Study of STIRAP-Like Transfer for N-Level Systems

Introduction
Stimulated Raman Adiabatic Passage (STIRAP) is a method of using lasers to complete population transfer between two states in a 3-level quantum system without populating an intermediate state. We want to extend this technique to N-level systems in order to control population in an infinite-dimensional system such as a trapped ion for the purpose of use as a qubit in a quantum computer [1]. Becoming familiar with quantum mechanics, STIRAP and studying the work that has been done so far for this extension to N-level systems is the focus of my research position. The goal is to use what I have learned to continue work on a paper which aims to optimize the application of STIRAP to an N-level system.

Method
The first step was to become familiar with quantum mechanics and 3-Level STIRAP.

Results and Discussion
Above is an example of time delay of pulses affecting population transfer. Here the Rabi frequencies of the pulses are of the form: $\Omega_{x,y}(t) = \Omega(t-\tau)$, where $f(t)$ is a Gaussian pulse and $\tau$ is the time delay[5].

With a knowledge of N-Level STIRAP-like transfers, I can begin research on trapped ion in a harmonic potential. With the experience I gained graphing the 3-level system I will be able to graph data for this system. I will also be able to perform necessary calculations thanks to my initial studies into quantum mechanics. I have already begun making edits to the paper and will continue to work on this project in the fall semester. I would like to recommend looking into the method of adiabatically eliminating off resonant intermediate states[5].

Sharing Methods in the Art of Rewarding Teaching in Science
As a result of the University of Windsor’s new hiring initiative, there will be 50 new professors hired in the next three years[6]. The aim of this project is to develop a weblog to feature award winning teacher-professors from science providing their most successful teaching tip so that it may benefit a new professor in science.

Working alongside a student from the faculty of business, we devised a name for the weblog: SMARTS (Sharing Methods in the Art of Rewarding Teaching in Science). A logo was created and a template for the website was also selected. A series of interview questions were developed. A list of professors that have been acknowledged for their excellence in teaching was compiled. Interviews were performed. Blog entries highlighting the tip were written.

Now that the content and design for the website has been created, all that is left to do is for the website to be coded and set up online by a developer. The SMARTS blog will be launched in September.

Physics and Society: Course Development
Physics and Society is a second year physics course geared towards non-science students. Compared to the first year Astronomy courses, enrollment in Physics and Society is much lower. The purpose of this project is to improve the course to encourage higher enrollment as well as to encourage interest in physics.

In order to assess a bank of already existing questions for the course, it was necessary to complete a training session on the use of Blackboard. Assessment of over 1000 multiple-choice questions was completed. The correctness, quality and clarity of questions were assessed. Several meetings took place where a project for students in the class was discussed. A list of topics was compiled that relate physics back to societal concerns that would interest a variety of students. These topics will form the basis for the project.

With an evaluation of the test bank completed, the course now has a solid testing material for student. Perhaps, it would be useful once the class is complete, to request student input on what they believe would improve the class in order to make it even more appealing. I will continue to work on this project by helping to edit online lectures.

References

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