Physical Review Letters[2]) measured the directions and energies of both neutrons and the energy of the core recoil, a so-called kinematically complete measurement. They found that very low excitation energies dominate in the final three-body system and argue that it is neither necessary nor desirable to attribute a strong collective character to this transition. With normal nuclei, electrical excitations connect by collective (multiparticle) transitions of the whole nucleus to excitation energies around 25 MeV, so-called giant dipole resonances. But in the lithium case, the authors prefer to view the process as predominantly a direct break-up leading to free single-particle states with low kinetic energy, of the order of 1 MeV or less.

The two experiments also contribute towards resolving the question of correlations, whether the neutrons move independently of one another or whether they are coupled somehow on opposite sides of the core, say. Already the first measurements[4] of neutron–neutron coincidences were consistent with the assumption of no correlations between the momenta of the neutrons, and the new experiments confirm this with much higher precision. The authors find that their reconstructed decay-energy spectrum can explain their data as well as the previous transverse-neutron[4] and parallel-core momentum[1] distributions, all with the assumption "that the decay energy is shared by ^{9}Li and the neutrons according to 3-body phase space"; in other words, neutron–neutron correlations are absent.

Comparisons

It is interesting to see how these conclusions fit with measurements of transverse momentum distributions of neutrons and core recoils. The ^{9}Li recoil momentum distribution in the break-up on light targets was found at the Berkeley Bevalac to be characterized by Γ_R=90 MeV/c. The angular distribution of the neutrons measured at GANIL in Caen gave Γ_n=26 MeV/c, both for heavy and for light targets. Comparison of the two values shows that they cannot represent the same intrinsic momentum, as the total momentum would not then be conserved, even if the two neutrons were moving in parallel. The momentum balance can be saved only if rather arbitrary additional assumptions (two-component momentum distributions) are made, as has been done in a recent paper by Tanihata *et al.*[5], who suggest that the two neutrons move essentially in parallel. If on the other hand the neutrons are assumed to be uncorrelated, then the recoil momentum width for the pair suggested by the GANIL experiment is $\Gamma_n\sqrt{2}$ = 37 MeV/c, in exact agreement with the new result.

It is not completely surprising if the momentum component of the ^{9}Li recoil parallel to the beam axis is more representative of the situation before the collision than is the transverse component. This is known empirically for certain nuclear break-up process at high energy. And it is also easy to see that for electrical break-up the parallel momentum component to a first approximation is unchanged because the retardation caused by the Coulomb repulsion on the incoming leg of the trajectory is compensated on the outgoing leg. It is tempting to assume that the transverse core-recoil distribution is broadened by some mechanism that we do not yet fully understand.

Reactions

Finally, the two new papers both take up a subject that could be of great diagnostic value for understanding in more detail the reactions of halo nuclei, namely that of possible shifts in the average fragment velocities relative to the beam velocity. The following simple model illustrates one mechanism that could cause such shifts. Consider ^{11}Li passing a heavy target in a straight-line trajectory. At the minimum distance the system has increased potential energy due to the electrostatic repulsion of the two nuclei and the kinetic energy is reduced by the same amount. If break-up takes place at this point, then the neutrons will emerge from the reaction with a proportionately reduced energy. The charged fragment, on the other hand, regains the missing energy on the outgoing leg of the trajectory, but as it is lighter than the projectile this will lead to a velocity slightly higher than that of the beam. Qualitatively, at least, effects of the expected order of magnitude have been observed for the neutrons[4], the charged fragments[1], and for the neutron-core velocity difference[2].

The two Michigan papers represent an important milestone towards a qualitative understanding of the two-neutron halo. The operative word here is clearly qualitative. We definitely expect effects such as neutron–neutron correlations, collective contributions and resonances to make their appearance at some improved level of experimental precision, but for the moment we are not in great need of them, which should please those who believe that a simple picture is preferable to a complicated one. □

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DAEDALUS

Kiss and tell

THE human skin is home to a vast variety of microorganisms. These harmless yeasts and bacteria feed on the many nutrients that it secretes, and shelter in its many niches, from hair follicles to sweat glands.

Each region of your skin (your hands, say, or your lips) has its own mixture of species and strains, continuously selected and maintained by the local conditions, and each as individual as a fingerprint. Somebody else's hands or lips, with different physical and chemical conditions, will support quite a different ecology. So a handshake or a kiss brings two different microscopic worlds together. Migrants pass in both directions; the ecology of each skin surface is challenged by an influx of competing newcomers. The natives are better adapted to the local conditions, but they may take many days gradually to oust the colonists and restore the previous ecology. So, says Daedalus, a good bacteriologist could tell who has kissed whom where, and when.

A DREADCO team is now applying this awesome ability, not merely to kisses and handshakes, but to hugs, punches, assaults and to various forms and degrees of sexual intimacy. The technique should be very sensitive. The skin can carry dozens of organisms, each in dozens of strains. Each could be positively identified by DNA tests; but selective culturing and testing with depleted media should be just as good and far easier. Furthermore, skin bacteria reproduce and maintain themselves. Even washing doesn't dislodge them; the survivors rapidly multiply back to their original density.

A husband and wife in continual contact, for example, might come to hold many organisms in common. A brief outside dalliance by one of them would introduce new organisms into the menage; these would spread slightly to the innocent spouse before being gradually eliminated by the indigenous ecology. By identifying the organisms and their changing counts on the various parties, DREADCO could establish when the dalliance occurred and with whom. Washing or bathing could not destroy the evidence.

A great deal of personal conflict and civil and criminal legal wrangling arises from allegations of various sorts of bodily contact. Daedalus will soon be in a position to prove or disprove them. Already DREADCO is being besieged by desperate detectives, outraged wives, victims of violence or molestation, maligned politicians and indignant good friends, all clamouring for proof that somebody is guilty, or that they themselves are innocent, of something. Daedalus seems sure of a profit on his research investment. David Jones