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# This Week's Citation Classic®

**Blin-Stoyle R J.** Parity nonconserving internucleon potentials. *Phys. Rev.* 118:1605-7, 1960; and Parity-nonconserving internucleon potentials. II. Effects in electromagnetic transitions. *Phys. Rev.* 120:181-9, 1960.
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In the first of these papers, general and specific forms for the parity nonconserving internucleon potential deriving from the weak interaction are obtained. The results are then used in the second paper to calculate the parity violating asymmetries to be expected in various types of electromagnetic transition in nuclei. [The *SCI*® indicates that this two-part paper has been cited in over 190 publications.]

## Parity Nonconservation in Nuclei

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The work embodied in these two papers was carried out over a period of about six months whilst I was on sabbatical leave from the University of Oxford at the Massachusetts Institute of Technology (MIT). On reflection I realize that many factors and influences shaped my thinking over this period. Early work on nuclear $\beta$-decay had stimulated an interest in the ways in which nuclear studies could reveal information about basic elementary particle interactions. This had been heightened over the years by my interaction with a number of people, particularly John Bell, Henry Primakoff, and Denys H. Wilkinson. At the same time, my involvement with experimenters at the Clarendon Laboratory, Oxford, such as Michael Grace, who were measuring $\beta$- and $\gamma$-decay angular distributions from nuclei oriented at low temperatures had versed me in the techniques of calculating these and similar distributions.

Four papers, however, were the key progenitors of my work at MIT. The first two, of course, were the proposal by T.D. Lee and C.N. Yang[1] and the verification by C.S. Wu *et al.*[2] that the weak interaction did not conserve parity. The third was the seminal paper[3] by R.P. Feynman and M. Gell-Mann proposing a universal current-current theory of weak interactions and that predicted a first order weak (parity violating) interaction between two nucleons. Finally, the fourth was a paper[4] by Wilkinson in which he discussed the types of experiments in nuclear physics that could lead to the observation of nonleptonic parity violating effects.

Arriving at MIT in September 1959 and encouraged by Hermann Feshbach, I decided to calculate the general form of such a parity violating potential using invariance arguments and also to attempt a simplistic derivation of its detailed form assuming one- and two-pion exchange. This work is embodied in the first of the two cited papers. It then seemed obvious to calculate in some detail the way in which such a potential would lead to parity impurities in nuclear states, and the extent to which such impurities would lead to parity violating asymmetries in the emission of $\gamma$-rays. This work is the substance of the second of the cited papers.

Although at that time no parity violating effects had been observed, a few experiments had set upper limits to their magnitude. Since then, however, parity violating $\gamma$-ray asymmetries have been observed in a number of nuclear processes: for example, in radiative nd-capture and in $\gamma$-decays of nuclei through from $^{19}F$ to $^{203}Tl$. Although data from complex heavy nuclei are difficult to analyse, that from nd-capture coupled with studies of other parity violating asymmetries in few nucleon systems have now enabled estimates of the weak meson-nucleon coupling strengths to be made,[5] and work to improve these results still continues.

I suppose these papers have been highly cited because they were the first to study nonleptonic, parity violating phenomena in nuclei in any depth and because such studies are really the only way to obtain information about the strangeness conserving hadronic weak interaction.

1. **Lee T D & Yang C N.** Question of parity conservation in weak interactions. *Phys. Rev.* 104:254-8, 1956. (Cited 660 times.)
2. **Wu C S, Ambler E, Hayward R W, Hoppes D D & Hudson R P.** Experimental test of parity conservation in beta decay. *Phys. Rev.* 105:1413-5, 1957. (Cited 390 times.)
3. **Feynman R P & Gell-Mann M.** Theory of the Fermi interaction. *Phys. Rev.* 109:193-8, 1958. (Cited 1,515 times.)
4. **Wilkinson D H.** Parity conservation in strong interactions: introduction and the reaction $He^4(d,\gamma)Li^6$. *Phys. Rev.* 109:1603-9, 1958. (Cited 105 times.)
5. **Adelberger E G & Haxton W C.** Parity violation in the nucleon-nucleon interaction. *Annu. Rev. Nucl. Par. Sci.* 35:501-58, 1985. (Cited 30 times.)