

```

(* ===== *)
ClearAll["Global`*"];
(* ===== *)
PathList = {"W:\\Math\\BM\\"};
BaseDir = "W:\\Math\\BM\\";
BaseFileName = "Example_06";
OutDir = BaseDir <> "Calc\\";
(* ===== *)
useParallelTbl = False;
Get["BerremanInit.m", Path → PathList];
Initialize[PathList, useParallelTbl];
(* ===== *)
opts = {BDPlotFigures → True, UseEulerAngles → False};
(* ===== *)
(*
FuncList={{StokesVectorI[1],StokesVectorI[2],StokesVectorI[3],StokesVectorI[4]},
  {StokesVectorR[1],StokesVectorR[2],StokesVectorR[3],StokesVectorR[4]},
  {EltEG[1],EltEG[2],EltEG[3],EltEG[4]},
  {XitEGDegree[1],XitEGDegree[2],XitEGDegree[3],XitEGDegree[4]},
  {IFull,RFull,TFull},{Ix,Iy,Rx,Ry,Tx,Ty},{Eli,Elr,Elt},
  {XiiDegree, XirDegree,XitDegree},{Sin2Xii,Sin2Xir,Sin2Xit}};
*)
(*
FuncList={StokesVectorR[1],StokesVectorR[2],StokesVectorR[3],StokesVectorR[4],
  RFull,TFull, StokesGammaR, StokesGammaDegreeR,StokesChiR, StokesChiDegreeR,
  StokesPolarizedR,XirDegree,Elr,PsiPPDegree,DeltaPPDegree,{Rx,Ry},{Tx,Ty}};
*)
FuncList = {RFull, TFull, {Rx, Ry}, {Tx, Ty}};

(* ===== *)
systemDescription =
  "One Layer biaxial thin film between two semi-infinite media.";
(* ===== *)
Print["Параметры падающего света..."];
nUpper = 1;

lambda = {200, 1000, 400, "λ", nm};
fita = {0, 75, 15, "φ", Degree};
beta = {0, 0, 45, "β", Degree};
gamma = {0, 0, 30, "γ", Degree};
ellipt = {0, 0, 0.5, "e"};

incidentLight = CreateIncidentRay[nUpper, lambda, fita, beta, ellipt];
OutputIncidentRayInfo[incidentLight];
(* ===== *)
Print["Оптические параметры первого тонкого слоя."];
fiLayer1 = {0, 0, 30, Subscript["φ", "1"], Degree};
thetaLayer1 = {0, 0, 30, Subscript["θ", "1"], Degree};
psiLayer1 = {0, 0, 30, Subscript["ψ", "1"], Degree};

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rotationAnglesLayer1 = {fiLayer1, thetaLayer1, psiLayer1};

thicknessLayer1 = {100, 100, 10, "h", nm};

epsLayer1 = EpsilonFromN[1.46];
Print["epsLayer1 = ", epsLayer1 // MatrixForm];

layer1 = CreateFilm[thicknessLayer1, rotationAnglesLayer1, epsLayer1];
(* ===== *)
Print["Оптические параметры нижней среды..."];
fi = {0, 0, 1, "φ", Degree};
theta = {0, 0, 1, "θ", Degree};
psi = {0, 0, 1, "ψ", Degree};
rotationAngles = {fi, theta, psi};
(*
nLower=1.5;
lowerMedia=CreateSemiInfiniteMediaFromN[nLower];
*)
epsLower = EpsilonFromN[3.87 + I * 0.0165];
Print["epsLower = ", epsLower // MatrixForm];

(*
muLower=DiagonalMatrix[{1,1,1}];
rhoLower=I*DiagonalMatrix[{0,0,0}];
Print["muLower = ", muLower // MatrixForm];
Print["rhoLower = ", rhoLower // MatrixForm];
*)
(* lowerMedia=
   CreateSemiInfiniteMedia[rotationAngles,epsLower,muLower,rhoLower]; *)
lowerMedia = CreateSemiInfiniteMedia[rotationAngles, epsLower];
(* Print ["lowerMedia = ", lowerMedia]; *)
(* ===== *)
Print["Создаем оптическую систему..."];
layeredSystem = CreateLayeredSystem[incidentLight, gamma, layer1, lowerMedia];
OutputLayeredSystem[layeredSystem];
(* ===== *)
Print["Производим вычисления для различных значений параметров...."];
allCalc = PerformAllCalculations[layeredSystem, FuncList, systemDescription, opts];
(* ===== *)

```

Инициализация...

Mathematica version is 10. Assigning RotationMatrix3D and BlockMatrix

Loading modules ...

Mathematica version is 10. Assigning OFULL via Join.

... completed.

=====

BM version: 6.02.001

Release date: 2016/04/12

Crystal Plate Reflection and Transmission. .

BerremanInitVersion = 6.02

BerremanCommonVersion = 6.02

BerremanDirectVersion = 6.02

BerremanInverseVersion = 5.03

FieldAlgebraVersion = 6.02

FieldIOVersion = 6.02

FieldIOFormatVersion = 6.02

Copyright: K<sup>3</sup>, 2001 - 2016.

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Инициализация завершена.

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Параметры падающего света...

Upper refractive index  $n_u = 1$ , parameters:

$$\begin{pmatrix} 200 & 1000 & 400 & \lambda & \frac{1}{1000000000} \\ 0 & 75 & 15 & \phi & \circ \\ 0 & 0 & 45 & \beta & \circ \\ 0 & 0 & 0.5 & e & \end{pmatrix}$$

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Оптические параметры первого тонкого слоя.

$$\text{epsLayer1} = \begin{pmatrix} 2.1316 & 0 & 0 \\ 0 & 2.1316 & 0 \\ 0 & 0 & 2.1316 \end{pmatrix}$$

Оптические параметры нижней среды...

$$\text{epsLower} = \begin{pmatrix} 14.9766 + 0.12771 i & 0 & 0 \\ 0 & 14.9766 + 0.12771 i & 0 \\ 0 & 0 & 14.9766 + 0.12771 i \end{pmatrix}$$

Создаем оптическую систему...

