d=8e-6; %sphere diameter

m\_sph=1.79; %sphere refractive index

m\_env=1.331; %medium refractive index

l\_vac=656.3e-9; %wavelength in vacuum

%H20: 1.3310R, 1.3344G, 1.3388B

%ME: 1.79-R, 1.89-G, 1.96-B

%PS: 1.589-R, 1.601-G, 1.617-B

%%%%%%%%% CALCULATIONS START AFTER HERE %%%%%%%%%%%%%%%%

a=d/2;

k=2\*pi/(l\_vac/m\_env);

x=k\*a;%DWH eq.1

m=m\_sph/m\_env;

M=ceil(x + 4\*(x^(1/3) + 2));

n=1:M;

fpsi=sqrt(pi\*x/2)\*besselj(n+0.5,x); %eq 4.9 %DWH eq.29

dfb=0.5\*(besselj(n-0.5,x)-besselj(n+1.5,x));

dfpsi=0.5\*sqrt((pi/2)/x)\*besselj(n+0.5,x)+sqrt(pi\*x/2)\*dfb;

fpsim=sqrt(pi\*(m\*x)/2)\*besselj(n+0.5,m\*x);

fdbm=0.5\*(besselj(n-0.5,m\*x)-besselj(n+1.5,m\*x));

fdpsim=0.5\*sqrt((pi/2)/(m\*x))\*besselj(n+0.5,m\*x)+sqrt(pi\*(m\*x)/2)\*fdbm;

fxsi=sqrt(pi\*x/2)\*besselh(n+0.5,x); %eq 4.10 %DWH eq.30

fdh=0.5\*(besselh(n-0.5,x)-besselh(n+1.5,x));

fdxsi=0.5\*sqrt((pi/2)/x)\*besselh(n+0.5,x)+sqrt(pi\*x/2)\*fdh;

an=(fpsi.\*fdpsim-m\*fpsim.\*dfpsi)./(fxsi.\*fdpsim-m\*fpsim.\*fdxsi); %eq 4.56 %DWH eq.26

bn=(m\*fpsi.\*fdpsim-fpsim.\*dfpsi)./(m\*fxsi.\*fdpsim-fpsim.\*fdxsi); %eq 4.57 %DWH eq.27

text=(l\_vac/m\_env)^2/(2\*pi)\*sum((2\*n+1).\*real(an+bn)); %total ext cs %eq 4.62 %DWH eq.32

tscat=(l\_vac/m\_env)^2/(2\*pi)\*sum((2\*n+1).\*(abs(an).^2+abs(bn).^2)); %total scat cs %eq 4.61 %DWH eq.33

tabsorp=text-tscat; %total abs cs

theta=0:0.1:25;

fpi=zeros(length(n),length(theta));

ftau=zeros(length(n),length(theta));

mu=cosd(theta);

%calculated by the info given between eq.4.47 and 4.48

%fpi(0)=0;

%fpi(1)=1;

fpi(1,:)=1;

fpi(2,:)=3\*mu;

ftau(1,:)=mu;

ftau(2,:)=6\*mu.^2 - 3;

for n2=3:M

fpi(n2,:)=(2\*n2-1)/(n2-1)\*mu.\*fpi(n2-1,:)-n2/(n2-1).\*fpi(n2-2,:); %eq 4.47

ftau(n2,:)=n2\*mu.\*fpi(n2,:)-(n2+1)\*fpi(n2-1,:); %eq 4.48

end

En=(2\*n+1)./(n.\*(n+1)); %DWH eq.22

aif0=abs(En.\*an\*fpi+En.\*bn\*ftau).^2; %DWH eq.22

aif90=abs(En.\*an\*ftau+En.\*bn\*fpi).^2; %DWH eq.23

m\_air=1;

dscat0=(l\_vac/m\_env)^2/(4\*pi^2)\*aif0; % diff scat cs (parallel) %DWH eq.19

dscat90=(l\_vac/m\_env)^2/(4\*pi^2)\*aif90; % diff scat cs (perpendicular) %DWH eq.20

dscat=(dscat0+dscat90)/2; % diff scat cs (unpolarized) %DWH eq.21

theta2=asind(sind(theta)\*m\_env/m\_air);

plim=find(theta2(:)>=5&theta2(:)<=21.8); %between 5-21.8 degree

[aa,bb]=findpeaks(dscat(plim));

peaks=round(theta2(bb+plim(1)),1); %calculation of peak angle

plot(theta2(plim),dscat(plim)./max(dscat(plim)),'LineWidth',2,'Color','r','LineStyle','-');

%title('Unpolarised');

xlabel('Scattering Angle ( ^\circ )','FontSize',16)

ylabel('Differential scattering cross section (A.U.)','FontSize',16)

xlim([theta2(plim(1)) theta2(plim(end))]); hold on

xlim([5 22])

ylim([0 1])

lmb=char(hex2dec('039B'));

fprintf(['Peaks at;\n' 'Diameter(um): ', num2str(d\*1e+6), '\n' ...

lmb '(nm): ' num2str(l\_vac\*1e+9) '\n' ...

'n\_sphere: ', num2str(m\_sph), [', and \n' ...

'n\_medium: '], num2str(m\_env) ' = [',num2str(peaks) ']\n']) %??