# Neutron- vs. Photo- induced reactions

## 1. $^{238}$U(n,2n) vs. $^{238}$U(γ,n)$^{237}$U

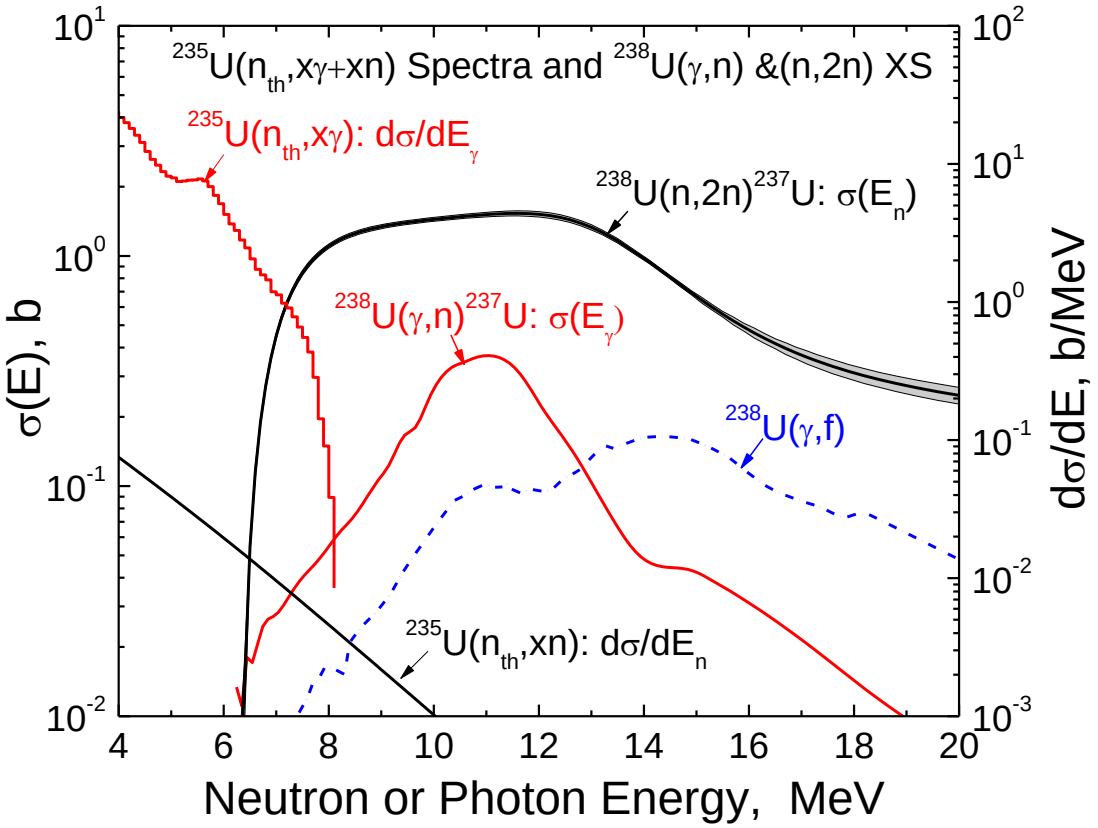


Fig. 1. Reaction cross sections for $^{238}$U(n,2n)$^{237}$U from IRDFF and for $^{238}$U(γ,n)$^{237}$U and $^{238}$U(γ,f) from ENDF/B-VII.1. Energy spectra of neutrons and photons from $^{235}$U($n_{th}$,xγ) and $^{235}$U($n_{th}$,xn) are from ENDF/B-VII.1.

Table 1. Evaluation of competition between $^{238}$U(n,2n)$^{237}$U and $^{238}$U(γ,n)$^{237}$U in the mixed neutron-gamma field from $^{235}$U($n_{th}$,xγ +,xn) .

| **Reaction** | **ν(n) or ν(γ) for $n_{th}$ + $^{235}$U** | **SPA in n- or γ-field, b** | **Yield per one $n_{th}$+$^{235}$U event, b** | **Contribution, %** |
|---|---|---|---|---|
| **$^{238}$U(n,2n)$^{237}$U** | 2.4367 | 0.014710 | 0.03590 | 99.4 |
| **$^{238}$U(γ,n)$^{237}$U** | 6.5650 | 0.000034 | 0.00022 | 0.6 |
| **Sum** | | | **0.03612** | **100** |

