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In[1]:= SetDirectory ["~/Factorisation/"];
<< kappaLib.m
<< helper.m
```

KappaLib v1.1

Loading helper.m..

```
In[4]:= vars = {x0, x1, x2, x3};
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$$\text{In[5]:= AA [D1_] := } \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & \frac{1}{2} \left(-D1 + \sqrt{4 + D1^2} \right) & 0 & 0 \\ 0 & 0 & \frac{1}{2} \left(-D1 + \sqrt{4 + D1^2} \right) & 0 \\ 0 & 0 & 0 & -1 \end{pmatrix};$$

$$\text{BB [D1_] := } \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & \frac{1}{2} \left(-D1 - \sqrt{4 + D1^2} \right) & 0 & 0 \\ 0 & 0 & \frac{1}{2} \left(-D1 - \sqrt{4 + D1^2} \right) & 0 \\ 0 & 0 & 0 & -1 \end{pmatrix};$$

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In[7]:= FullSimplify [vars.AA [D1].vars]
FullSimplify [vars.BB [D1].vars]
```

$$\text{Out[7]= } x0^2 + \frac{1}{2} \left(\left(-D1 + \sqrt{4 + D1^2} \right) (x1^2 + x2^2) - 2 x3^2 \right)$$

$$\text{Out[8]= } x0^2 + \frac{1}{2} \left(\left(D1 + \sqrt{4 + D1^2} \right) (x1^2 + x2^2) - 2 x3^2 \right)$$

■ Fresnel surface function of x0, x1^2 + x2^2, x3

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In[9]:= vars = {x0, 0, x2, x3};
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In[10]:= f1 [D1_] := FullSimplify [vars.AA [D1].vars]
f2 [D1_] := FullSimplify [vars.BB [D1].vars]
```

```
In[12]:= F [D1_] := toEqs [{f1 [D1], f2 [D1]}]
```

■ Viewpoint and ViewVertical

```
In[13]:= vp = {1.9182892524446804`, 2.4632276376155486`, 1.3048662572241434`};
vv = {0.13721054563794138`, 0.19011461479660596`, 0.9721263803675306`};
```

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In[15]:= F [-25]
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$$\text{Out[15]= } \left\{ x0^2 + \frac{1}{2} \left(25 + \sqrt{629} \right) x2^2 - x3^2 == 0, x0^2 - \frac{1}{2} \left(-25 + \sqrt{629} \right) x2^2 - x3^2 == 0 \right\}$$

$\{f1[d] == 0, f2[d] == 0\}$

$$\left\{ x0^2 + \frac{1}{2} \left(-d + \sqrt{4 + d^2} \right) x2^2 - x3^2 == 0, x0^2 - \frac{1}{2} \left(d + \sqrt{4 + d^2} \right) x2^2 - x3^2 == 0 \right\}$$

In[16]:= **d = -25;**

**p1 = ContourPlot3D[{f1[d] == 0, f2[d] == 0}, {x0, -1, 1}, {x2, -1.1, 1.1},
{x3, -1, 1}, Axes → False, Boxed → False, ViewPoint → vp, ViewVertical → vv]**

In[18]:= **d = 0;**

**p2 = ContourPlot3D[{f1[d] == 0, f2[d] == 0}, {x0, -1, 1}, {x2, -1, 1},
{x3, -1, 1}, Axes → False, Boxed → False, ViewPoint → vp, ViewVertical → vv]**

In[22]:= **d = 25;**

**p3 = ContourPlot3D[{f1[d] == 0, f2[d] == 0}, {x0, -1, 1}, {x2, -1, 1},
{x3, -1, 1}, Axes → False, Boxed → False, ViewPoint → vp, ViewVertical → vv]**

In[24]:= **all = Show[GraphicsGrid[{{p1, p2, p3}}]]**

In[25]:= **printNotebook["Plot_IV.pdf"]**