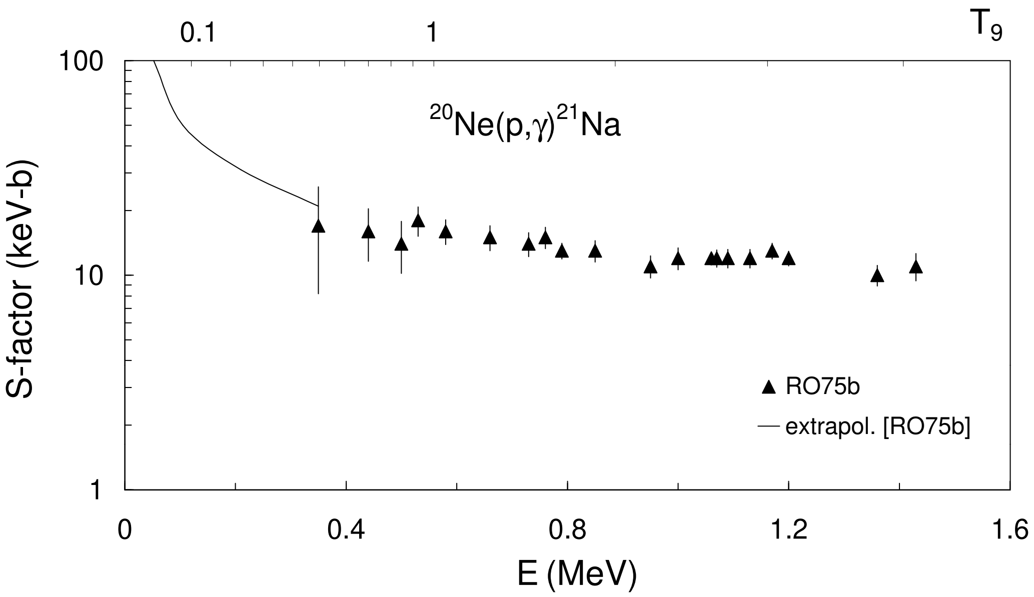
# Reaction: $^{20}$Ne(p,$\gamma$)$^{21}$Na

The non-resonant reaction rate is obtained from the experimental $S$-factor of RO75b. Below the low energy limit, the theoretical extrapolation of RO75b is used, which takes account of the $1/2^+$ subthreshold state at $E_r = -7$ keV in $^{21}$Na. The $\gamma$ width of this state is given as $0.31 \pm 0.07$ eV by RO75b, and $0.17 \pm 0.05$ eV by AN77. The former experiment gives however a "formal" width which must be converted to an "observed" width (see LA58) to be compared with the AN77 result. After correction of the RO75b value ($0.14 \pm 0.03$ eV), both data agree within the error bars. Since the non-resonant reaction rate involves a subthreshold state contribution and a direct capture term, the analytical fit contains a free parameter $\alpha$ in $T_9^\alpha$. The optimal value is $\alpha = -1.84$, which is close to $\alpha = -2$, valid for a subthreshold state contribution only. The resonant reaction rate involves eight resonances up to $E_r = 2035$ keV. The present reaction rate are larger than those of CA88 at low temperatures, probably because the reduced proton width of the subthreshold state in CA88 is lower than in RO75b.

| $E_r$ (keV) | $J^\pi$ | adopted $\omega\gamma$ (eV) | | |
|---|---|---|---|---|
| $366 \pm 1$ | $1/2^-$ | $(1.1 \pm 0.2) \times 10^{-4}$ | RO75b | I |
| $398 \pm 1$ | $9/2^+$ | $(6 \pm 1) \times 10^{-5}$ | RO75b | I |
| $1113 \pm 1$ | $5/2^+$ | $1.13 \pm 0.07$ | BL69 | M |
| $1248 \pm 1$ | $3/2^-$ | $0.035 \pm 0.010$ | BL69 | M |
| $1432 \pm 1$ | $5/2^-$ | $0.050 \pm 0.015$ | BL69 | M |
| $1742 \pm 1$ | $3/2^-$ | $1.0 \pm 0.3$ | RO75b | M |
| $1861 \pm 1$ | $5/2^+$ | $2.4 \pm 0.7$ | BL69 | M |
| $2035 \pm 1$ | $3/2^+$ | 1.6 | EN78 | M |