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```

Layered System = {LayeredSystem, {{1, 3.87 + 0.0165 i, {0, 0, 30,  $\gamma$ , °},
  {{0, {{2.1316, 0, 0}, {0, 2.1316, 0}, {0, 0, 2.1316}}, {{1, 0, 0}, {0, 1, 0}, {0, 0, 1}},
  {{0, 0, 0}, {0, 0, 0}, {0, 0, 0}}, {{0, 0, 0}, {0, 0, 0}, {0, 0, 0}},
  {{2.1316, 0, 0}, {0, 2.1316, 0}, {0, 0, 2.1316}}, {{1, 0, 0}, {0, 1, 0}, {0, 0, 1}},
  {{0, 0, 0}, {0, 0, 0}, {0, 0, 0}}, {{0, 0, 0}, {0, 0, 0}, {0, 0, 0}}}}, Layered System,
1, 0, {{{1, 0, 0}, {0, 1, 0}, {0, 0, 1}}, {{1, 0, 0}, {0, 1, 0}, {0, 0, 1}},
  {{0, 0, 0}, {0, 0, 0}, {0, 0, 0}}, {{0, 0, 0}, {0, 0, 0}, {0, 0, 0}},
  {{14.9766 + 0.12771 i, 0, 0}, {0, 14.9766 + 0.12771 i, 0}, {0, 0, 14.9766 + 0.12771 i}},
  {{1, 0, 0}, {0, 1, 0}, {0, 0, 1}}, {{0, 0, 0}, {0, 0, 0}, {0, 0, 0}},
  {{0, 0, 0}, {0, 0, 0}, {0, 0, 0}}}},
  {{200, 1000, 400,  $\lambda$ ,  $\frac{1}{1\,000\,000\,000}$ }, {0, 75, 15,  $\phi$ , °}, {0, 0, 45,  $\beta$ , °},
  {0, 0, 30,  $\gamma$ , °}, {0, 0, 0.5, e}, {0, 0, 1,  $\varphi$ , °}, {0, 0, 1,  $\theta$ , °},
  {0, 0, 1,  $\psi$ , °}, {0, 0, 30,  $\varphi_1$ , °}, {0, 0, 30,  $\theta_1$ , °}, {0, 0, 30,  $\psi_1$ , °},
