Geometry of Quantum Mechanical Tunneling: Solution to the Navier-Stokes Equation

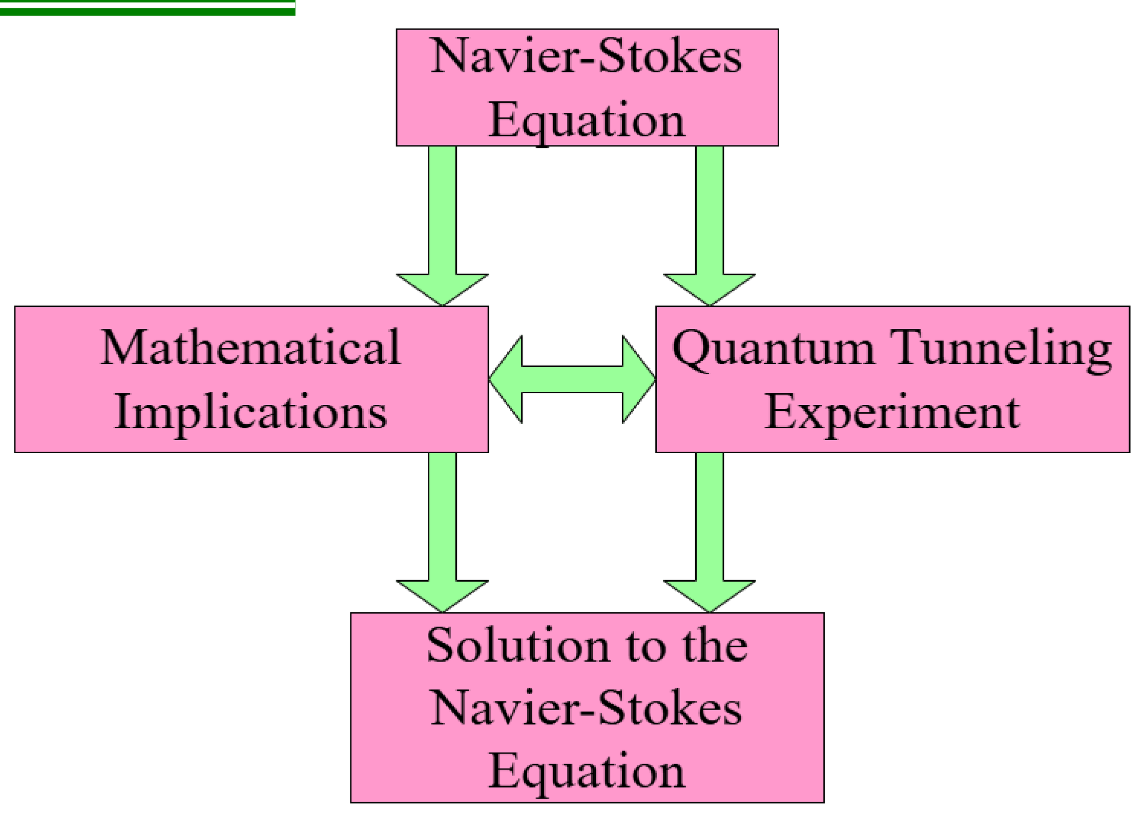
Raghvendra Singh

Supervisor: Prof. N. M. Singh

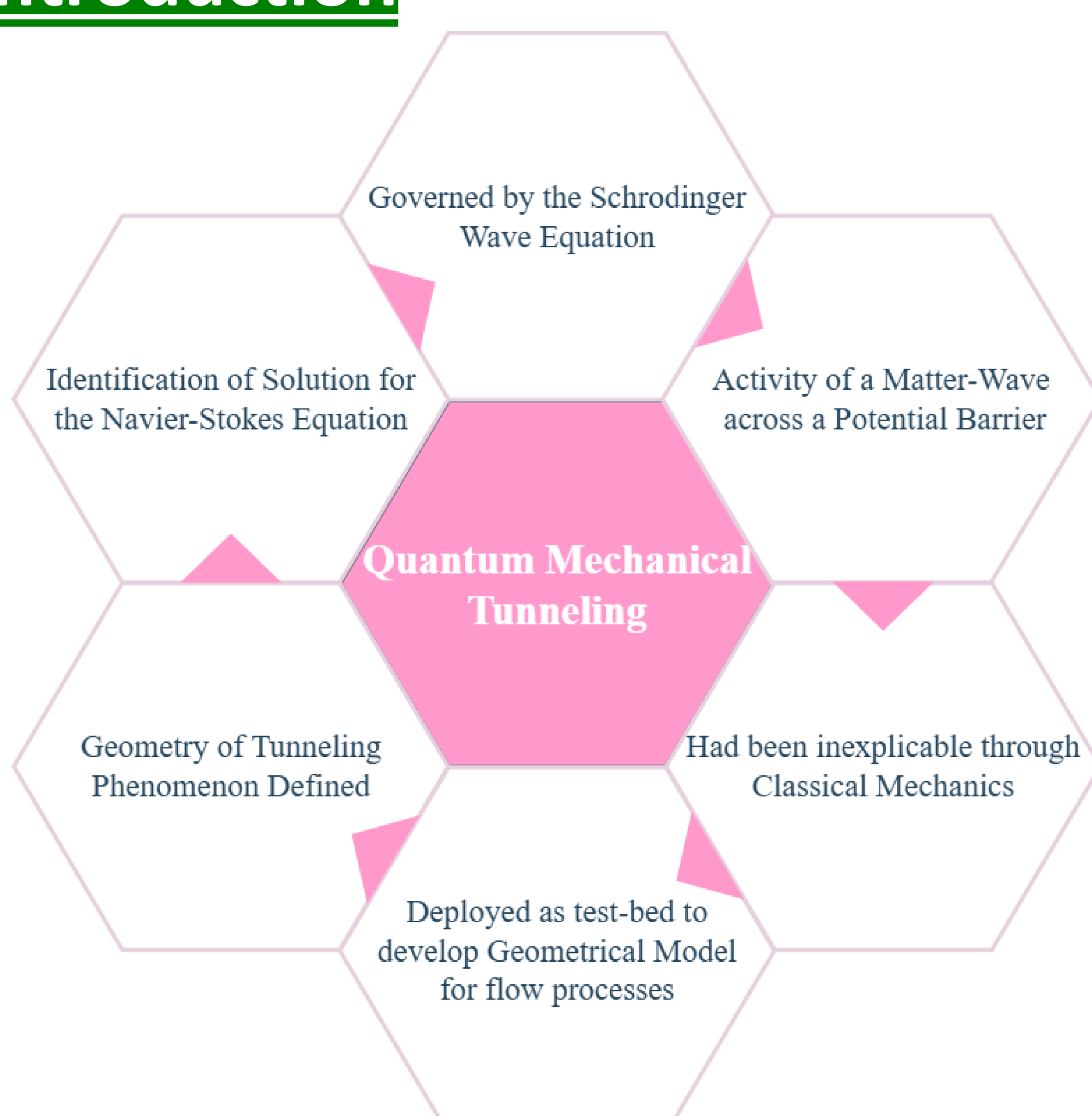
VJTI

EED, VJTI

Abstract:

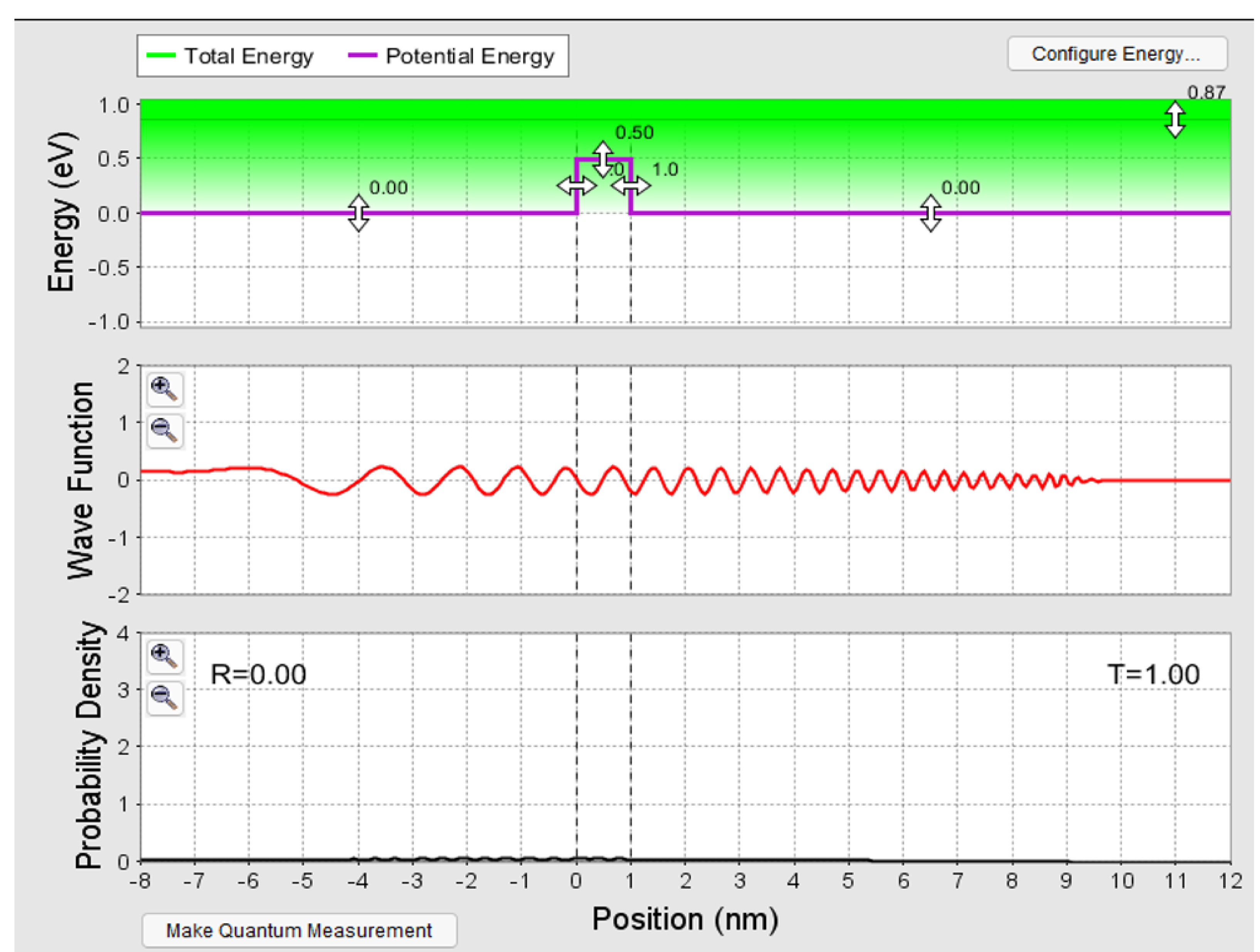


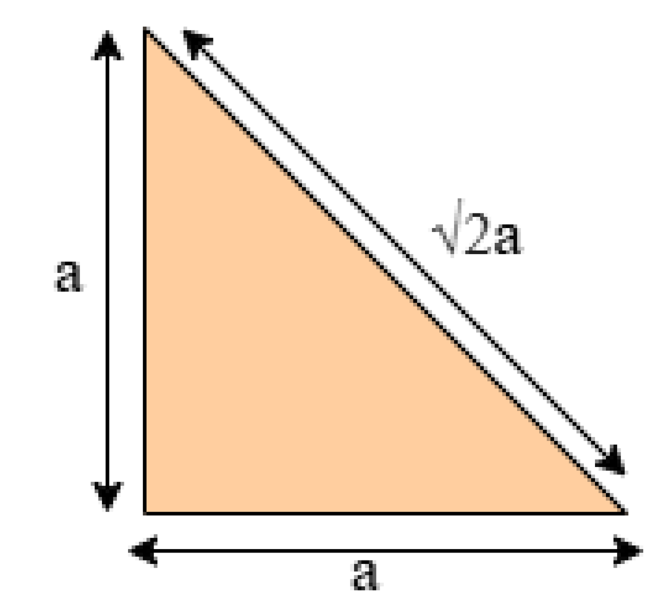
Introduction



Quantum Tunneling:

- In linear quantum tunneling through a square potential barrier, the geometric degeneration of orthogonal components of the matter-wave along the potential barrier is the RMS value of the associated components.
- For three dimensional matter-wave, considering the orthogonal components as unity, coefficient of the RMS value is 1.732.
- In simulation cases, the ratio of 1:1.732 of the potential energy to the incident energy is observed for a 100% transmitted wave.
- This property of the matter-wave makes it describable through a Riemannian manifold with three contravariant indices and one covariant index.
- The contravariant indices represent spatial dimensions, and the covariant index is representative of the dimension of time.





(c)

Mathematical Implications:

The inferred results guides us to describe any object as a discrete point x, upon which the following operation is performed:

$$f(x) = (\sqrt{nx} - \sqrt{x})^2$$

$f(x) = x$, when $n = 0$ or 4, and the coefficient of x is 1

This function defines a four dimensional Riemannian manifold which have three contravariant indices and one covariant index, exhibiting the geometry of matter-wave understood from the Tunneling phenomenon.

The differential of this function is:

$$f'(x) = -2\sqrt{nx} / \sqrt{x} + n + 1$$

This expression is in fact the continuity form of the Navier-Stokes equation conventionally expressed as:

$$\partial \rho / \partial t + \nabla \cdot (\rho v) = 0$$

