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In[1]:= (*Fuzzy Sphere scaling to 5 part lemniscate
with 6 steps printed for 5x5 matrices. Each step is in 6
ths for the images. Increase step to create the video,
Finally, one can compress the video in linux via
ffmpeg -i F5scale.avi-vcodec msmpeg4v2-q:v 7 F5scale_cmprsd.avi
*)
n = 2;
(a = {{2, 0, 0, 0, 0}, {0, 1, 0, 0, 0},
      {0, 0, 0, 0, 0}, {0, 0, 0, -1, 0}, {0, 0, 0, 0, -2}}) // MatrixForm
(b = {{0, 1, 0, 0, 0}, {0, 0, 1, 0, 0}, {0, 0, 0, 1, 0},
      {0, 0, 0, 0, 1}, {0, 0, 0, 0, 0}}) // MatrixForm;
(b2 = (1/(2*n)) * (ConjugateTranspose[b] + b)) // MatrixForm
(c = (1/(2*n)) * I * (ConjugateTranspose[b] - b)) // MatrixForm
sigma1 = {{0, 1}, {1, 0}};
sigma2 = {{0, -I}, {I, 0}};
sigma3 = {{1, 0}, {0, -1}};
loclzr = KroneckerProduct[sigma1, r*a - x*IdentityMatrix[5]] +
        KroneckerProduct[sigma2, b2 - y*IdentityMatrix[5]] +
        KroneckerProduct[sigma3, c - z*IdentityMatrix[5]];
MatrixForm[loclzr]
charpoly = FullSimplify[Det[loclzr]]

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Out[2]//MatrixForm=

$$\begin{pmatrix} 2 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & 0 & -2 \end{pmatrix}$$

Out[4]//MatrixForm=

$$\begin{pmatrix} 0 & \frac{1}{4} & 0 & 0 & 0 \\ \frac{1}{4} & 0 & \frac{1}{4} & 0 & 0 \\ 0 & \frac{1}{4} & 0 & \frac{1}{4} & 0 \\ 0 & 0 & \frac{1}{4} & 0 & \frac{1}{4} \\ 0 & 0 & 0 & \frac{1}{4} & 0 \end{pmatrix}$$

Out[5]//MatrixForm=

$$\begin{pmatrix} 0 & -\frac{i}{4} & 0 & 0 & 0 \\ \frac{i}{4} & 0 & -\frac{i}{4} & 0 & 0 \\ 0 & \frac{i}{4} & 0 & -\frac{i}{4} & 0 \\ 0 & 0 & \frac{i}{4} & 0 & -\frac{i}{4} \\ 0 & 0 & 0 & \frac{i}{4} & 0 \end{pmatrix}$$