  {{100, 100, 10, h,  $\frac{1}{1\,000\,000\,000}$ }}, {UseThickLastLayer → False}}}
```

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Производим вычисления для различных значений параметров....

PerformAllCalculations::Calculating...

Start time: 15:18:27

Total number of points to calculate: 18

Estimated total calculation time: 0:00:00

Estimated end time: 15:18:27

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Using Optima angles for rotation:

Rotation 1: Fi (angle between crystal

axis and deposition direction) - rotation around z;

Rotation 2: Psi (angle between crystal axis and substrate

plane.) - rotation around y (in the opposite direction!!!);

Rotation 3: Alpha (rotation of crystal around its axis.) - rotation around x.

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Printing Collection...

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\*\*\* Multilayered Thin Film Output File Format Version 6.02 \*\*\*

\*\*\* Modelling Engine Version 6.02 \*\*\*

\* Description \*

One Layer biaxial thin film between two semi-infinite media.

\*\*\* Begin Options Block \*\*\*

|                 |         |
|-----------------|---------|
|                 | Using I |
|                 | Solving |
|                 | Rotati  |
|                 | Using ( |
| AbsoluteAzimuth | Using i |

\*\*\* End Options Block \*\*\*

\*\*\* Begin Optical Properties Block \*\*\*

\*\* Media \*\*

Refraction\_Index

1

\*\* Begin Detailed Substrate Block \*\*

Epsilon RE

14.9766

0

0

14.9766

0

0

\*\* End Detailed Substrate Block \*\*

Thickness

Nothing to ouput so far...

\*\* Media End \*\*

\*\* Film \*\*

n

1.46

0.

0.

1.46

0.

0.

k

0

0

0

0

0

0

Epsilon\_RE

2.1316

0

0

2.1316

0

0

Epsilon\_IM

0

0

0

0

0

0

\*\* Film End \*\*

\*\*\* End Optical Properties Block \*\*\*

\*\*\* Begin Output Block \*\*\*

| Input No | $\lambda$ | $\phi$ | $\beta$ | $\gamma$ | $e$ | $\varphi$ | $\theta$ | $\psi$ | $\varphi_1$ | $\theta_1$ | $\psi_1$ | $h$  | Output | R         | T        | $R_p$     |
|----------|-----------|--------|---------|----------|-----|-----------|----------|--------|-------------|------------|----------|------|--------|-----------|----------|-----------|
