

Insalate di Matematica  
*presents*

# Introduction to noncommutative probability

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## Abstract

In the first half of the twentieth century Kolmogorov introduced the axioms of classical probability theory; however Quantum Mechanics showed a behaviour which could not be explained within this framework. A more general probability theory incorporating noncommutative structures was formalized by Von Neumann giving birth to Quantum Probability. We will introduce the notion of quantum probability space in finite dimension and we will show how classical probability spaces can be seen as a special instance of quantum probability spaces. On the other hand through Bell's inequality we will see that the converse is not true. We will then present the quantum analogue of the simplest random variables and stochastic processes: Bernoulli random variables and a Bernoulli random walk.



## Keywords:

Noncommutative probability · quantum Bernoulli variables ·  
Bell inequality

*"Obvious" is the most dangerous word in mathematics. - Eric Temple Bell*