African School of Fondamental Physics
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African School of Fundamental Physics and Applications

INFLUENCE OF RADIAL DISLOCATIONS IN THE DYNAMIC INSTABILITY OF MICROTUBULES

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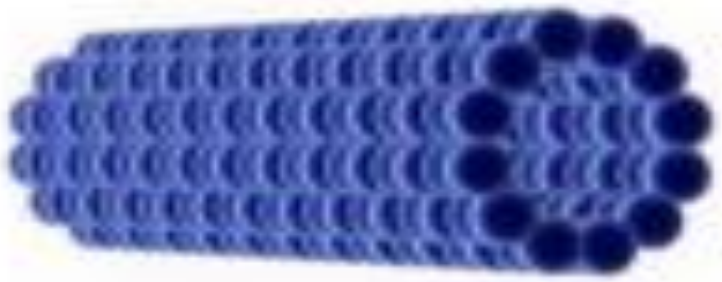
What is a fundamental problem?

Alzheimer disease is a type of dementia that causes problems of memory, thinking and behavior.

How occurs this disease?

Recently it was emitted the hypothesis that Alzheimer disease is related to microtubules dysfunctions

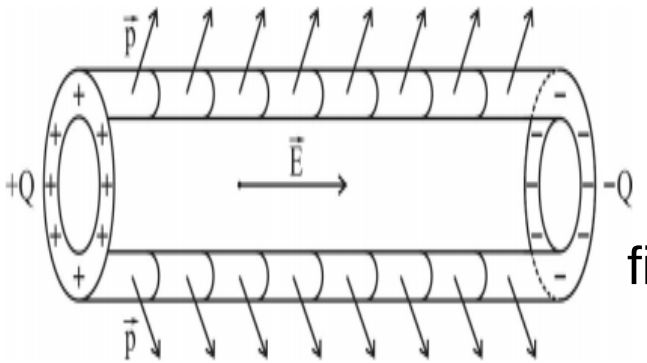
microtubule



In neurons, microtubules respond instantly to mental events and constantly build and take down elaborate structures for the rapidly changing axons and dendrites of the synapses. Some think that microtubules are quantum computers and the seat of consciousness.

With the aim to discover the appropriate treatment of this disease we want to understand the brain’s mechanisms related to dynamic instability of microtubules.

Our objective is to resort the more realistic and theoretical model of the dynamic of microtubules.



Physical representation of microtubule's model

Where P represent a dipolar moment, E is an intrinsic electric field, Q is a charge

The Hamiltonian for the one protofilament is represented as follows:

$$H = \sum_n \left[\frac{m}{2}\dot{U}_n^2 + \frac{K}{2}\left(U_{n+1} - U_n\right)^2 - qEU_n + \left(-\frac{1}{2}AU_n^2 + \frac{1}{4}BU_n^4\right) - PECosU_n \right]$$