| 1.       | 200.      | 0.     | 0.      | 0.       | 0.  | 0.        | 0.       | 0.     | 0.          | 0.         | 0.       | 100. |        | 0.0895081 | 0.910492 | 0.0895081 |
| 2.       | 200.      | 15.    | 0.      | 0.       | 0.  | 0.        | 0.       | 0.     | 0.          | 0.         | 0.       | 100. |        | 0.0981199 | 0.90188  | 0.0981199 |
| 3.       | 200.      | 30.    | 0.      | 0.       | 0.  | 0.        | 0.       | 0.     | 0.          | 0.         | 0.       | 100. |        | 0.129709  | 0.870291 | 0.129709  |
| 4.       | 200.      | 45.    | 0.      | 0.       | 0.  | 0.        | 0.       | 0.     | 0.          | 0.         | 0.       | 100. |        | 0.160478  | 0.839522 | 0.160478  |
| 5.       | 200.      | 60.    | 0.      | 0.       | 0.  | 0.        | 0.       | 0.     | 0.          | 0.         | 0.       | 100. |        | 0.127199  | 0.872801 | 0.127199  |
| 6.       | 200.      | 75.    | 0.      | 0.       | 0.  | 0.        | 0.       | 0.     | 0.          | 0.         | 0.       | 100. |        | 0.0485321 | 0.951468 | 0.0485321 |
| 7.       | 600.      | 0.     | 0.      | 0.       | 0.  | 0.        | 0.       | 0.     | 0.          | 0.         | 0.       | 100. |        | 0.0844975 | 0.915503 | 0.0844975 |
