect is similar to the change in pitch we hear in a train's whistle as it approaches and passes.

30 The larger the planet and the closer it is to the host star, the faster the star moves about the center of mass, causing a larger color shift in the spectrum of starlight. That's why many of the first planets discovered are Jupiter-class (300 times as massive as Earth), with orbits very close to their parent stars.

Source: <http://planetquest.jpl.nasa.gov/page/methods>

*Dimmer : plus faible/sombre*  
*moth: papillon de nuit*  
*to sway: se balancer*  
*wobble : oscillation*

### Questions:

- 1- Present and comment on the text
- 2- What is "Doppler effect" ?
- 3- Why is it so difficult to see exoplanets ? How can we detect them ?
- 4- Why did we discover mainly Jupiter-class exoplanets ?
- 5- Why do you think scientists are interested in finding new exoplanets?