Theoretical Interpretation of the ^{142}Ce(d,p)^{143}Ce Reaction

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The ^{142}Ce$_{84}$ and ^{142}Ce$_{85}$ nuclei are described by
coupling two- and three-particle clusters to quadrupole
vibrations, respectively. We used the single-particle
positions as centres of gravity determined experimentally
from (d,p) reactions. The phonon energy was $\hbar\omega=1$MeV,
adopted as an average phonon energy for medium-heavy
nuclei; the pairing strength was G=21/A. The only free
parameter was the particle-vibration coupling strength; it
was chosen to be a=0.9. The calculated wave functions of
the target and daughter nucleus were inserted in the ex-
pression for the spectroscopic factor. These theoretical results
for low-lying states are compared with experimental data
in table 1, and are discussed qualitatively. In the
zeroth-order approximation, the spectroscopic factor is
large for the $0^+_1 \to 7/2^-_1$ transfer reaction, while it is zero
for the $0^+_1 \to 3/2^-_1$, $0^+_1 \to 5/2^-_1$, $0^+_1 \to 9/2^-_1$ reactions, because the
states $3/2^-_1$, $5/2^-_1$ and $9/2^-_1$ are of the $(f^3_{7/2})$I cluster-
type. This pattern is qualitatively conserved for a=0.9
owing to the partial destructive interference. It should
be stressed that the
presence of the low-lying
triplet $3/2^-_{g.s.}$, $7/2^-$
(21 keV), $5/2^-$ (40 keV)
excludes the possibility
of interpreting these
states by coupling odd
particle (quasiparticle)
to the ^{142}Ce core.

TABLE 1

J_{theor}	S(theor)	J_{exp}	S(exp)
$3/2^-_1$	0.10	$3/2^-$	0.03
$7/2^-_1$	0.62	$7/2^-$	0.50
$5/2^-_1$	0.02	$5/2^-$	0.02
$9/2^-_1$	0.13	$9/2^-$	0.26
$3/2^-_2$	0.31	$3/2^-$	0.50
$9/2^-_2$	0.37	$9/2^-$	0.44
$5/2^-_2$	0.04	$(5/2^-)$	0.09