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Excess Energy of Delocalized Bohr Orbit

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Abstract: *The excess energy of delocalized Bohr orbit was calculated.*

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1. Introduction

Suppose an electron in the ground state of a hydrogen atom can delocalize from a Bohr orbit 137 Compton wavelengths to an orbit half a wavelength shorter, that is, 136.5 λe, and also to an orbit half a wavelength longer, that is, 137.5 λe. The difference in orbital length is accompanied by a difference in energy. [1] Energy is released (negative sign) during the contraction to a lower shorter orbit; energy is consumed (positive sign) during the expansion to an upper longer orbit. When the Bohr orbit of 137 λe contracts, slightly more energy is released than is consumed when that orbit expands. In our case, we are dealing with an excess of delocalized energy of the Bohr orbit (negative sign), which is the result of the contraction and expansion of the Bohr orbit during delocalization.

2. The Estimation of Excess Energy of Delocalized Bohr Orbit

The excess energy of a delocalized Bohr orbit is the sum of the energy of the orbit below and the energy of the orbit above the Bohr orbit:

$$E_{delocalized} = E_{below} + E_{above}\,. \qquad (a)$$

The excess energy of a delocalized Bohr orbit can be estimated knowing the corresponding change in the length of the Bohr orbit, expressed in Compton wavelengths of the electron, and the Rydberg constant Ry = 13.605 693 122 990 eV [1]:

$$E_{delocalized} = \left(1 - \frac{137}{137 - 0.5}\right) Ry + \left(1 - \frac{137}{137 + 0.5}\right) Ry. \qquad (b)$$

Yielding

$$E_{delocalized} = \left(2 - 137\frac{136.5 + 137.5}{136.5\;x\;137.5}\right) Ry = -\frac{2}{75075} Ry = -0.000\,362\;eV. \qquad (c)$$

And energy equivalent 4.2 K

3. Conclusion

Of course, if the concept is true, according to available data [2], the heat release in the Bohr orbit delocalisation could play a key role in low-temperature hydrogen processes in fields such as cryogenics, superconductivity, and fusion energy research.

References

[1] Janez Špringer. " Minimum Added Energy to Ground State of Hydrogen Atom" International Journal of Advanced Research in Physical Science (IJARPS), vol 12, no. 01, pp. 21-22, 2025

[2] https://www.perplexity.ai/search/hydrogen-atom-at-4-2-k-Lwsydq8xTWaUpw404gyNeA. Retrieved January 2025

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