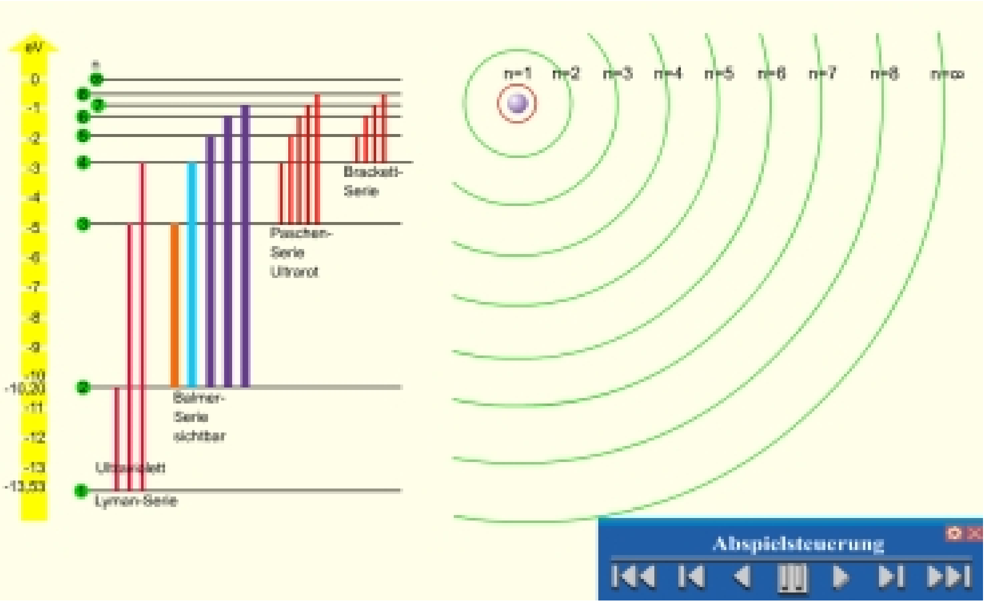
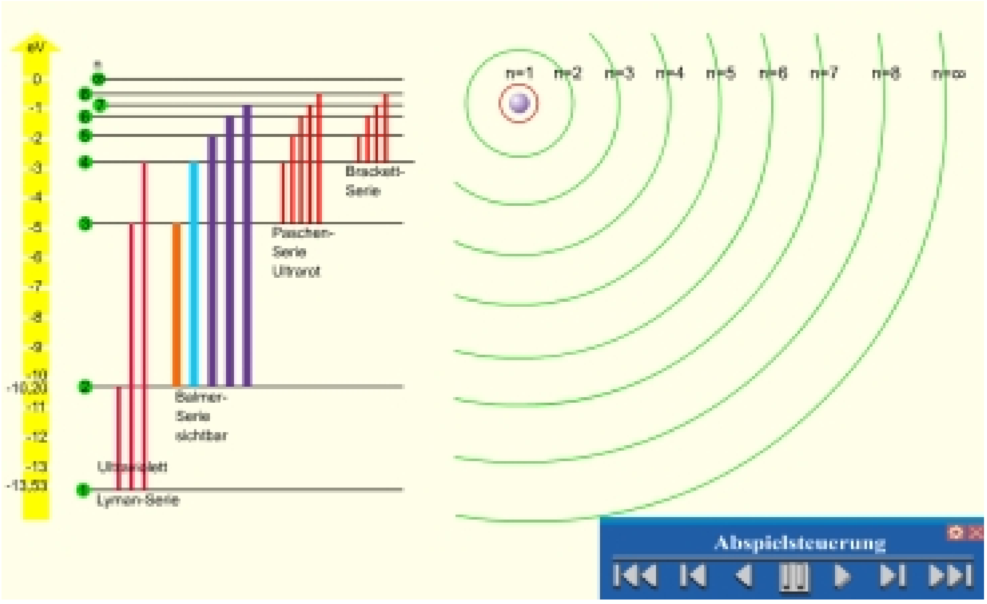
Spectral series of hydrogen



Attention: To see the animation, you need a player of macromedia (Flash5)
Author:: BIGS 2002 (C. Bluck, J. Gans, A. Gleixner, Prof. Heimbrodt, S. Stallmann)

Explanation

The quantum leaps are explained on the basis of Bohr's theory of atomic structure. From the Lyman series to the Brackett series, it can be seen that the energy applied forces the hydrogen electrons to a higher energy level by a quantum leap. They remain at this level very briefly and, after about 10^{-8}s, they return to their initial or a lower level, emitting the excess energy in the form of photons (once again by a quantum leap).



