998-81-95 **George A Hagedorn** (hagedorn@calvin.math.vt.edu), Department of Mathematics, Virginia Tech, Blacksburg, VA 24061-0123, and **Julio H Toloza*** (htoloza@uaeh.reduaeh.mx), Centro de Investigacin en Matemticas, Universidad Autnoma del Estado de Hidalgo, Carretera Pachuca-Tulancingo Km. 4.5, 42090 Pachuca, Hidalgo, Mexico. *A Time-Independent Born-Oppenheimer Approximation with Exponentially Small Error Estimates.*

We consider a simple molecular–type quantum system in which the nuclei have one degree of freedom and the electrons have two levels. The Hamiltonian has the form

$$H(\epsilon) \;=\; -\frac{\epsilon^4}{2}\frac{\partial^2}{\partial y^2} \;+\; h(y),$$

where $h(y)$ is a 2×2 real symmetric matrix. Near a local minimum of an electron level $\mathcal{E}(y)$ that is not at a level crossing, we construct quasimodes that are exponentially accurate in the square of the Born–Oppenheimer parameter ϵ by optimal truncation of the Rayleigh–Schrödinger series. That is, we construct E_ϵ and Ψ_ϵ, such that $\|\Psi_\epsilon\| = O(1)$ and

$$\|\,(H(\epsilon) \,-\, E_\epsilon))\,\Psi_\epsilon\,\| \;<\; \Lambda\,\exp\left(-\Gamma/\epsilon^2\right), \qquad \text{where} \quad \Gamma > 0$$

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