Dipolar potential energy

Double quadratic well potential

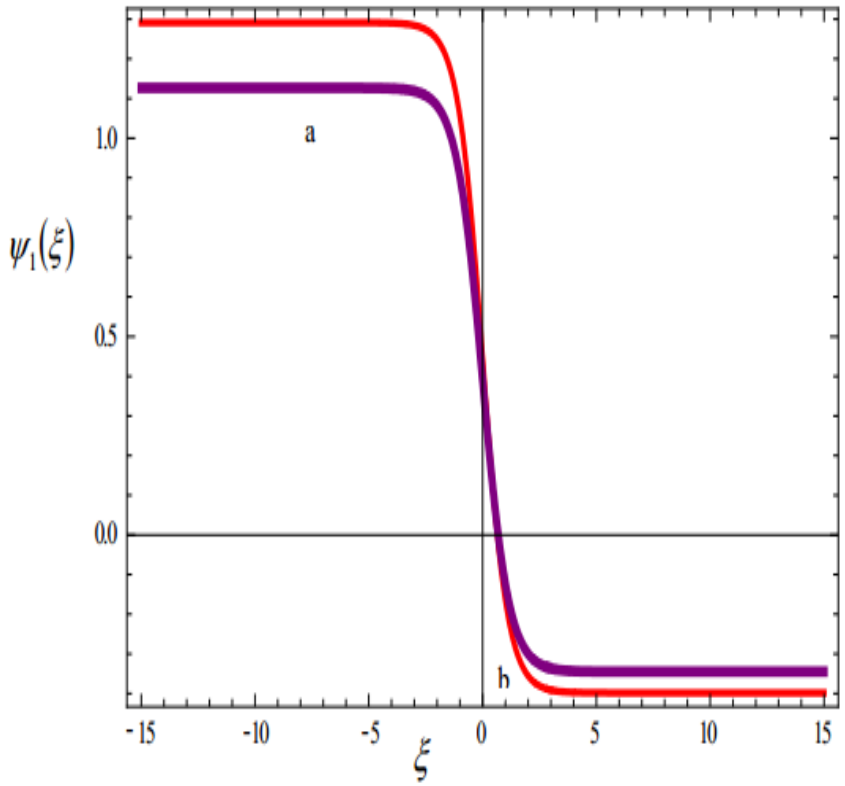
Electric potential

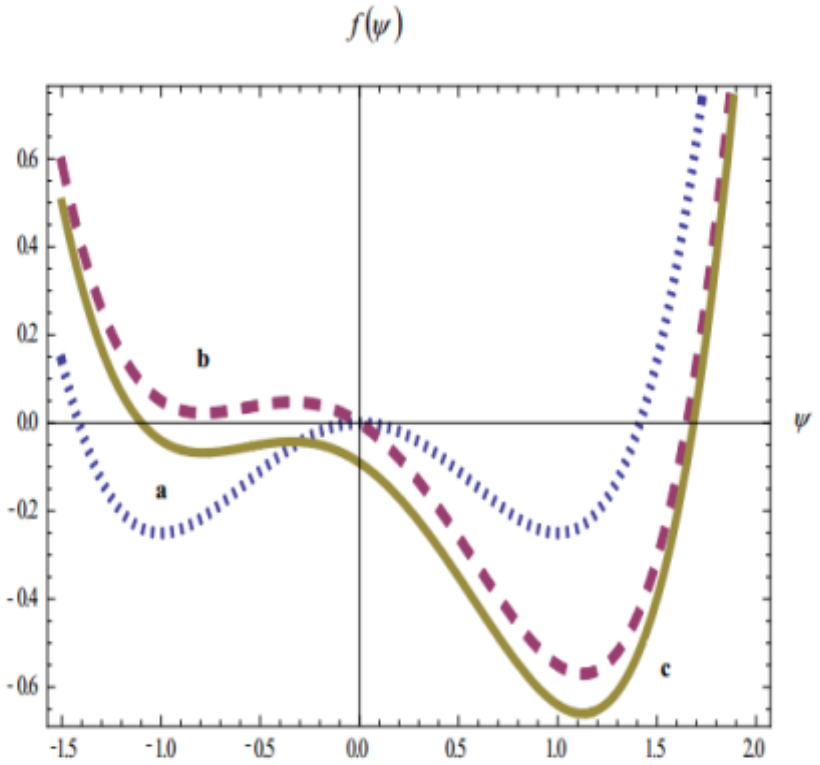
Elastic potential

Kinetic energy

The microtubule's movement is giving by this nonlinear partial differential equation

$$\alpha\psi'' - \rho\psi' - \beta\psi + \lambda\psi^3 - \sigma = 0$$





In order to solve our fundamental problem which is a Alzheimer disease we have opted to an electronic chip modeling which will be able to be incorporated in the brain to replace the microtubules destroyed.

This chip will be built from the circuit deriving from the movement’s equation.

The real problem that we encounter is linked to the fact that the differential equation which modeled the movement depends on both time and space.

Thanks for your kind attention