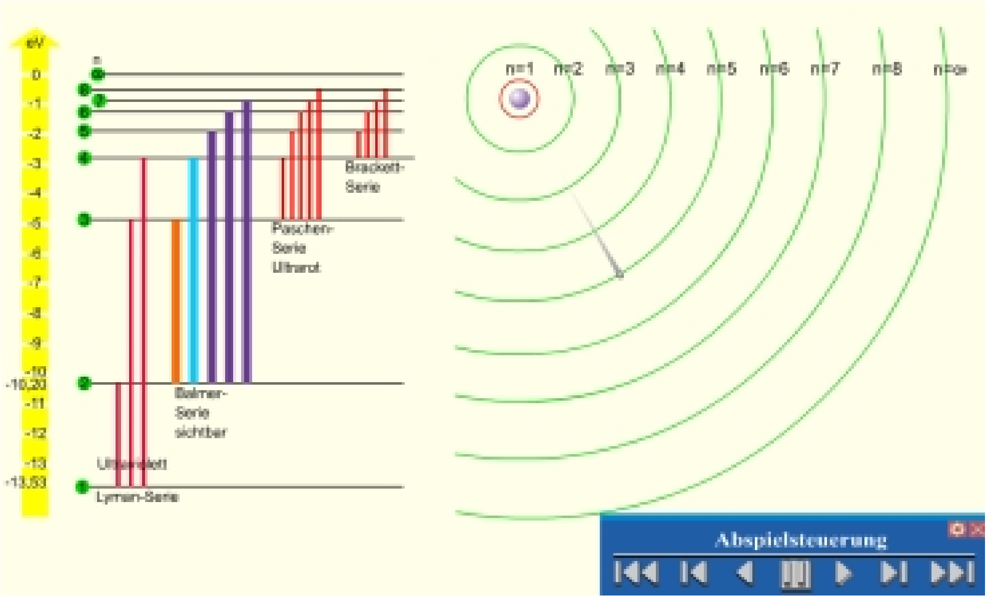
Explanation

Lyman series

Hydrogen atoms excited to luminescence emit characteristic spectra. On excitation, the electron of the hydrogen atom reaches a higher energy level. In this case, the electron is excited from the base state, with a principal quantum number of n = 1, to a level with a principal quantum number of n = 4. After an average dwell time of only about 10^{-8}s, the electron returns to its initial state, releasing the excess energy in the form of a photon.

The various transitions result in characteristic spectral lines with frequencies which can be calculated by $f=R(1/n^2 - 1/m^2)$ R = Rydberg constant.

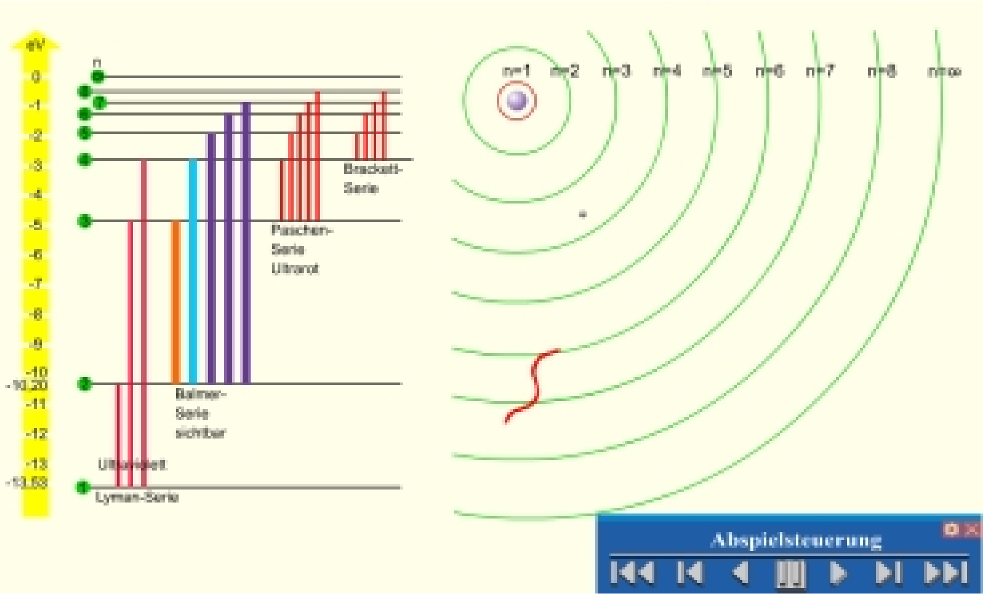
The lines of the Lyman series (n = 1) are located in the ultraviolet range of the spectrum. In this example, m can reach values of 2, 3 and 4 in succession.



