identical structures. Similarly in their beta decay to C^{12}, B^{12} and N^{12} are linked by the charge conjugation of the leptons. If the weak interactions are invariant under the combination of charge symmetry and charge conjugation in this sense, then the intrinsic rate of decay of B^{12} and N^{12} will be the same (after one corrects for electromagnetic and nuclear effects). That is, if when one goes from B^{12} to N^{12} one only has plus terms in the Hamiltonian ($B = 0$ as well as $C = 0$), then the strength of decay when N^{12} decays will be the same as for B^{12}. But if the minus-sign terms are present, they will subtract from the N^{12} decay if they added to the B^{12} decay; then one will observe different intrinsic decay rates.

Subsequent experiments showed that in fact the intrinsic decay rates differed by more than 10%. Careful nuclear-structure calculations by Roger Blin-Stoyle and M. Rosina showed that the discrepancy might be a real one. That was five years ago, and there the matter rested until last Christmas when Wilkinson decided to look into the present experimental knowledge of mirror-pair beta decay.

Relative decay rates. In actual nuclear-physics experiments one finds the intrinsic decay rate by determining the *ft* value (where *t* is the halflife of the transition and *f* is a statistical factor depending on the amount of energy available for the transition). If there are no second-class currents the ratio of the *ft* value for positron emission to the *ft* value for electron emission would be equal to one. So $\delta = [(ft)^+/(ft)^-]-1$ is a measure of how important second-class currents are.

Although the effect of finite *B* is difficult to calculate, as energy goes up the expression simplifies and δ becomes directly proportional to the sum of the energy released from the two kinds of decay, Wilkinson told us. He feels that when energy released is as high as 10 MeV, the simple form should be good to a few percent.

Wilkinson's examination of the data showed that many *ft* values were not known well enough. A plot of δ vs. the sum of the energy released looked like a straight line if one disregarded a few maverick mirror pairs. So Wilkinson and his long-time collaborator, Alburger, decided to make new measurements for the isotopes that appeared uncertain.[2,3] Their measurements on $A = 18$, 20 and 25 made the situation much clearer; there are now no major discrepancies. When we visted the two men at Brookhaven late in July they were measuring the lifetimes of Na^{20} and B^{13} to see if the straight-line behavior would still look good.

Then Wilkinson was going to the University of Washington, where he will spend a sabbatical year on leave from Oxford University, where he is the professor of experimental physics (somewhat of a misnomer, because he is equally famous as a theorist).

[Wilkinson also has been active as an ornithologist. When doctors gave him six months to live after he received an overdose of radiation (he still doesn't know how) in World War II, he became interested in bird navigation. He showed that the traditional method of releasing birds in a group and timing how long they took to return to their nests was producing results that could be predicted from a diffusion model. Although experimenters then discarded the technique in favor of individual release of birds, ornithologists still haven't come up with an explanation of how birds do find their nests again, though they have established that some birds are indeed able to.]

Wilkinson pointed out that one would expect *ft* values to be the same only if the nuclear structure of the mirror pair is exactly the same; but it cannot be, if only for the differing electromagnetic interaction in the two nuclei. In $A = 12$, for instance, the binding energy of the last proton in N^{12} is different than that of the last neutron in B^{12}; so the wave functions will overlap differently when they decay to C^{12}, causing a different decay rate. But the best calculations on $A = 12$ suggest a difference of only 2%, whereas experimentally the difference is 12%. One thing Wilkinson plans to do in Seattle is to collaborate with Ernest Henley there on some nuclear-structure calculations.

Where else can one look for evidence of second-class currents in mirror nuclei? One needs a big energy release for the straight-line behavior to be valid. This occurs when the central member is an even-even nucleus because it costs a lot of energy to break it up. One soon runs out of even-even nuclei, though, as one needs too many neutrons to hold the nucleus together. The big energy release also occurs in odd-mass nuclei when one starts from a mirror pair; one tends to run out of the higher Z member of the pair because, again, as Z increases one needs more neutrons.

High-energy physics also provides a test for second-class currents, but it is far from definitive. One can look at the mirror beta decay of the Σ^+ hyperon into Λ^0 and the Σ^- hyperson into Λ^0 to see if the intrinsic decay rates are the same (provided that hyperons decay by the same process as ordinary neutrons and protons). Because the events are rare, the data are not accurate. The data suggest, Wilkinson told us, that if there is a second-class current it behaves oppositely to what one sees in nuclei. That is, in nuclei, positron emission is slower than electron emission. The statistically insignificant data for Σ decay tend towards the opposite effect.

One can also look for second-class currents in muon capture by C^{12}, and other light nuclei but one cannot look at the mirror situation. Wilkinson says calculations may show a slight indication of second-class currents.

Wilkinson emphasized that he is not claiming that second-class currents do exist. He does say that there is a linear dependence of the intrinsic decay-rate discrepancy on energy that is consistent with second-class currents. And that lots more work needs to be done. —CBL

References

1. D. H. Wilkinson, Phys. Lett. **31B**, 447 (1970).
2. D. H. Wilkinson, D. E. Alburger, Phys. Rev. Lett. **24**, 1134 (1970).
3. D. E. Alburger, D. H. Wilkinson, Phys. Lett. **32B**, 190 (1970).

First observatory in Israel to have 40-inch telescope

The Tel Aviv University Observatory is expected to be completed by November. Anticipated research, using primarily a 40-inch wide-field Ritchey-Chretien reflecting telescope, includes infrared observations of star formation, and studies of young clusters and stars known to be losing mass. Israel's first astronomical observatory is supported equally by Tel Aviv University and the Israeli government, the Smithsonian Institution, and the American Friends of Tel Aviv University. The Observatory director is Uri Feldman. Staff members of the Smithsonian Astrophysical Observatory will conduct joint research with Israeli astronomers.

Deep space network equipment available for radio astronomy

Cal Tech's Jet Propulsion Laboratory has announced that some of the equipment in its Deep Space Network (DSN) is available free for limited use by qualified radio scientists. DSN equipment includes a 210-foot paraboloid and an 85-foot paraboloid at Goldstone, California and 85-foot paraboloids overseas.

The 210-foot antenna is now used in the 2.3-GHz range with zenith system temperatures under 20 K and 0.6 aperture efficiency. It will shortly have equipment in the 8-GHz range with about 30-K system temperature and 0.4 to 0.5 efficiency. About 5% of the time on the 210-foot will be alloted for radio astronomy.

Detailed technical information and proposal procedures are available from Don Spitzmesser, CIT JPL, 238-334, 4800 Oak Grove Drive, Pasadena, Calif. 91103. Proposals should be sent to Jesse Greenstein at Cal Tech, who heads experiment-selection panel. □