

***Desigualdades de Bell em Mecânica  
Quântica***

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# **Content**

- 1) Product and entangled states: the example of the spin  $1/2$  states.**
- 2) Bell's states**
- 3) Bell's dichotomic operators.**
- 4) The Bell-CHSH inequality**
- 5) Tsirelson's bound**
- 6) Gisin theorem for pure states. Check of Gisin's theorem**
- 7) Generalization of the Bell-CHSH inequality to spin 1**
- 8) Spin  $j$  particles: the pairing mechanism. Odd and even spin**
- 9) Bell-CHSH for continuous variables. The case of the momentum and of the coordinate. Weyl operators. Weyl algebra. Bell's gaussian state. Violation of the Bell-CHSH inequality.**
- 10) Bell-CHSH inequality for Infinite dimensional Hilbert spaces: Harmonic oscillator. Fock space. Pseudo-spin operators.**
- 11) NOON states**

***12) Coherent states in Quantum Mechanics. Properties and applications. Displacement operator and its algebra***

***13) Coherent entangled states.***

***14) Schroedinger cat's states***

***15) Squeezed states. Entanglement and Bell-CHSH violation***

***16) Squeezed states and Bogoliubov transformations***

***17) Inequalities for multipartite systems: the Mermin inequalities.***

***18) GHZ (Greenberg-Horne-Zeilinger) states and maximal violation of the Mermin inequality***

***19) Entanglement and mixed states***

***20) The PPT criterion***

***21) The Werner states***

## ***Bibliography***

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- 2) A. Peres: “Quantum Theory: Concepts and Methods”, Springer, 1995**
- 3) M. A. Nielsen and I. L. Chuang: “Quantum Computation and Quantum Information”, Cambridge, 10th anniversary Edition**
- 4) V. Scarani: “Bell Nonlocality”, Oxford Graduate Texts, 2019**