

**Homework due May 8, 2009 for Physics 623, Spring 2009, O.W.
Greenberg**

Your name must be written in large legible letters.

1. Consider the Klein-Gordon equation with an attractive square well potential of depth $-|V_0|$ and range R . Find the weakest potential that produces an S-wave bound state
 - (a) if the potential is introduced as the time component of the vector potential;
 - (b) if the potential is introduced as a scalar potential, i.e. as a mass term.
2. Find a 5th anticommuting matrix in addition to α_i and β .
3. Derive a formula for $\gamma^\mu \gamma^\nu$ in terms of $g^{\mu\nu}$ and $\sigma^{\mu\nu} = i[\gamma^\mu, \gamma^\nu]$.
- In 4. and 5. express your work in terms of the 2x2 identity matrix and the Pauli matrices.
4. Derive a set of gamma matrices in which $\gamma^5 = i\gamma^0\gamma^1\gamma^2\gamma^3$ is diagonal.
5. Derive a set of gamma matrices that are pure imaginary.