Recent progress on phonon-nuclear theoretical models

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The models have as a foundation a relativistic phonon-nuclear interaction, derived from a many-particle Dirac model. Although this model is not covariant, numerical solutions for a moving two-body composite are reasonably close to what would be expected from a covariant theory. Similar coupling arises from the 2-body Bethe-Salpeter model.

The first step in excess heat production in the model is the transfer of the large 24 MeV quantum from the $D_2/^4He$ transition to produce a reasonably stable highly excited state in a nucleus in the host lattice. Indirect evidence for this comes from low-level energetic particle emission in experiments not producing excess heat. A second step involves subdivision to two reasonably stable highly excited nuclei near 12 MeV. Indirect evidence for this comes from low-level neutron emission in the 4-6 MeV range.

Excitation transfer of the 5.5 MeV quantum from the $HD/^3He$ transition is considered in the case of light water experiments. Highly excited states are known in the case of Ni isotopes. Transitions near resonance are identified. One such near resonance occurs in ^{137}Cs, suggesting an explanation for the 661 keV emission observed in the Piantelli experiment, and also a connection to the Vysotskii and Kornilova experiments. New experiments are needed to clarify if this interpretation is correct.

The null reaction in which the $D_2/^4He$ transition transfers excitation to ^4He to produce D_2 was proposed more than 20 years ago. This process has the possibility of increasing the probability of two deuterons being close together, and may be connected to excess heat production at high rates, low-level dd-fusion, other energetic particle emission, and low-level 3-body reactions reported by Kasagi et al, and by Hubler et al.

Progress on the calculation of phonon-nuclear matrix elements includes a reduction of the relativistic phonon-nuclear interaction in the case of the one-pion exchange potential with pseudovector coupling. A reduction of the $HD/^3He$ phonon-nuclear matrix element has been carried out. The phonon-nuclear matrix element for the ^{57}Fe transitions relevant to recent excitation transfer experiments has been considered. Some progress has been made on excitation transfer models in a lattice, suggesting the possibility of new experiments involving single crystals where the emission would show up in a diffraction pattern.

The acceleration of excitation transfer due to off-resonant energy shifts is predicted. A new model for many-quantum down-conversion has been studied.