Abstract Submitted
for the SES08 Meeting of
The American Physical Society

The Padua Algorithm for the Computation of Deuteron wave functions, Binding Energy and Other Properties MESGUN SEBHATU, Wionthrop University — The deuteron is a bound state of a neutron and proton in $^3S_1$ and $^3D_1$ states. The wavefunctions that represent the $^3S_1$(u) & $^3D_1$(w) are obtained by solving a Rarita-Schwinger (RS) equation. In this presentation, an algorithm pioneered by a Padua group [1] for solving the RS equation is described. The Padua algorithm yields accurate results with fewer mesh points (N=300 or more) compared to standard methods [2]. The algorithm relies on the transformation x= $\tan^{-1}$(r). This truncates the infinite integration domain 0<r< ∞ to 0<x< $\pi/2$. This enables a grid that is uniform in x to explore the inner most region of r with a finer mesh than the asymptotic region. After second-order central difference approximations are used to replace the derivatives in the modified RS equation, it reduces to a standard eigenvaue problem of the form AY = E^2Y, where A is a 2Nx2N matrix, N the maximum number of steps, E the binding energy and Y is u(n) (1<n<N) and w(n) (N+1<n<2N). n is an index for individual steps. A FOTRAN program with a subroutine from IMSL is used to solve the RS equation for the Reid Soft Core Potential to illustrate the algorithm. [1] T.A. Minnelli, A.Pacolini, and C. Villi, Nuovo Cimento, 101, (1991) p.1626 [2] W.H.Press et al. Numerical Recipes, 1986, Ch. 16

Mesgun Sebhatu
Wionthrop University

Date submitted: 13 Aug 2008 Electronic form version 1.4