| 8.       | 600.      | 15.    | 0.      | 0.       | 0.  | 0.        | 0.       | 0.     | 0.          | 0.         | 0.       | 100. |        | 0.0866426 | 0.913357 | 0.0866426 |
| 9.       | 600.      | 30.    | 0.      | 0.       | 0.  | 0.        | 0.       | 0.     | 0.          | 0.         | 0.       | 100. |        | 0.0958897 | 0.90411  | 0.0958897 |
| 10.      | 600.      | 45.    | 0.      | 0.       | 0.  | 0.        | 0.       | 0.     | 0.          | 0.         | 0.       | 100. |        | 0.117579  | 0.882421 | 0.117579  |
| 11.      | 600.      | 60.    | 0.      | 0.       | 0.  | 0.        | 0.       | 0.     | 0.          | 0.         | 0.       | 100. |        | 0.165208  | 0.834792 | 0.165208  |
| 12.      | 600.      | 75.    | 0.      | 0.       | 0.  | 0.        | 0.       | 0.     | 0.          | 0.         | 0.       | 100. |        | 0.325508  | 0.674492 | 0.325508  |
| 13.      | 1000.     | 0.     | 0.      | 0.       | 0.  | 0.        | 0.       | 0.     | 0.          | 0.         | 0.       | 100. |        | 0.2023    | 0.7977   | 0.2023    |
