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This Week's Citation Classic

Hamada T & Johnston I D. A potential model representation of two-nucleon data below 315 mev. *Nucl. Phys.* **34**:382-403, 1962. [Daily Telegraph Theoretical Department, School of Physics, University of Sydney, Sydney, Australia]

This paper describes an energy independent nucleon-nucleon potential which represents the two-nucleon data below 315 Mev. It consists of central, tensor, linear *L.S* and, in addition, quadratic *L.S* forces and is characterised by the tail consistent with the one-pion-exchange potential. [The *SCI*® indicates that this paper has been cited over 735 times since 1962.]

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"This paper was written in 1961 when I was a post doctoral fellow at the University of Sydney where I spent nearly 6 years from 1956 to 1961. I worked rather hard on the nuclear force for about 3 years, from 1958, and by the end of 1960 I thought I had enough of it and wanted to move into a new field. In fact when Ian Johnston, now an astrophysicist at the University of Sydney, came to help me carry out most numerical calculations, I was already working on the theoretical models of white dwarfs and neutron stars with Edwin Salpeter who was just visiting Sydney. Some readers may recall that this work played an important role later, in 1967-68, in deciding the physical nature of the pulsars. The year 1961 was undoubtedly the year of the "best crop" in terms of my career.

"The Hamada-Johnston potential was born after I had almost left the field of nuclear physics. One day in early 1961, I received **a** letter from Hans Bethe asking me to do a little more work on nucleon-nucleon potentials. He had just started a project on nuclear matter calculations using the Brueckner-Bethe-Goldstone formalism and apparently wanted reliable nucle-on-nucleon potentials. A similar letter of encouragement by Gregory Breit was received some time later. He had just completed an extensive phase shift analysis of 2-nucleon scattering data and he naturally wanted to see if any potential model could fit his phase shifts. John Blatt was considering a big variational calculation of the nuclear 3-body problem and he also wanted a better potential.

"Having been asked by these giants in nuclear physics, I thought I should do what they wanted and I had an idea how to do it. But I was already busy with white dwarfs and neutron stars. So I asked Stuart Butler if I could get help from one of his students. A few days later Ian Johnston arrived and we immediately started playing around with 29 parameters contained in the potential. After about 4 months or so the Hamada-Johnston potential was born.

"The potential has a relatively simple analytical form and, above all, the same hard core radius in all 2-nucleon states. These features perhaps have made the potential very popular among people working in the field of nuclear physics. Ian Johnston and I never expected the work to become a classic in this field when we were working together. I find that life is full of fun."