**Contents**

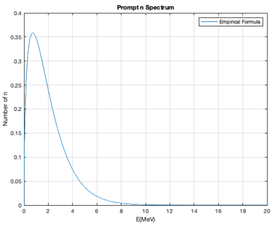


```
clc
clear all
```

## Problem 1

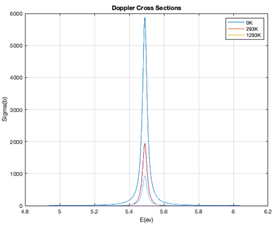
```
N_emp = @(E) 0.453*exp(-1.036*E)*sinh(sqrt(2.29*E));


Emin = 0;

Emax = 20;

E = linspace(Emin,Emax,1000);

n_emp = zeros(1,length(E));

for i = 1:length(E)
    n_emp(1,i) = N_emp(E(i));
end

figure(1)
plot(E,n_emp)
grid on
title('Prompt n Spectrum')
xlabel('E(MeV)')
ylabel('Number of n')
legend('Empirical Formula')



N = max(n_emp);

I = 0;
for ii = 1:length(E)
   if N_emp(E(ii)) == N
       I = ii;
       break
   end
end


E_MAX = E(I)

Icut = 0;
for j = I:length(E)
    if n_emp(1,j) <= 0.001
        Icut = j;
        break
    end
end

E_cutoff = E(Icut)

n_avg = sum(n_emp)/length(E);

for jj = I:length(E)
   if n_emp(1,jj) <= n_avg

       E_avg = E(jj)
       break

   end
end


l = 20.8738;


dE_peak = (0.7207-0.00009)/417;
dE_avg = (4.5846-0.00009)/503;


mn = 939.57;

c = 3.0*10^8;

DE_peak = zeros(1,417);
DE_avg = zeros(1,503);

DE_peak(1,1) = 0.7207;
DE_avg(1,1) = 4.5846;


for i = 2:418
    DE_peak(1,i) = DE_peak(1,i-1) - dE_peak;
end

for j = 2:504
    DE_avg(1,j) = DE_avg(1,j-1) - dE_avg;
end

vc_peak = zeros(1,417);
vc_avg = zeros(1,503);

for i = 2:418

    a = (2*DE_peak(1,i))/mn;
    vc_peak(1,i) = sqrt(a);
end

for j = 2:504
    a = (2*DE_avg(1,i))/mn;
    vc_avg(1,j) = sqrt(a);
end


v_peak = vc_peak*c;
v_avg = vc_avg*c;


T_peak = v_peak/l;
T_avg = v_avg/l;

t_peak = sum(T_peak)
t_avg = sum(T_avg)
```

```
E_MAX =

    0.7207


E_cutoff =

    9.8098


E_avg =

    4.5846


t_peak =

   1.5623e+08


t_avg =

   2.9531e+08
```




## Problem 2

```
sigma0 = 28349.04;

Gamma = 0.0308;

E0 = 5.49;

A = 92;


Gamma_g = 0.029;

Gamma_n = 0.0018;

Gamma_D293 = 0.07763;
Gamma_D1293 = 0.161813;


Sigma_0K = @(E) sigma0*(Gamma_g/Gamma)*((E0/E)^(1/2))*((Gamma_n+Gamma_g)/((E-E0)^2 + (1/4)*Gamma^2));

Sigma_293K = @(E) ((Sigma_0K(E)*Gamma_g*sqrt(pi))/(2*Gamma_D293))*exp(-((E-E0)^2)/(Gamma_D293)^2);

Sigma_1293K = @(E) ((Sigma_0K(E)*Gamma_g*sqrt(pi))/(2*Gamma_D1293))*exp(-((E-E0)^2)/(Gamma_D1293)^2);



Emax = 1.1*E0;


Emin = 0.9*E0;


E = linspace(Emin,Emax,1000);


sigma_0K = zeros(length(E));

sigma_293K = zeros(length(E));

sigma_1293K = zeros(length(E));


for i = 1:length(E)

    sigma_0K(i) = Sigma_0K(E(i));

    sigma_293K(i) = Sigma_293K(E(i));

    sigma_1293K(i) = Sigma_1293K(E(i));

end


figure(2)
plot(E,sigma_0K)
hold on
grid on
plot(E,sigma_293K)
hold on
grid on
plot(E,sigma_1293K)
hold off
grid on
title('Doppler Cross Sections')
xlabel('E(ev)')
ylabel('Sigma(b)')
legend('0K', '293K', '1293K')
```





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