| 14.      | 1000.     | 15.    | 0.      | 0.       | 0.  | 0.        | 0.       | 0.     | 0.          | 0.         | 0.       | 100. |        | 0.199868  | 0.800132 | 0.199868  |
| 15.      | 1000.     | 30.    | 0.      | 0.       | 0.  | 0.        | 0.       | 0.     | 0.          | 0.         | 0.       | 100. |        | 0.190184  | 0.809816 | 0.190184  |
| 16.      | 1000.     | 45.    | 0.      | 0.       | 0.  | 0.        | 0.       | 0.     | 0.          | 0.         | 0.       | 100. |        | 0.168147  | 0.831853 | 0.168147  |
| 17.      | 1000.     | 60.    | 0.      | 0.       | 0.  | 0.        | 0.       | 0.     | 0.          | 0.         | 0.       | 100. |        | 0.138649  | 0.861351 | 0.138649  |
| 18.      | 1000.     | 75.    | 0.      | 0.       | 0.  | 0.        | 0.       | 0.     | 0.          | 0.         | 0.       | 100. |        | 0.190478  | 0.809522 | 0.190478  |

\*\*\* End Output Block \*\*\*

Done.

=====

Saving Collection...

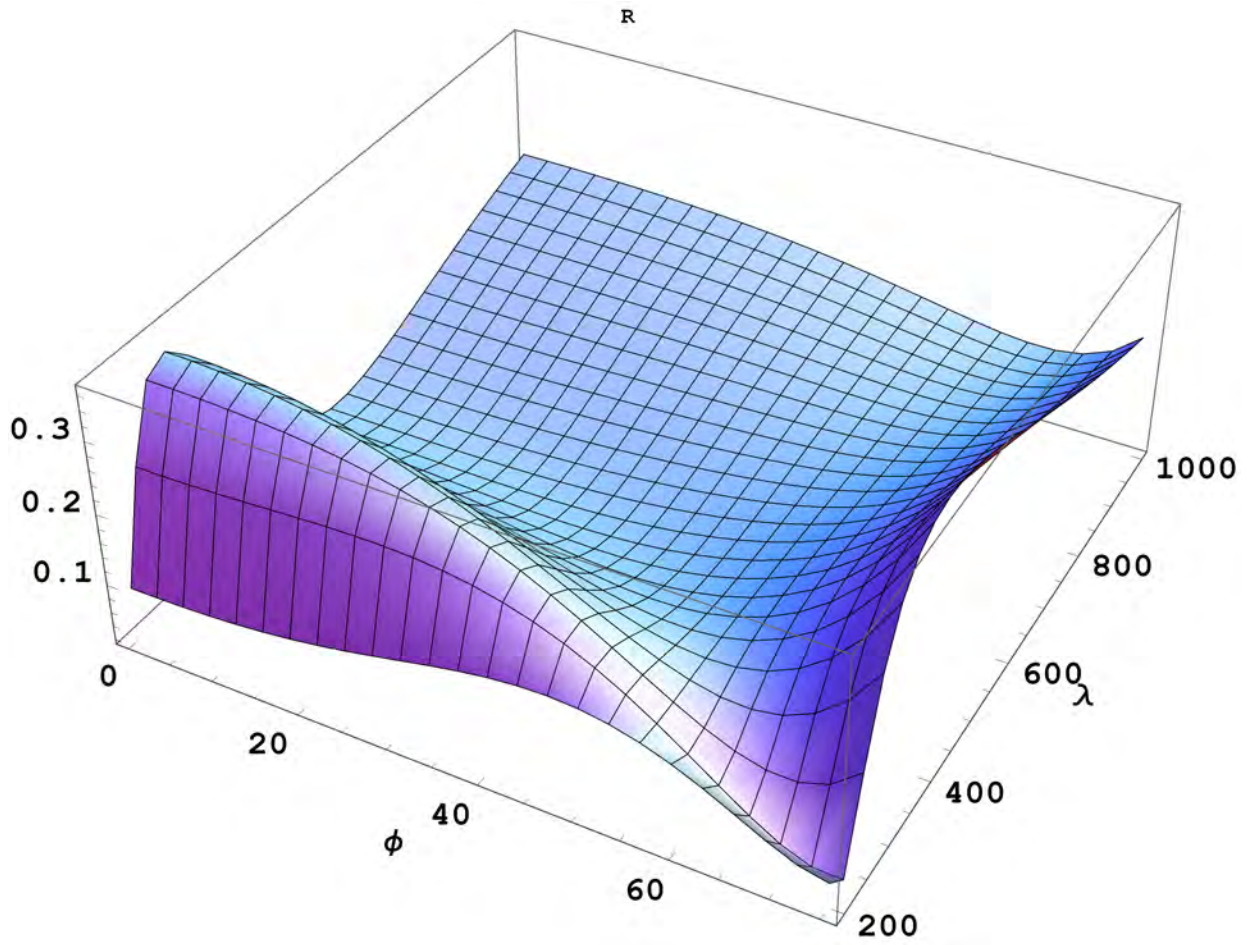
Done.

Sat 8 Oct 2016 15:18:28, time used: 1.802, total time used: 2.

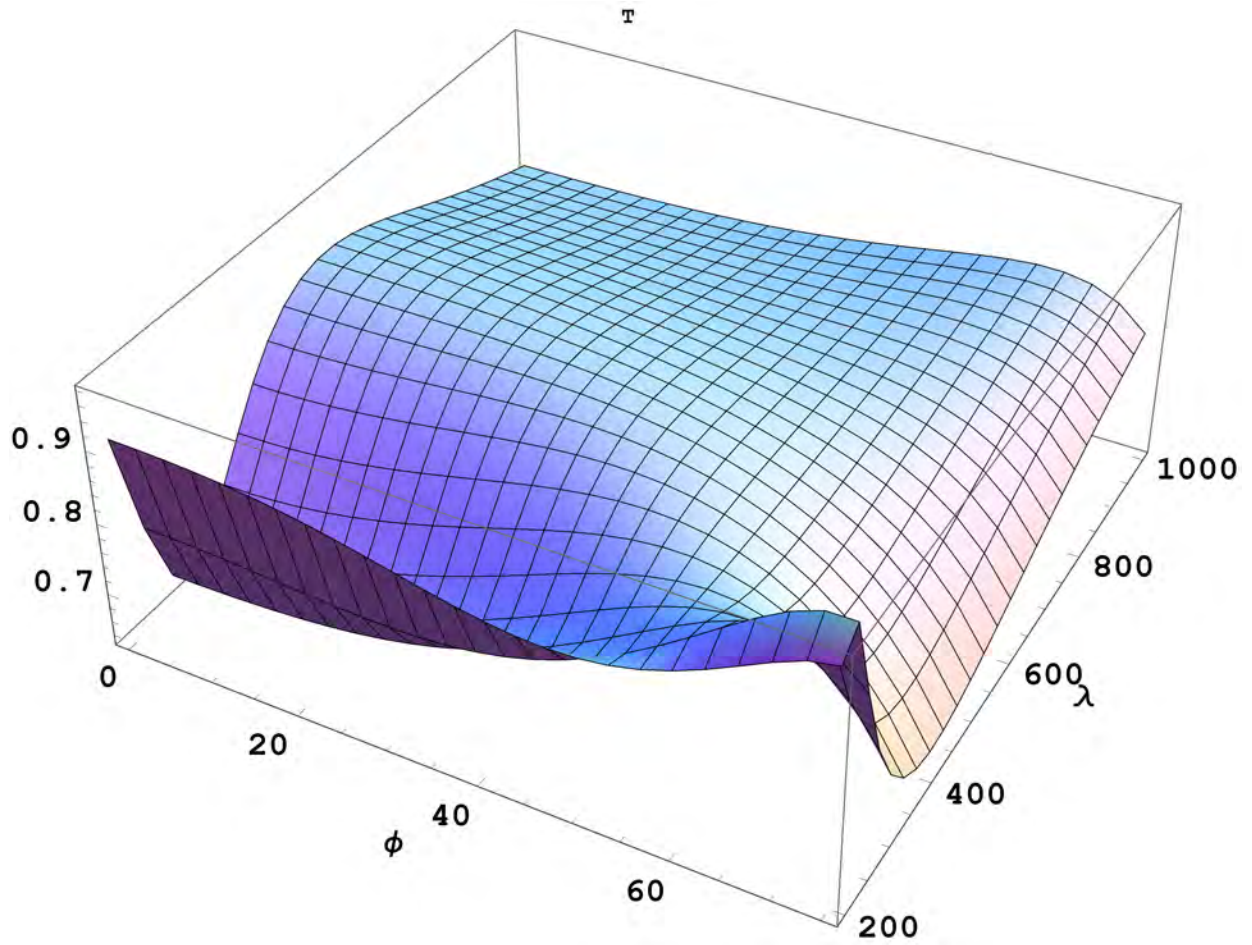
-----

