

Path Integral Quantization

Adrian P. C. Lim

Department of Mathematics, Cornell University

Email: pclim@math.cornell.edu

Abstract

A typical path integral on a manifold M , is an informal expression of the form

$$\frac{1}{Z} \int_{\sigma \in H(M)} f(\sigma) e^{-E(\sigma)} \mathcal{D}\sigma, \quad (1)$$

where $H(M)$ is a space of paths in M with energy $E(\sigma) < \infty$, f is a real valued function on $H(M)$, $\mathcal{D}\sigma$ is a “Lebesgue measure ” and Z is a normalization constant. The use of path integrals for “quantizing” classical mechanical systems (whose classical energy is E) started with Feynman in [2] with very early beginnings being traced back to Dirac [1]. In this talk, I will give several rigorous definitions to Equation (1), by reviewing work done by Driver and Andersson and recently by me. The idea is to approximate $H(M)$ by finite dimensional subspaces consisting of broken geodesics and then to pass to the limit of finer and finer approximations.

References

- [1] P. A. M. Dirac, *Physikalische Zeitschrift der Sowjetunion* **3** (1933), 64.
- [2] R. P. Feynman, *Space-time approach to non-relativistic quantum mechanics*, *Rev. Modern Physics* **20** (1948), 367–387.