THE MATHEMATICS OF THE HYDROGEN ATOM

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The object of this course is to develop the mathematical model for the hydrogen atom (and, in a more approximate sense, other atoms) that explains the structure of the electron shells and leads to a theoretical basis for the periodic table of elements. The emphasis is on the exploitation of the rotational symmetry of the problem to guide the way to the solution. This goal provides an opportunity to see how algebra (mostly linear algebra) and analysis can be used together to analyze a situation, and to introduce some more advanced mathematical subjects such as Hilbert spaces and Lie groups.

We will work through as much as possible of the book *Linearity, Symmetry, and Prediction in the Hydrogen Atom* by Stephanie Frank Singer.

Prerequisites: The required prerequisites are (i) Math 308 or Math 136; (ii) Math 324 and 327 or Math 334 and 335; (iii) Physics 121-2-3. Also recommended are at least one 400-level math course (402 is particularly relevant) and/or at least one 200 or 300 level physics course.