Time Independent Perturbation

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1 What: What are we doing

Time dependetnt perturbation theory takes advantage of potentials which can be written as a combination of a analytic part (Normally a larger contribution) and a perturbative (normally smaller) potential which would normally make the problem non-analytic. Via perturbation theory we can write our 'unsolvable' eigenvalues in a similar way to a power series in terms of our solved, non perturbed eigenstates. In this way we can neglect 'higher order' terms in order to get an approximate solution with increasing accuracy based on each order.

For time dependent perturbation theory we turn to the time dependent schrodinger equation, which tells us the connection between the Hamiltonian and our systems evolution in time. Whatever our state vector is, it will obey the time dependent schrodinger equation, so we can write our state vector as a linear combination of our unperturbed states (our unperturbed states form a complete basis, so this is not approximate), including the time dependence in the form of complex exponentials with the corresponding energy. We can also expand our Hamiltonian. Upon applying the product rule on our time dependent coefficients and our exponential time dependence, we can cancel terms and are left with an expression relating two sums.

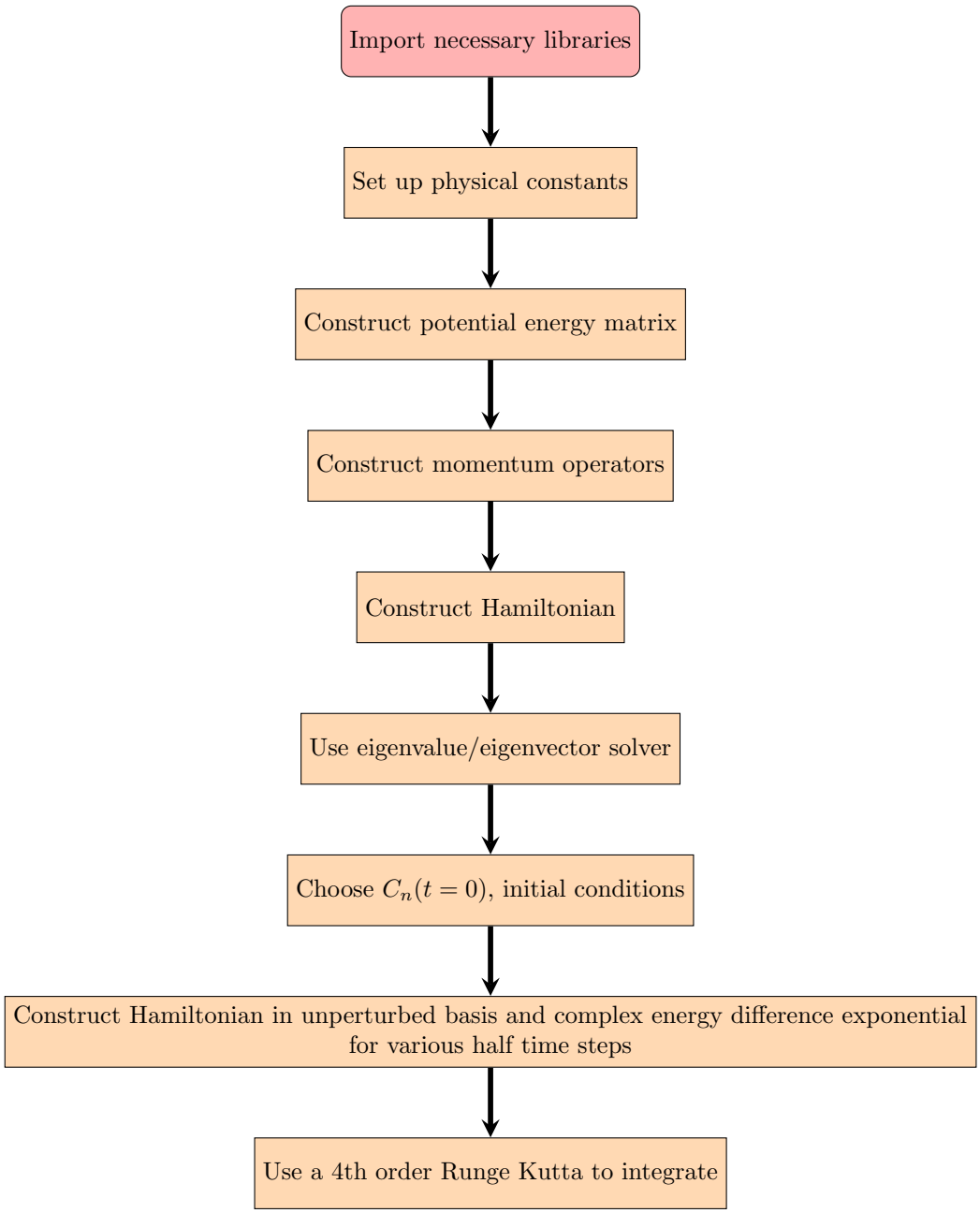
Like we do often to simplify these sums, we can take the inner product with the mth eigenstate of our unperturbed state, and from it we receive a series of linear equations for our time dependent coefficients.

From here we can simplify further by implementing approximations, such as that our system began in an eigenstate of our unpertubed system, a decent approximation for systems whre the perturbation 'turns on' at some point. We can also assume that the coefficients of our eigenstates remain relatively constant over time. This is in line with observation that we may take repeated measurements of our system and it will collapse to an eigenstate, so we expect that between two observations seperated by time tau, we can see a probability favoring remaining in the same state but with a small possibility of transitioning to another state.

In code, we have a simpler setup than required for our time dependent case. Really, all we are watching is the change in our c coefficients, which are really just our a_n coefficients, I believe. Any differences between the two would be minute if not cosmetic

2 Why: Why are we doing it

3 How: How are we designing this? AKA Pseudocode



4 How: Future steps