**$^{235}$U($n_{th}$,x) data from ENDF/B-VII.1:**

| Total | Fission | Absorption | Elastic | (n,xg) | | (n,xg)/Fis+abs |
|---|---|---|---|---|---|---|
| 698.6725 | 584.8925 | 98.66403 | 15.11601 | 4487.824 | => | 6.565 |

my MCNP: $^{238}$U(γ,f) SPA in the $^{235}$U($n_{th}$,xγ) field = 4.36957E-02/1.300E+3 = 3.36E-5 b

## 2. $^{23}$Na(n,2n) vs. $^{23}$Na(γ,n)$^{22}$Na

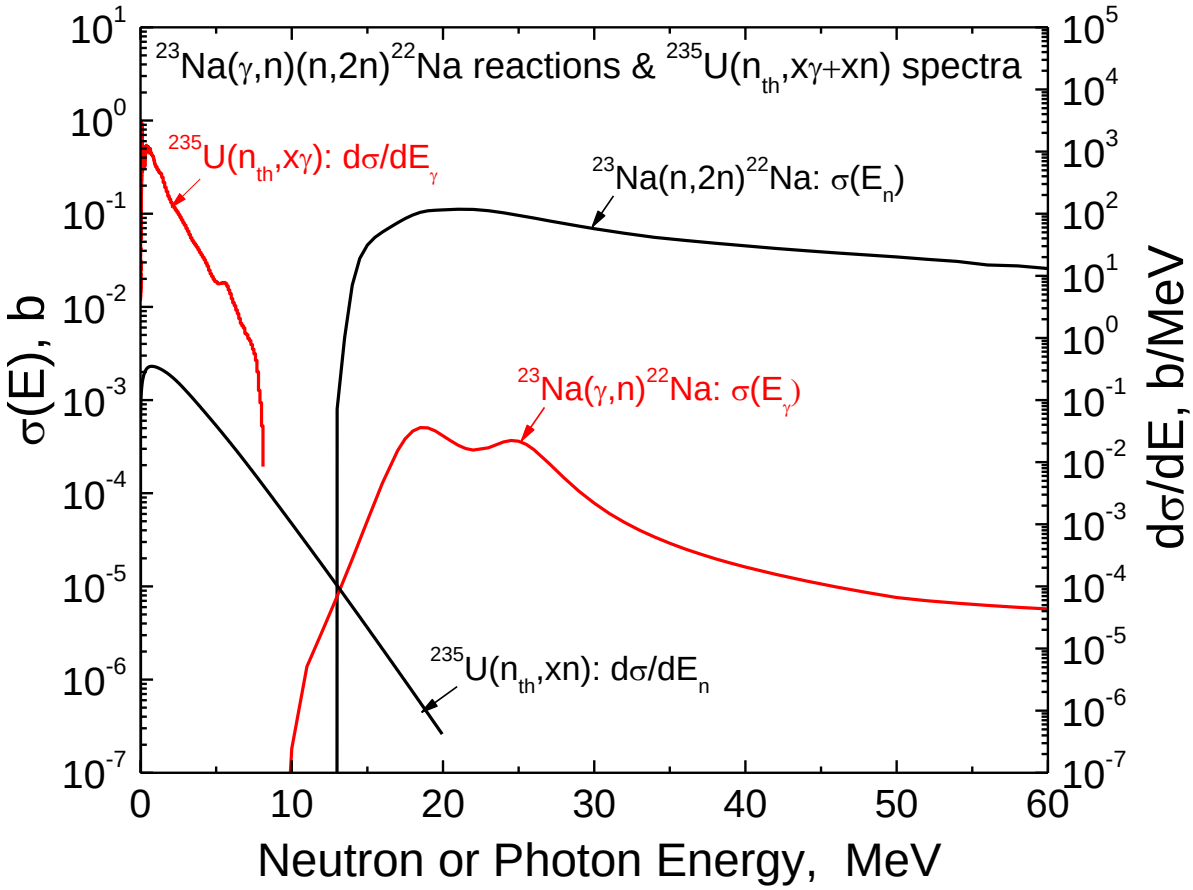


Fig. 2. Reaction cross sections for $^{23}$Na(n,2n)$^{22}$Na from IRDFF-1.05 and for $^{23}$Na(γ,n)$^{22}$Na from ENDF/B-VII.1.
Energy spectra of neutrons and gammas from $^{235}$U($n_{th}$,xn) and $^{235}$U($n_{th}$,xγ) are from ENDF/B-VII.1.