

Due Date: 11-05-08

## Nuclear Physics 621

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### Homework 7 - Spin operators, deuteron

- a) Show that the triplet and singlet wave functions are eigenvectors of the operator

$$P^{\sigma} = \frac{1}{2} (1 + \vec{\sigma}_1 \cdot \vec{\sigma}_2)$$

With the eigenvalues of +1 and -1, respectively.

- b) Consider a simplified deuteron potential of the form

$$V(r) = f(r) (1 + a\vec{\sigma}_1 \cdot \vec{\sigma}_2)$$

where

$$f(r) = \begin{cases} -V_0, & r \leq R \\ 0, & r > R \end{cases}$$

This gives rise to a square well potential where the depths become different for the triplet and singlet wave functions. Scattering data show that  $V_{\text{triplet}} \approx 2V_{\text{singlet}}$ . Determine the constant  $a$ .