998-81-135 **George A. Hagedorn*** (`hagedorn@math.vt.edu`), Department of Mathematics, 422 McBryde Hall, Virginia Tech, Blacksburg, VA 24061-0123, and **Alain Joye**, Institut Fourier, Universite de Grenoble I, BP 74, F–38402 St Martin d'Heres, France. *Time Development of Exponentially Small Non–Adiabatic Transitions.*

We study the adiabatic approximation for the time–dependent Schrödinger equation, *i.e.*, the small ϵ asymptotics of solutions to

$$i\,\epsilon\,\frac{\partial\psi}{\partial t} \;=\; H(t)\,\psi.$$

For a particular analytic two–level Hamiltonian function $H(t)$, we use optimal truncation of an asymptotic expansion to construct an approximate solution that agrees with the exact solution up to an exponentially small error. The exact solution has norm 1, and the norm of the error is bounded by $C_1\,\exp(-\,\Gamma/\epsilon)$, where C_1 and $\Gamma > 0$ are the best possible for an adiabatic approximation. We then rigorously compute the leading order exponentially small correction to this approximate solution for all times t.

The correction term describes a true non–adiabatic transition. Its behavior is consistent with the universal behavior predicted in the physics literature by Sir Michael Berry. (Received February 21, 2004)