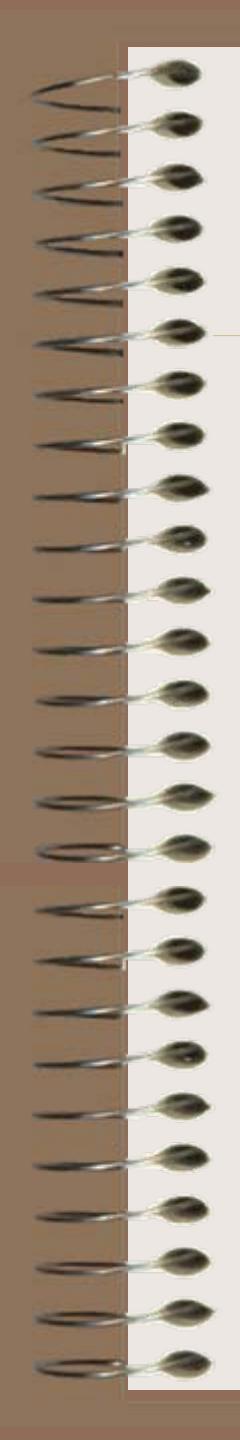


# Resonance Parameters

V.McLane

National Nuclear Data Center

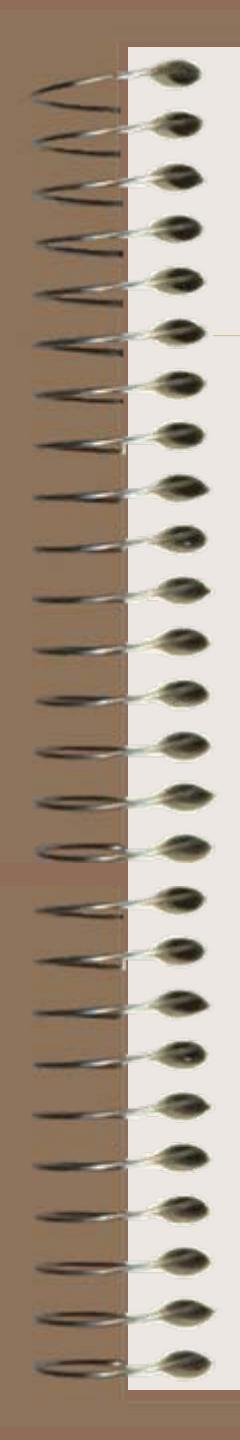


# *Single-Level Resonance Parameters*

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## Single level resonance parameters

- calculated from fit to measured cross section
- using a Breit-Wigner single-level formalism .



# *Single-Level Resonance Parameters*

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## Resonance Energy ( $E_0$ )

- **Determined by the author:** assigned a REACTION code and entered into data table under DATA.  
**( ... (N,0) , , EN )**
- **Taken from other sources:** entered into data table as an independent variable with data heading EN-RES.  
In this case, the energy is entered for only those resonances for which the author has calculated other resonance parameters.
- **Negative energy resonances** should be coded with negative energy, as given.

# *Single-Level Resonance Parameters*

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## Resonance widths ( $\Gamma_\gamma$ )

### REACTION Coding:

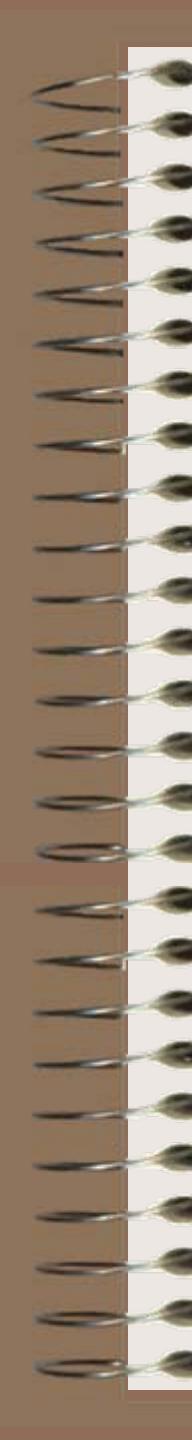
- (...(**N, TOT**) , , **WID**) = total width ( $\Gamma$ )
- (...(**P, G**) , , **WID**) = capture width ( $\Gamma_\gamma$ )
- Units: code with dimensions E (e.g., MILLI-EV).

## Reduced neutron widths ( $\Gamma_\gamma^l$ )

### REACTION coding:

(...(**N, EL**) , , **WID/RED**)

- angular momentum ( $l$ ) should be specified under the data heading MOMENTUM L.
- Units: code with dimensions E (e.g., EV).



# *Single-Level Resonance Parameters*

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**Peak cross section:** cross section at peak of resonance.

