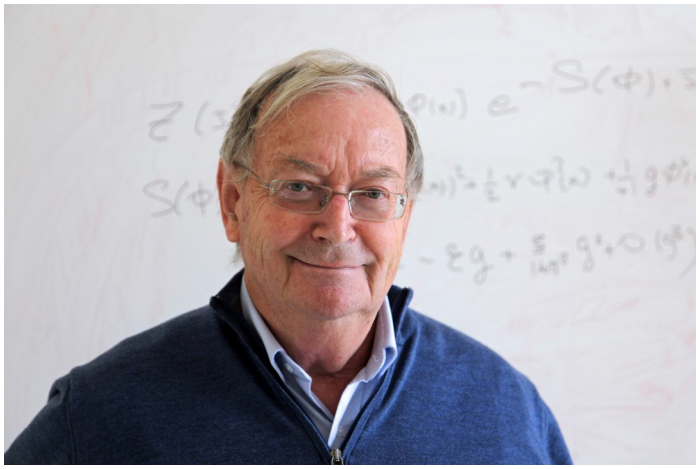
Functional integration: a major tool of modern theoretical physics

Jean Zinn-Justin

Nuclear Research Centre, Saclay, France



Functional integration has played, and still plays, an important role in different areas of physics. The main reason is that while for a long time physics phenomena could be described by equations, in the twenties century, increasingly the main problems were related to systems with large, quantum or statistical fluctuations. A few examples of problems for which functional integration has played an essential role are quantization and renormalization of non-Abelian gauge theories, relation between quantum field theory and statistical physics of macroscopic phase transitions, the origin of the variational principle in classical physics. Most of the topics require many lectures. Here, we concentrate on barrier penetration effects and large order behavior in quantum mechanics quantum field theory and, if time is left, fields with many components (large N techniques).

J. Zinn-Justin, *Quantum Field Theory and Critical Phenomena*, 4th Edition (Oxford University Press, Oxford, 2002)

J. Zinn-Justin, *Path Integrals in Quantum Mechanics*, (Oxford University Press, Oxford, 2005)

J. Zinn-Justin, *Phase Transitions and the Renormalization Group*, (Oxford University Press, Oxford, 2013)