



## AN AESTHETIC PICTURE OF THE QUBIT. THE BLOCH BALL

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**Abstract.** A simple description of the Bloch ball is given.

This note I am writing most warmly congratulating Jan to his seventieth birthday. We met one another first, I think, in the middle of the seventieth at one of the famous conferences and workshops organized by H.-D. Doebner at the Arnold Sommerfeld Institut für Mathematische Physik in Clausthal-Zellerfeld. Because of similar interests and kinds of thinking we stay in contact since then. We met us every year at conferences and workshops at different places, rather often in Toruń. He visited our institute at the Technische Universität Berlin several times and I thank him for his talks given at my birthday and retirement colloquia.

Since I have no new results to present, I will shortly tell what came into my mind lecturing after my retirement on quantum information during 2002 through 2011. The operational approach to quantum physics is for me the most convincing and fascinating respective axiomatics. It stresses the common roots of probability theory and quantum theory and restricts itself to assume only axioms of very high degree of evidence. It has been set up step by step mainly in the the work on foundations of quantum theory by Günther Ludwig [7] and later work. A comprehensive representation in mathematical language has been given in Gudder [5]. According to this approach the states of a quantum theory form a convex set of positive elements in a real, ordered Banach space forming the base of the positive cone of a base-norm-space whereas the primitive observables (effects in Ludwig's language, yes-no observables in the language of Jauch and Piron) are given by the elements of the order unit interval in the its Banach dual which is an order-unit-space. This is generally less known among physicists. But earlier and generally well known is the representation of qubit states in the so-called Bloch ball which is