| $T_9$ | low | adopt | high | exp | ratio | $T_9$ | low | adopt | high | exp | ratio | $T_9$ | low | adopt | high | exp | ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.011 | 0.61 | 1.08 | 1.55 | -27 | 1.6 | 0.11 | 3.91 | 7.87 | 11.8 | -9 | 1.2 | 0.9 | 7.56 | 9.28 | 11.0 | -1 | 1.0 |
| 0.012 | 0.65 | 1.15 | 1.64 | -26 | 1.6 | 0.12 | 1.11 | 2.25 | 3.39 | -8 | 1.2 | 1 | 1.51 | 1.79 | 2.08 | 0 | 1.0 |
| 0.013 | 5.42 | 9.41 | 13.4 | -26 | 1.6 | 0.13 | 2.82 | 5.74 | 8.67 | -8 | 1.2 | 1.25 | 7.28 | 8.17 | 9.07 | 0 | 1.0 |
| 0.014 | 3.64 | 6.28 | 8.92 | -25 | 1.6 | 0.14 | 0.65 | 1.34 | 2.02 | -7 | 1.2 | 1.5 | 2.50 | 2.75 | 3.00 | 1 | 1.0 |
| 0.015 | 2.06 | 3.52 | 4.98 | -24 | 1.6 | 0.15 | 1.40 | 2.88 | 4.35 | -7 | 1.2 | 1.75 | 6.30 | 6.91 | 7.51 | 1 | 1.0 |
| 0.016 | 1.00 | 1.70 | 2.40 | -23 | 1.6 | 0.16 | 2.83 | 5.80 | 8.77 | -7 | 1.2 | 2 | 1.27 | 1.40 | 1.53 | 2 | 1.0 |
| 0.018 | 1.63 | 2.75 | 3.87 | -22 | 1.5 | 0.18 | 0.99 | 2.01 | 3.03 | -6 | 1.1 | 2.5 | 3.40 | 3.81 | 4.22 | 2 | 1.0 |
| 0.02 | 1.79 | 3.01 | 4.23 | -21 | 1.5 | 0.2 | 2.94 | 5.91 | 8.88 | -6 | 1.1 | 3 | 6.51 | 7.49 | 8.46 | 2 | 0.9 |
| 0.025 | 2.13 | 3.61 | 5.08 | -19 | 1.5 | 0.25 | 2.98 | 5.50 | 8.03 | -5 | 1.1 | 3.5 | 1.03 | 1.22 | 1.41 | 3 | 0.9 |
| 0.03 | 0.79 | 1.37 | 1.96 | -17 | 1.5 | 0.3 | 1.99 | 3.32 | 4.64 | -4 | 1.0 | 4 | 1.46 | 1.77 | 2.07 | 3 | 0.9 |
| 0.04 | 1.47 | 2.72 | 3.97 | -15 | 1.4 | 0.35 | 0.93 | 1.42 | 1.92 | -3 | 1.0 | 5 | 2.38 | 2.98 | 3.59 | 3 | 0.9 |
| 0.05 | 0.60 | 1.15 | 1.71 | -13 | 1.4 | 0.4 | 3.15 | 4.60 | 6.05 | -3 | 1.0 | 6 | 3.33 | 4.26 | 5.19 | 3 | 0.9 |
| 0.06 | 1.02 | 2.00 | 2.97 | -12 | 1.3 | 0.45 | 0.84 | 1.19 | 1.54 | -2 | 1.0 | 7 | 4.27 | 5.52 | 6.76 | 3 | 0.8 |
| 0.07 | 0.99 | 1.94 | 2.89 | -11 | 1.3 | 0.5 | 1.88 | 2.60 | 3.32 | -2 | 1.0 | 8 | 5.23 | 6.75 | 8.27 | 3 | 0.8 |
| 0.08 | 0.64 | 1.26 | 1.89 | -10 | 1.3 | 0.6 | 6.53 | 8.73 | 10.9 | -2 | 1.0 | 9 | 6.20 | 7.95 | 9.71 | 3 | 0.8 |
| 0.09 | 3.11 | 6.15 | 9.19 | -10 | 1.2 | 0.7 | 1.67 | 2.18 | 2.69 | -1 | 1.0 | 10 | 7.21 | 9.14 | 11.1 | 3 | 0.8 |
| 0.1 | 1.20 | 2.40 | 3.59 | -9 | 1.2 | 0.8 | 3.68 | 4.66 | 5.64 | -1 | 1.0 | | | | | | |