( ...(N,TOT),,PCS) Total peak cross section

**Eta and Alpha at resonance:**

( ...(N,ABS),,ETA,,RES)

( ...(N,ABS),,ALF,,RES)

# *Single-Level Resonance Parameters*

## Resonance area

( ... (N,EL) , , ARE) Scattering area

**Units:** code with dimensions B\*E (e.g., B\*EV).

$\Gamma_n \Gamma_r$ / $\Gamma$  is proportional to the capture area

```

REACTION (( (...(N,EL),,WID,,G)*(...(N,G),,WID))/
          (...(N,TOT),,WID)))

```

## **RESULT (CAPTA)**

**Units:** code with dimensions E (*e.g.*, EV).

# *Single-Level Resonance Parameters*

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## Resonance strength

( ... ( P , A ) , WID / STR )

Units: code with dimension E, *e.g.*, EV .

## Some special representations

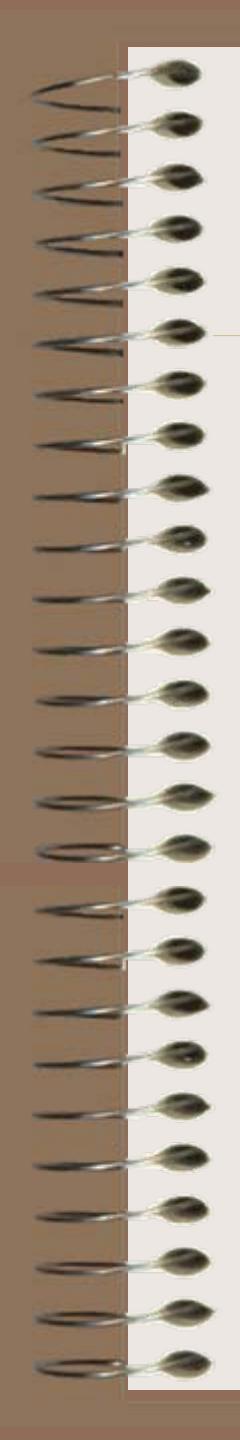
- $\sigma_0 \Gamma_f$  ( ..... ( N , F ) , , WID , , S0 )
- $\sigma_0 \Gamma^2$  ( ..... ( N , TOT ) , , WID , S0 / SQ ) )
- $g \Gamma_n$  ( ..... ( N , EL ) , , WID , , G ); g = statistical weight factor
- $a g \Gamma_n$  ( ..... ( N , EL ) , , WID , , AG ); a = isotopic abundance

# *Single-Level Resonance Parameters*

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*Example:*

```
BIB
REACTION 1(...(N,0),,EN)
          2(...(N,0),J)
          3(...(N,0),L)
          4(...(N,EL),,WID)
ENDBIB
NOCOMMON
DATA
DATA      1DATA       2DATA       3DATA       4DATA-ERR   4
EV        NO-DIM     NO-DIM     MILLI-EV    MILLI-EV
...
ENDDATA
```



## *Multilevel Resonance Parameters*

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USED: for resonance analysis of fissile nuclides, to account for interference effects from neighboring resonances and also distant resonances.

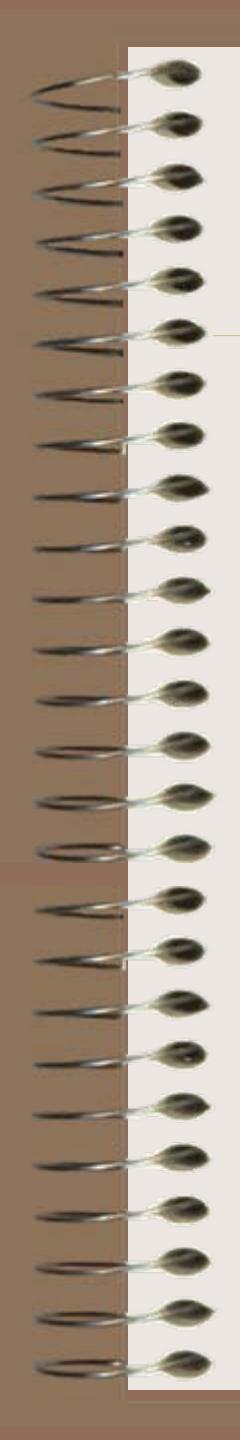
Formalism generally used: Reich-Moore; derived from the R-matrix theory of Wigner and Eisenbud.

# *Multilevel Resonance Parameters*

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## Reich-Moore Resonance Parameters:

- **(N, 0) , , EN** Resonance energy
- **(N, TOT) , , WID , , RM)** Total width
- **(N, G) , , WID , , RM)** Capture width
- **(N, F) , 1 , WID , , RM)** Fission width for channel 1
- **(N, F) , 2 , WID , , RM)** Fission width for channel 2
- **(N, F) , , WID , , RM)** Total fission width
- **(N, EL) , , WID , , RM)** Neutron width
- **(N, EL) , , WID/RED , , RM)** Reduced neutron width
  
- Relative phases of fission widths for channels 1 and 2 are 0 or 180 degrees; therefore, the parameter values are given with either a positive or negative sign.



# *Multilevel Resonance Parameters*

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## R-Matrix Reduced Width ( $\gamma^2$ )

(..., **WID/RED**, , **RMT**)

**Units:** code with dimension E (e.g., EV)

**Reduced Width Amplitude ( $\gamma$ ):** square-root of reduced width.

(..., **WID/RED**, , **RMT/AMP**)

**Units:** code with dimension RE (e.g., RT-EV)