PerformAllCalculations::Plotting figures...

Full intensity of Reflected light.



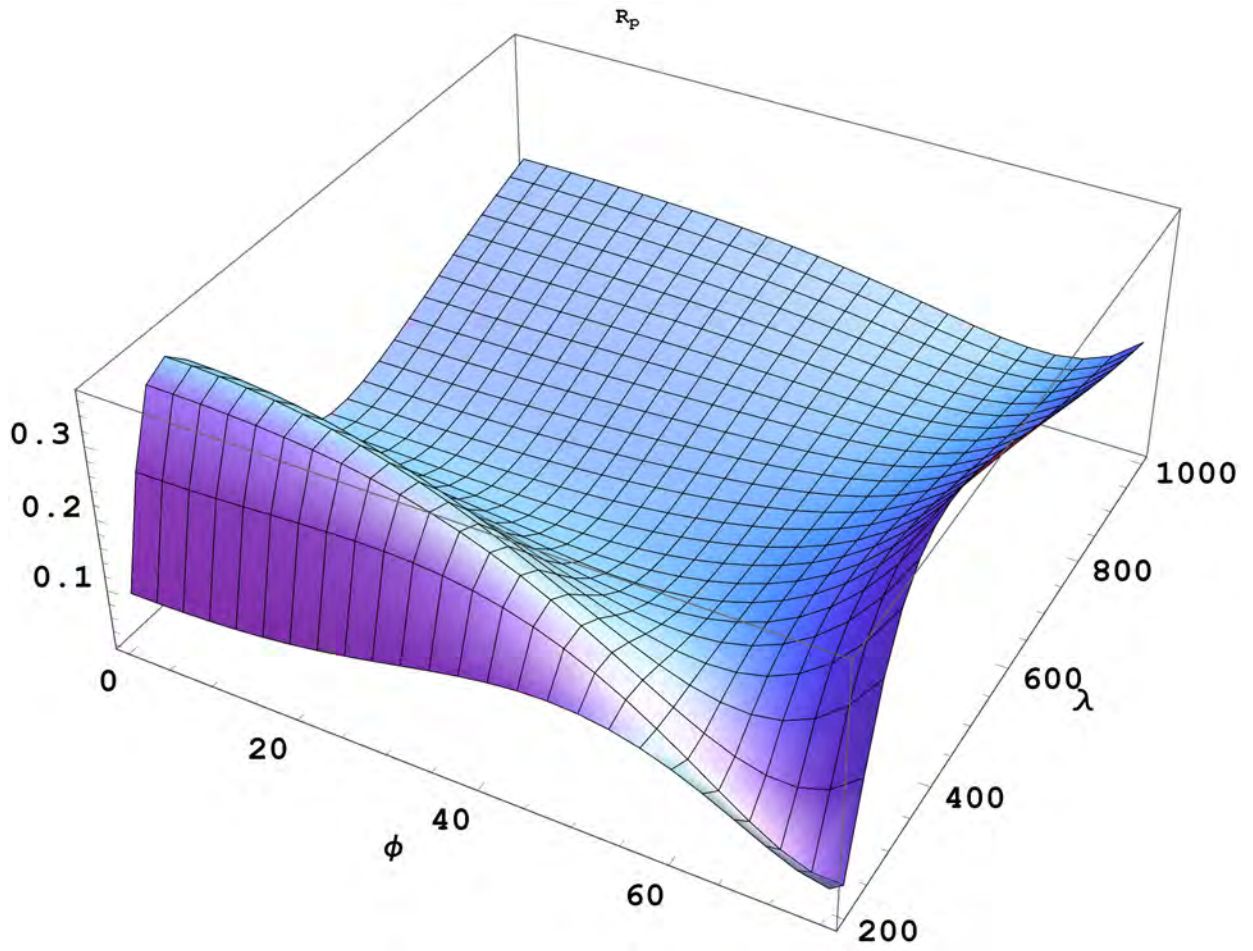
Full intensity of Transmitted light.



=====

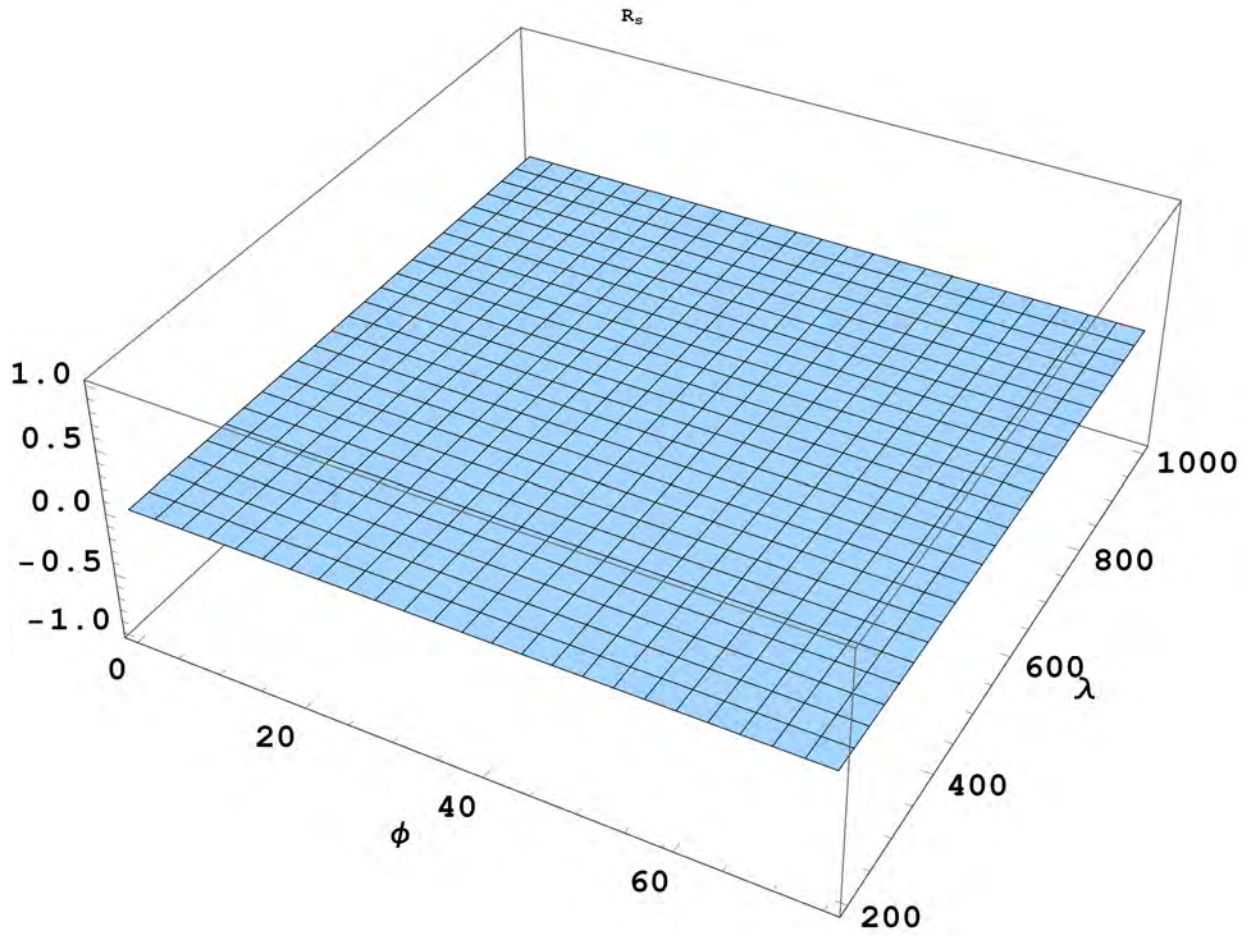
Intensity of Reflected light going into X component.





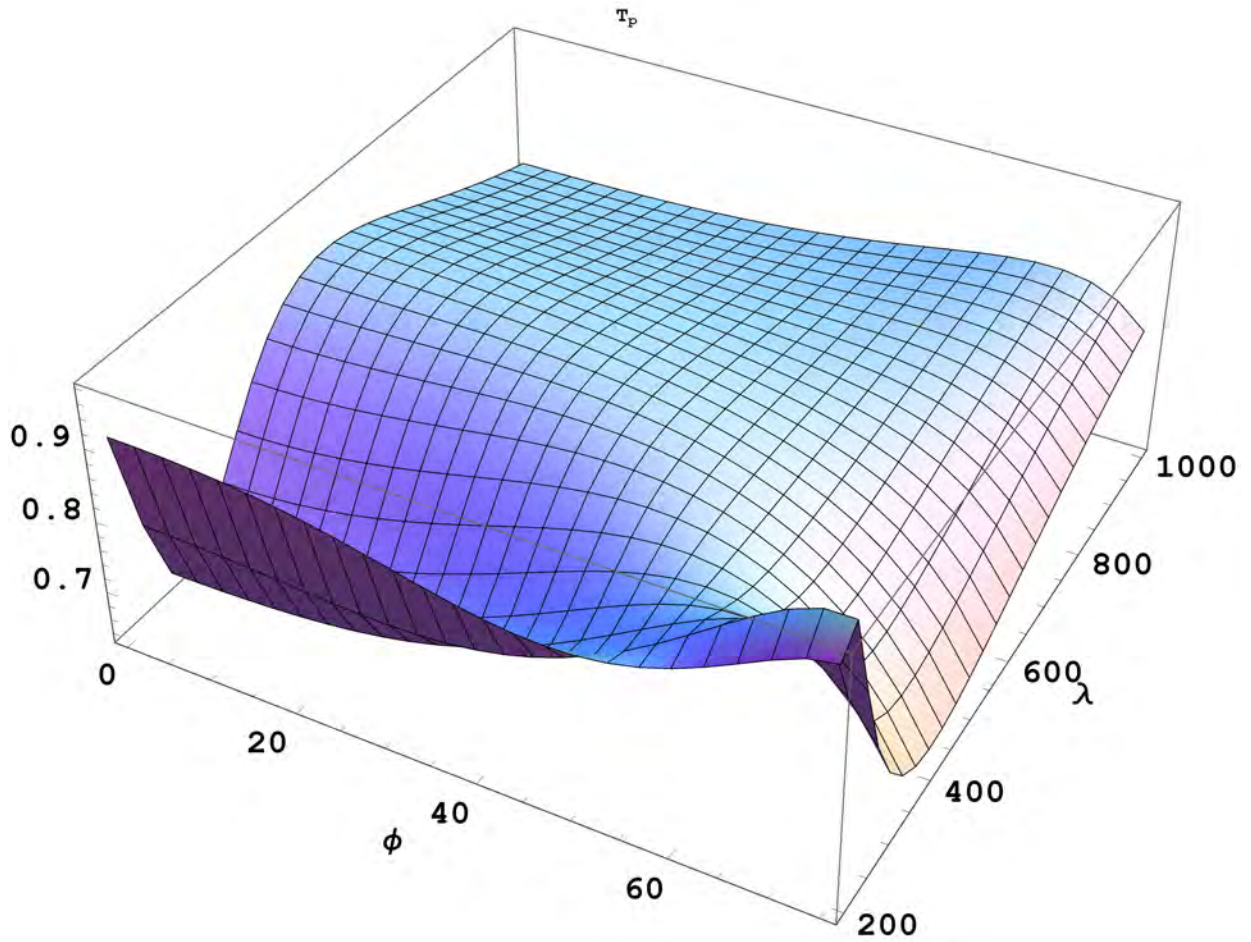
=====

Intensity of Reflected light going into Y component.



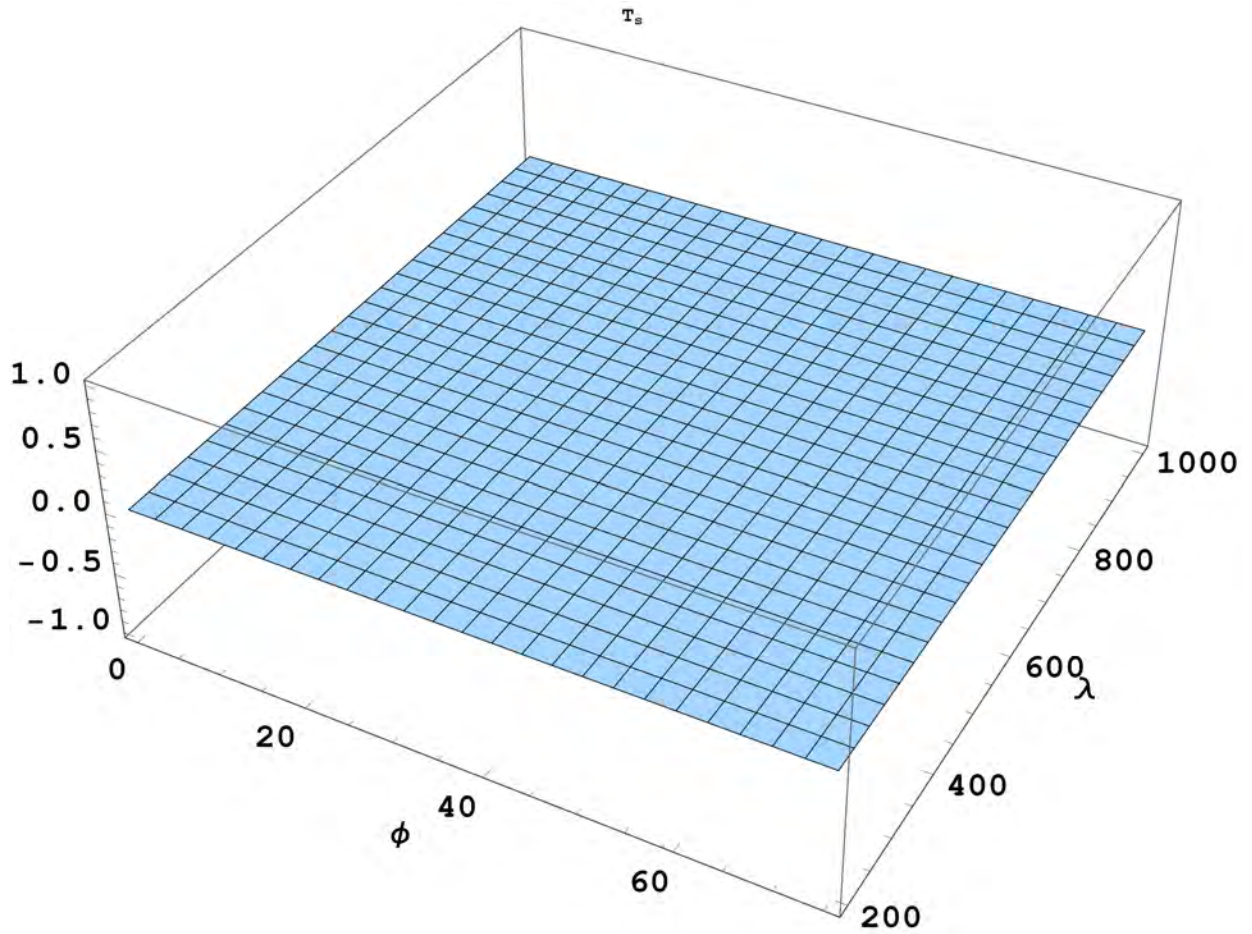
=====

Intensity of Transmitted light going into X component.



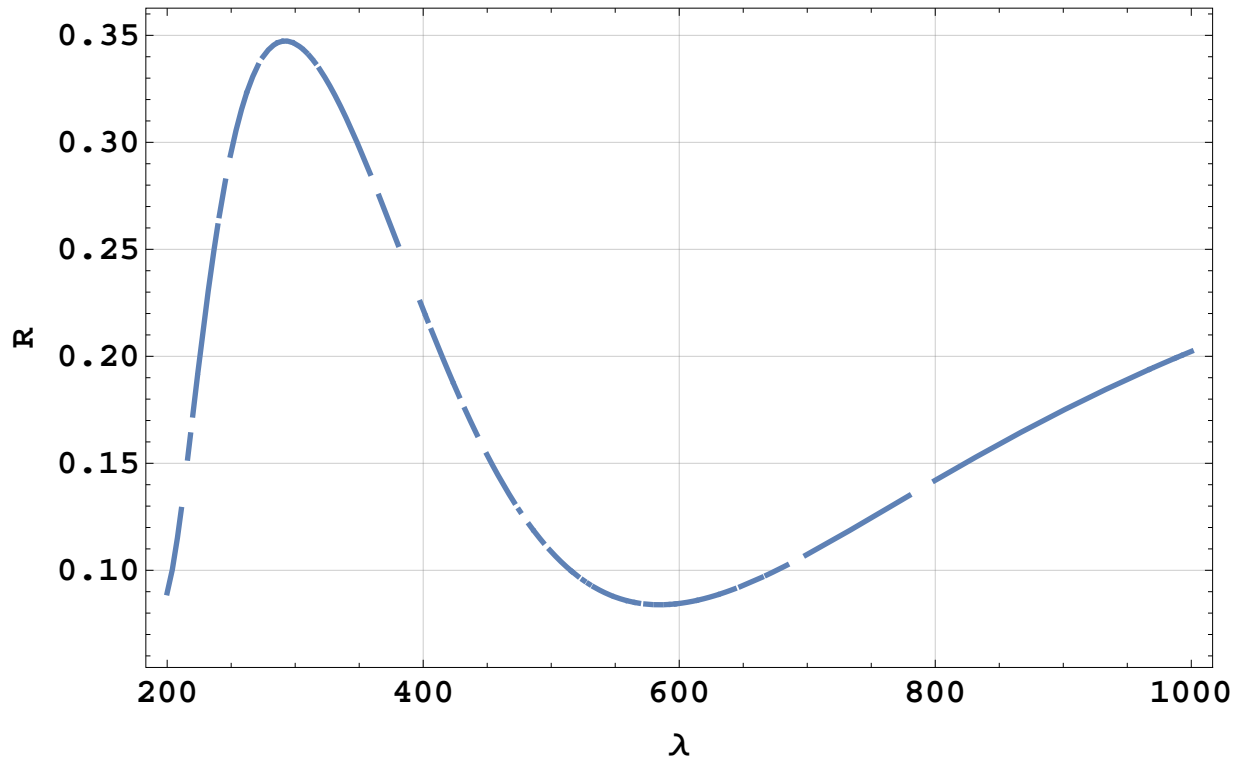
=====

Intensity of Transmitted light going into Y component.

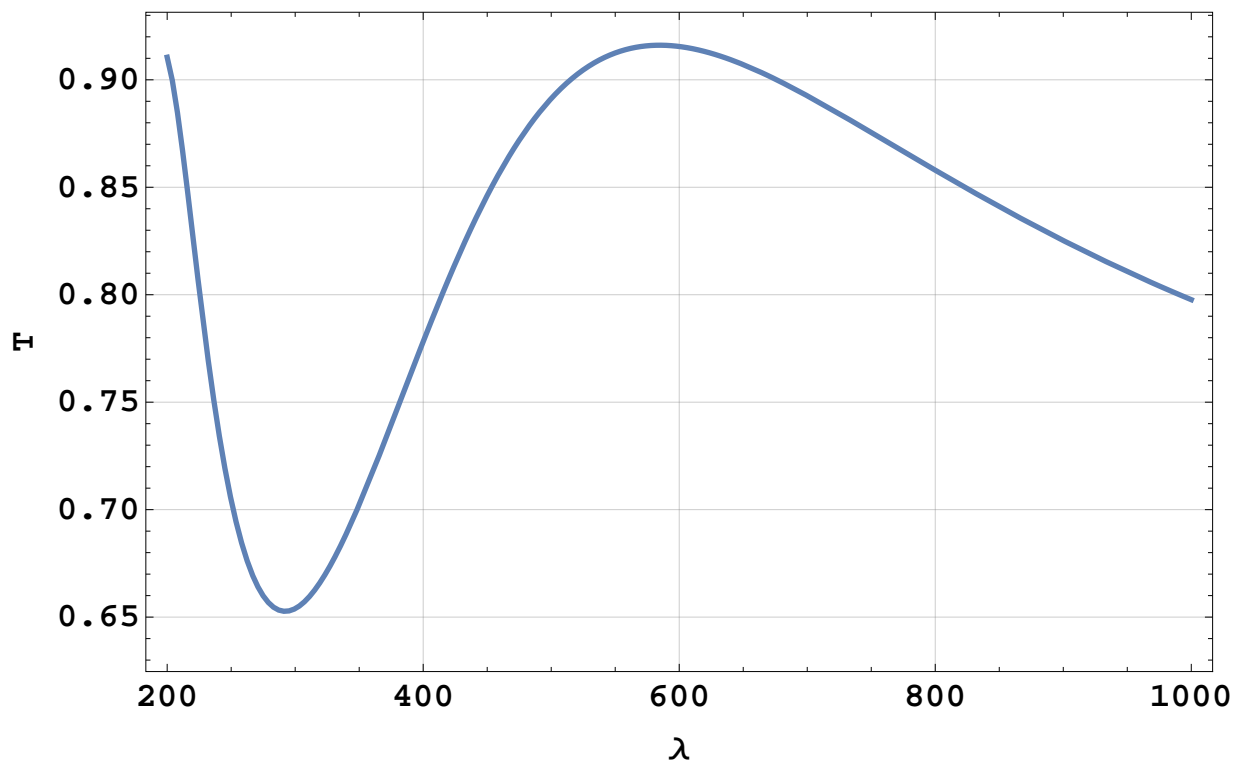


=====

Full intensity of Reflected light.

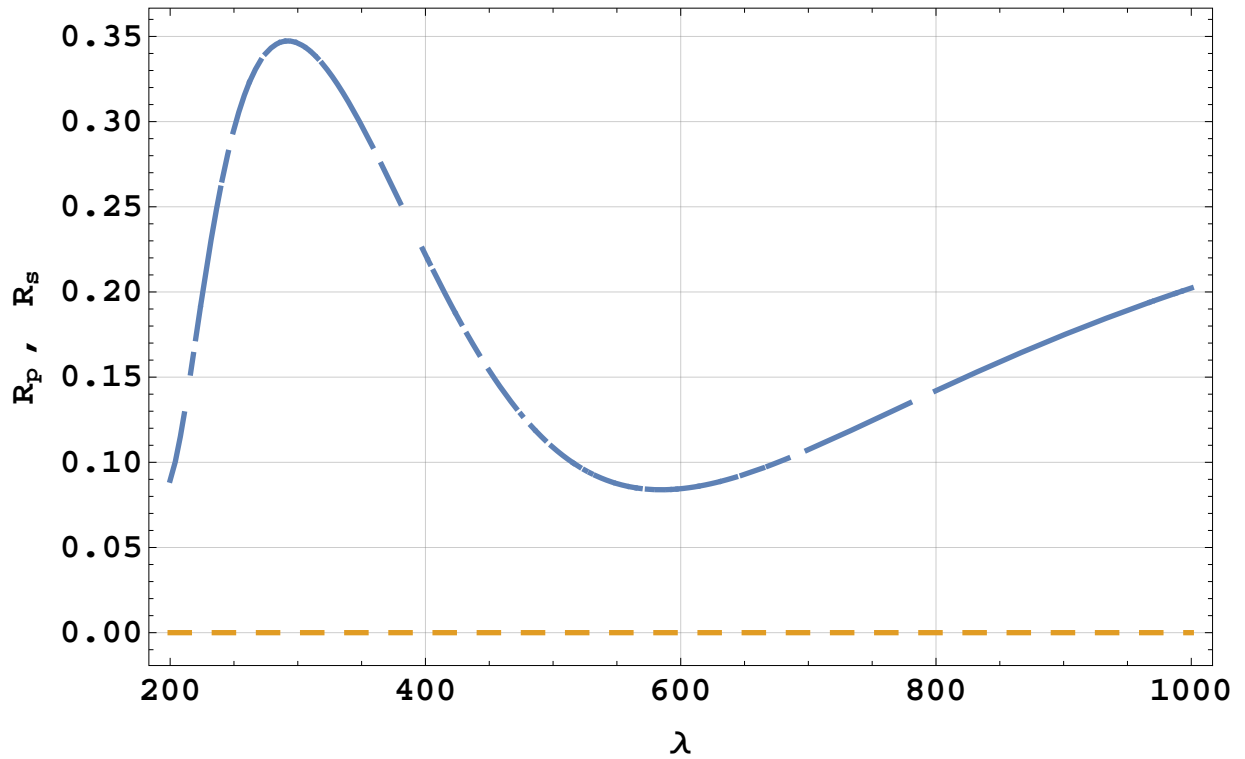


Full intensity of Transmitted light.

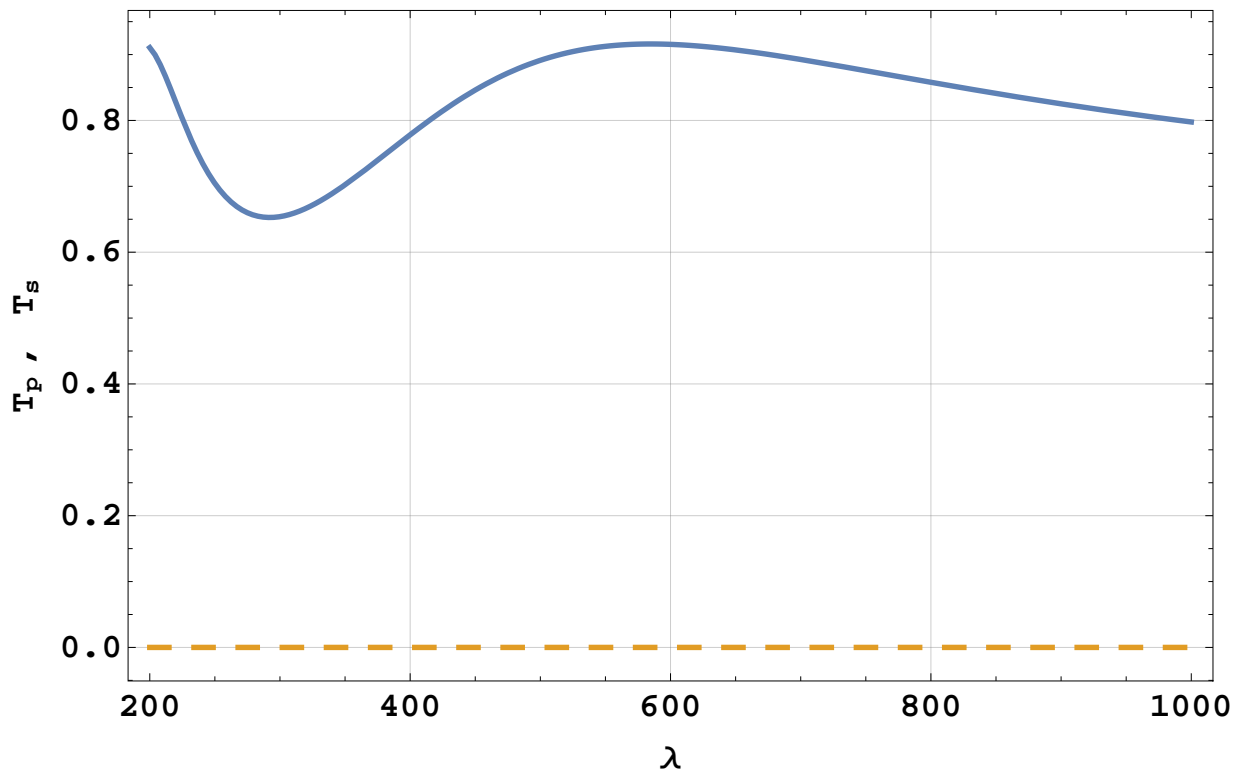


{Intensity of Reflected light going into X component.,  
Intensity of Reflected light going into Y component.}





{Intensity of Transmitted light going into X component.,  
Intensity of Transmitted light going into Y component.}



Sat 8 Oct 2016 15:19:23, time used: 55.036, total time used: 57.

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