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Phys 453 project

Instantons

When studying quantum tunnelling, you have encountered a strange case where the wavefunction is inside the potential barrier, you would ask what is this wavefunction correspond to ? How a particle would exist inside the potential ?

The answer is it is something close to a particle, it is called an *instanton*, ot a semi-particle. Instantons have a huge importance in modern physics and many applications, from condensed matter physics to particle physics and gravitation. They are basically a classical solution to the system when we let the time be Euclidean , i.e. $t \to i\tau$.

In this project, you are advised to read the attached references and summarise your understanding on instantons in quantum mechanics in the following points

1. Quick review on path integrals
2. Introduction to Instantons and their applications
3. Mathematical definition
4. Example of instanton solutions in quantum mechanics.

You should include the references in your project

○ Vaĭnshteĭn, A. I., et al. "ABC of instantons." Soviet Physics Uspekhi 25.4 (1982): 195.
○ Zinn-Justin, Jean. "Expansion around instantons in quantum mechanics." Journal of Mathematical Physics 22.3 (1981): 511-520.

Best Regards,

Dr Salwa Alsaleh