Explanation

Balmer series

Hydrogen atoms excited to luminescence emit characteristic spectra. On excitation, the electron of the hydrogen atom reaches a higher energy level. In this case, the electron is excited from the base state, with a principal quantum number of n = 1, to a level with a principal quantum number of n = 4. The Balmer series becomes visible if the electron first falls to an excited state with the principal quantum number of n = 2 before returning to its initial state.
The various transitions result in characteristic spectral lines with frequencies which can be calculated by $f=R(1/n^2 - 1/m^2)$ R = Rydberg constant.
The lines of the Balmer series (n = 2) are located in the visible range of the spectrum.
In this example, m can reach values of 3, 4, 5, 6 and 7 in succession.



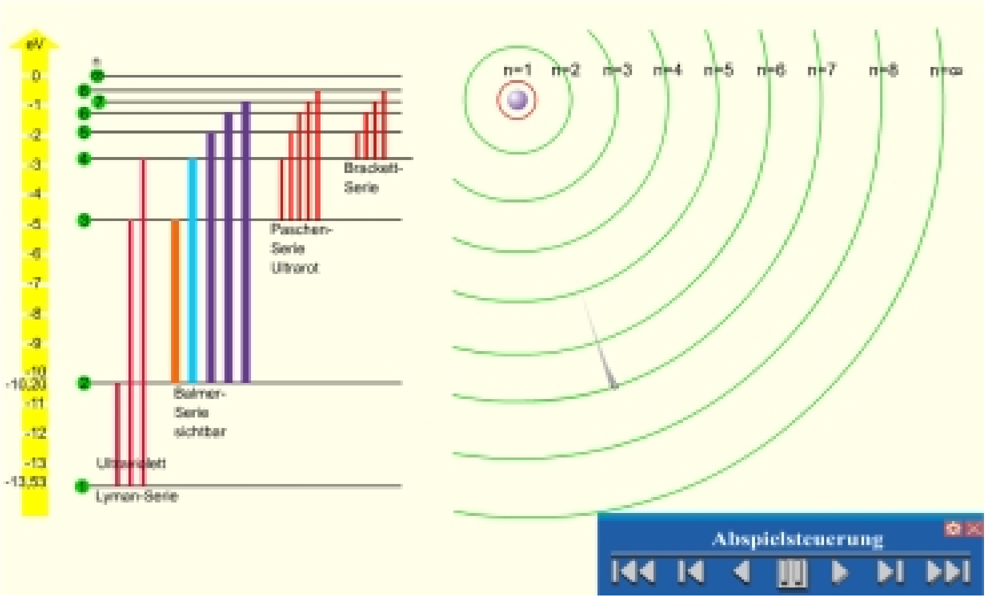
Explanation

Paschen series

Hydrogen atoms excited to luminescence emit characteristic spectra. On excitation, the electron of the hydrogen atom reaches a higher energy level. In this case, the electron is excited from the base state, with a principal quantum number of n = 1, to a level with a principal quantum number of n = 7. The Paschen series becomes visible if the electron first falls to an excited state with the principal quantum number of n = 3 before returning to its initial state.

The various transitions result in characteristic spectral lines with frequencies which can be calculated by $f=R(1/n^2 - 1/m^2)$ R = Rydberg constant.

The lines of the Paschen series (n = 3) are located in the near infrared range of the spectrum. In this example, m can reach values of 4, 5, 6 and 7 in succession.



Explanation

Brackett series

Hydrogen atoms excited to luminescence emit characteristic spectra. On excitation, the electron of the hydrogen atom reaches a higher energy level. In this case, the electron is excited from the base state, with a principal quantum number of n = 1, to a level with a principal quantum number of n = 8. The Brackett series becomes visible if the electron first falls to an excited state with the principal quantum number of n = 4 before returning to its initial state.
The lines of the Brackett series (n = 4) are located in the infrared range of the spectrum. In this example, m can reach values of 5, 6, 7 and 8 in succession.