Here the term $\partial \rho / \partial t$ is equivalent to the left hand side of the previous equation, and the term $\nabla \cdot (\rho v)$ is equivalent to the right hand side of the same equation.

We have hereby developed a solution to the Navier-Stokes equation which explains the existence of four dimensional reality.

Conclusions:

- Thus through the study of quantum mechanical tunneling we are able to gain a solution for the Navier-Stokes equation. Quantum tunneling is reckoned to be analogous with the case of macroscopic body collisions like that of a bike and a truck wherein the action-reaction forces are transmitted equally in the two opposite directions.
- In the case of tunneling this had long being interpreted as a reflection and transmission of waves. Notably it is fact that divergence in time for macroscopic phenomenon is too minuscule and non-inferential, that we had missed on the practical similarities of the two cases.
- In the standard Navier-Stokes equation, when the differentiation with respect to time is zero, we have a static body which is the case with every solid non-deforming body.
- Any kind of deformation, in space and time, is the result of a difference in the energies in the system under consideration.

References:

1. Eddi, A. and Fort, E. and Moisy, F. and Couder, Y., Unpredictable Tunneling of a Classical Wave-Particle Association. Phys. Rev. Lett., 24, 102 (2009). https://link.aps.org/doi/10.1103/PhysRevLett.102.240401
2. Wang, ZY. Generalized momentum equation of quantum mechanics. Opt Quant Electron 48, 107 (2016). https://doi.org/10.1007/s11082-015-0261-8

Acknowledgement:

The author also acknowledges the facilities provided by the E-MC[2] Lab.