Hole states in N=27 isotones for
$^{45}$Ar, $^{47}$Ca, $^{49}$Ti, $^{51}$Cr, $^{53}$Fe, $^{55}$Ni

$Z = 18, 20, 22, 24, 26, 28$

via pickup reactions $A+1(p,d)A$

$H(46\text{Ar},d)45\text{Ar} \ [\text{MSU}]$
$48\text{Ca}(p,d)47\text{Ca} \ [1-3]$
$50\text{Ti}(p,d)49\text{Ti} \ [4]$
$52\text{Cr}(p,d)51\text{Cr} \ [5]$
$54\text{Fe}(p,d)53\text{Fe} \ [6-9]$
$H(56\text{Ni},d)55\text{Ni} \ [\text{MSU}]$

References
[8] 52 MeV Ohnuma JPSJ 32(1972)1466

Most figures can be found in /.../plot2
States that have substantial cross-sections from \((p,d)\) transfer
g.s. \((7/2^-)\), 1\(^{\text{st}}\) excited states \((p3/2^-)\)
s\(1/2^+\), d\(3/2^+\) (often come as doublets)

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<tr>
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<th>(45\text{Ar})</th>
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4 states populated by \((p,d)\) transfer reactions in \(N=27\) isotones

\[ \text{H(}^{46}\text{Ar,d)}^{45}\text{Ar} \]
(Lee, PhD, 2010)

\[ \text{H(}^{56}\text{Ni,d)}^{55}\text{Ni} \]
(Sanetullaev, PhD, 2011)
States that have substantial cross-sections from \((p,d)\) transfer reactions are g.s. \((7/2^-)\), 1\textsuperscript{st} excited states \((p3/2^-)\) state (very small c.s.), \(s_{1/2}^+\), and \(d_{3/2}^+\) (often come as doublets).

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From NNDC
Data agree with shell model values for g.s. and 1\textsuperscript{st} excited p1/2 states.
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States that have substantial cross-sections from \((p,d)\) transfer reactions are g.s. \((7/2^-)\), 1\(^{st}\) excited states \((p3/2^-)\) state (very small c.s.), \(s_{1/2}^+\), and \(d_{3/2}^+\) (often come as doublets).
Spacing between s1/2 and d3/2 states increases with Z

N=27 hole states

E* (MeV)

Z (proton number)

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S1/2 state occurs at much lower energy (3 MeV) than predicted (12 MeV).


FIG. 6. (Color online) Spectral strengths for one-neutron transfer on \(^{56}\text{Ni}\) obtained from the self-consistent single-particle propagator \(g(\omega)\). Poles above (below) the Fermi energy, \(E_F\), correspond to transition to eigenstates of \(^{57}\text{Ni}\) (\(^{55}\text{Ni}\)). The respective spectroscopic factors are given as a fraction of the independent-particle model value. The quasiparticle poles corresponding to the valence orbits of the \(1p0f\) shell are indicated by arrows. A logarithmic scale was chosen to put in stronger evidence the distribution of the fragmented strength. Results are for \(\hbar\Omega = 10\text{ MeV}, N_{\text{max}} = 9, \) and \(\kappa_M = 0.57\text{ MeV}.\)
Calculations by Alex brown:

All of the energies start arbitrarily at 2 MeV - there is nothing in the sdpfu Hamiltonian that has been adjusted for the absolute energies of these states. The results show the fragmentation of strength and how much is in the lowest state.
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