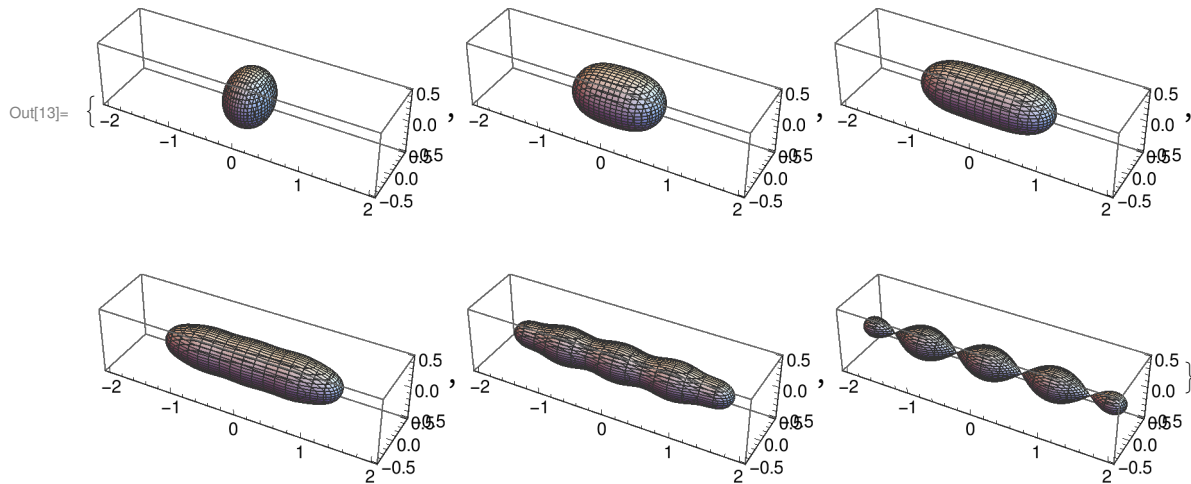
Out[10]//MatrixForm=

$$\begin{pmatrix} -z & -\frac{i}{4} & 0 & 0 & 0 & 2r-x+iy & -\frac{i}{4} & 0 & 0 \\ \frac{i}{4} & -z & -\frac{i}{4} & 0 & 0 & -\frac{i}{4} & r-x+iy & -\frac{i}{4} & 0 \\ 0 & \frac{i}{4} & -z & -\frac{i}{4} & 0 & 0 & -\frac{i}{4} & -x+iy & -\frac{i}{4} \\ 0 & 0 & \frac{i}{4} & -z & -\frac{i}{4} & 0 & 0 & -\frac{i}{4} & -r-x \\ 0 & 0 & 0 & \frac{i}{4} & -z & 0 & 0 & 0 & -\frac{i}{4} \\ 2r-x-iy & \frac{i}{4} & 0 & 0 & 0 & z & \frac{i}{4} & 0 & 0 \\ \frac{i}{4} & r-x-iy & \frac{i}{4} & 0 & 0 & -\frac{i}{4} & z & \frac{i}{4} & 0 \\ 0 & \frac{i}{4} & -x-iy & \frac{i}{4} & 0 & 0 & -\frac{i}{4} & z & \frac{i}{4} \\ 0 & 0 & \frac{i}{4} & -r-x-iy & \frac{i}{4} & 0 & 0 & -\frac{i}{4} & z \\ 0 & 0 & 0 & \frac{i}{4} & -2r-x-iy & 0 & 0 & 0 & -\frac{i}{4} \end{pmatrix}$$

$$\begin{aligned} \text{Out[11]} = & -\frac{x^2}{256} - 16r^8(x^2+y^2+z^2) + r^6(1+4x^2+40x^4-40y^4-4z^2-40z^4-4y^2(1+20z^2)) + \\ & \frac{1}{4}r^4(1-132x^6+y^2+z^2-4(y^2+z^2)^2(5+33y^2+33z^2)-4x^4(9+35y^2+35z^2)- \\ & x^2(-1+140y^4+24z^2+140z^4+8y^2(3+35z^2))) + \frac{1}{32}(-32x^{10}-32(y^2+z^2)^5- \\ & 32x^8(1+5y^2+5z^2)-4x^6(3+80y^4+24z^2+80z^4+8y^2(3+20z^2))- \\ & x^2(y^2+z^2)(1+160y^6+6z^2+32y^4(1+15z^2)+y^2(6+64z^2+480z^4)+32(z^4+5z^6))- \\ & 2x^4(1+160y^6+9z^2+48z^4+160z^6+48y^4(1+10z^2)+y^2(9+96(z^2+5z^4)))) + \\ & \frac{1}{64}r^2(1+640x^8+4y^2+4z^2+128x^6(3+10y^2+10z^2)+8x^4(11+56y^2+56z^2)- \\ & 4(y^2+z^2)^2(-1+160y^4+16z^2+160z^4+16y^2(1+20z^2))+ \\ & 4x^2(3+15z^2-5(64y^6+192y^4z^2+64z^6+3y^2(-1+64z^4)))) \end{aligned}$$

In[12]:= **step = 1/6;**

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In[13]:= plots2 = ParallelTable[ContourPlot3D[
  -  $\frac{x^2}{256}$  - 16 r8 (x2 + y2 + z2) + r6 (1 + 4 x2 + 40 x4 - 40 y4 - 4 z2 - 40 z4 - 4 y2 (1 + 20 z2)) +
   $\frac{1}{4}$  r4 (1 - 132 x6 + y2 + z2 - 4 (y2 + z2)2 (5 + 33 y2 + 33 z2) - 4 x4 (9 + 35 y2 + 35 z2) -
  x2 (-1 + 140 y4 + 24 z2 + 140 z4 + 8 y2 (3 + 35 z2)) +  $\frac{1}{32}$  (-32 x10 - 32 (y2 + z2)5 -
  32 x8 (1 + 5 y2 + 5 z2) - 4 x6 (3 + 80 y4 + 24 z2 + 80 z4 + 8 y2 (3 + 20 z2)) - x2 (y2 + z2)
  (1 + 160 y6 + 6 z2 + 32 y4 (1 + 15 z2) + y2 (6 + 64 z2 + 480 z4) + 32 (z4 + 5 z6)) -
  2 x4 (1 + 160 y6 + 9 z2 + 48 z4 + 160 z6 + 48 y4 (1 + 10 z2) + y2 (9 + 96 (z2 + 5 z4))) +
   $\frac{1}{64}$  r2 (1 + 640 x8 + 4 y2 + 4 z2 + 128 x6 (3 + 10 y2 + 10 z2) + 8 x4 (11 + 56 y2 + 56 z2) -
  4 (y2 + z2)2 (-1 + 160 y4 + 16 z2 + 160 z4 + 16 y2 (1 + 20 z2)) +
  4 x2 (3 + 15 z2 - 5 (64 y6 + 192 y4 z2 + 64 z6 + 3 y2 (-1 + 64 z4))) == 0,
  {x, -2, 2}, {y, -.5, .5}, {z, -.5, .5}, BoxRatios → Automatic,
  Contours → {{1, LightBlue}},
  PlotPoints → 50], {r,
  step, 1, step}]
```



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In[14]:= Export["FuzzySphere1.eps", plots2[[3]], ImageSize → 3.2 * 72];
In[15]:= Export["FuzzySphere2.eps", plots2[[4]], ImageSize → 3.2 * 72];
In[16]:= Export["FuzzySphere3.eps", plots2[[5]], ImageSize → 3.2 * 72];
In[17]:= Export["FuzzySphere4.eps", plots2[[6]], ImageSize → 3.2 * 72];
In[18]:= plotsall = Join[plots2, Reverse[plots2]];
In[19]:= Export["F5scale.avi", plotsall, ImageResolution → 300, "FrameRate" → 30]
Out[19]= F5scale.avi
```