In[1]:= << "christoffelsymbols.m"
(* First index is upper index Table[FS[cc[[ii,;;,;;]]==T[cc[[ii,;;,;;]]]],{ii,1,4}] *)

In[2]:= Get["EPtensors.m"]

⋯ ReplaceAll: {subsg} is neither a list of replacement rules nor a valid dispatch table, and so cannot be used for replacing.

In[3]:= v0 = {0, ax * t + vx, 0, az * t + vz}

Out[3]= $\{0,\ ax\,t+vx,\ 0,\ az\,t+vz\}$

In[4]:= gammav0 = Series[1 / Sqrt[1 - v0.v0 / c ^ 2], {c, Infinity, 4}]

Out[4]= $1+\frac{(ax\,t+vx)^2+(az\,t+vz)^2}{2\,c^2}+\frac{3\left(ax^2\,t^2+az^2\,t^2+2\,ax\,t\,vx+vx^2+2\,az\,t\,vz+vz^2\right)^2}{8\,c^4}+O\left[\frac{1}{c}\right]^5$

In[5]:= x0 = FS[{Integrate[gammav0 /. {t → ttt}, {ttt, 0, t}] + gammav0 * v0.coords / c ^ 2, 0, 0, 0} +
Join[{0}, coords[[2 ;;]] + Integrate[(gammav0 * v0[[2 ;;]]) /. {t → ttt}, {ttt, 0, t}] + (gammav0 - 1) * (v0.coords) * v0[[2 ;;]] / (v0.v0)]]

Out[5]= $\Big\{t+\frac{1}{c^2}\Big(\frac{1}{6}\,t\left(ax^2\,t^2+az^2\,t^2+3\,ax\,t\,vx+3\,az\,t\,vz+3\left(vx^2+vz^2\right)\right)+(ax\,t+vx)\,x+(az\,t+vz)\,z\Big)+\frac{1}{c^4}$
$\Big(\frac{1}{40}\,t\Big(3\,ax^4\,t^4+3\,az^4\,t^4+15\,ax^3\,t^3\,vx+15\,az^3\,t^3\,vz+30\,az\,t\,vz\left(vx^2+vz^2\right)+15\left(vx^2+vz^2\right)^2+10\,az^2\,t^2\left(vx^2+3\,vz^2\right)+5\,ax\,t\,vx\left(3\,az^2\,t^2+8\,az\,t\,vz+6\left(vx^2+vz^2\right)\right)+ax^2\,t^2\left(6\,az^2\,t^2+15\,az\,t\,vz+10\left(3\,vx^2+vz^2\right)\right)\Big)+\frac{1}{2}\left(\left(ax\,t+vx\right)^2+\left(az\,t+vz\right)^2\right)\left(ax\,t\,x+vx\,x+(az\,t+vz)\,z\right)\Big)+$
$\frac{3\left(ax^2\,t^2+2\,ax\,t\,vx+vx^2+(az\,t+vz)^2\right)^2\left(ax\,t\,x+vx\,x+(az\,t+vz)\,z\right)}{8\,c^6}+O\left[\frac{1}{c}\right]^7,\ \left(\frac{ax\,t^2}{2}+t\,vx+x\right)+\frac{1}{c^2}\Big(\frac{1}{24}\,t\left(3\,ax^3\,t^3+12\,ax^2\,t^2\,vx+4\,vx\left(az^2\,t^2+3\,az\,t\,vz+3\left(vx^2+vz^2\right)\right)+ax\,t\left(3\,az^2\,t^2+8\,az\,t\,vz+6\left(3\,vx^2+vz^2\right)\right)\right)+\frac{1}{2}\left(ax\,t+vx\right)\left(ax\,t\,x+vx\,x+(az\,t+vz)\,z\right)\Big)+\frac{1}{c^4}$
$\Big(\frac{1}{80}\,t\Big(5\,ax^5\,t^5+30\,ax^4\,t^4\,vx+2\,ax^2\,t^2\,vx\left(18\,az^2\,t^2+50\,vx^2+45\,az\,t\,vz+30\,vz^2\right)+ax^3\,t^3\left(10\,az^2\,t^2+24\,az\,t\,vz+15\left(5\,vx^2+vz^2\right)\right)+ax\,t\left(5\,az^4\,t^4+24\,az^3\,t^3\,vz+45\,az^2\,t^2\left(vx^2+vz^2\right)+40\,az\,t\,vz\left(3\,vx^2+vz^2\right)+15\left(vx^2+vz^2\right)\left(5\,vx^2+vz^2\right)\right)+2\,vx\left(3\,az^4\,t^4+15\,az^3\,t^3\,vz+30\,az\,t\,vz\left(vx^2+vz^2\right)+15\left(vx^2+vz^2\right)^2+10\,az^2\,t^2\left(vx^2+3\,vz^2\right)\right)\Big)+$
$\frac{3}{8}\left(ax\,t+vx\right)\left(ax^2\,t^2+2\,ax\,t\,vx+vx^2+(az\,t+vz)^2\right)\left(ax\,t\,x+vx\,x+(az\,t+vz)\,z\right)\Big)+O\left[\frac{1}{c}\right]^5,\ y,\ \left(\frac{az\,t^2}{2}+t\,vz+z\right)+\frac{1}{c^2}\Big(\frac{1}{24}\,t\left(4\,ax\,t\,vx\left(2\,az\,t+3\,vz\right)+ax^2\,t^2\left(3\,az\,t+4\,vz\right)+3\left(az\,t+2\,vz\right)\left(az^2\,t^2+2\,az\,t\,vz+2\left(vx^2+vz^2\right)\right)\right)+\frac{1}{2}\left(az\,t+vz\right)\left(ax\,t\,x+vx\,x+(az\,t+vz)\,z\right)\Big)+\frac{1}{c^4}$
$\Big(\frac{1}{80}\,t\Big(6\,ax^3\,t^3\,vx\left(4\,az\,t+5\,vz\right)+ax^4\,t^4\left(5\,az\,t+6\,vz\right)+2\,ax\,t\,vx\left(12\,az^3\,t^3+45\,az^2\,t^2\,vz+30\,vz\left(vx^2+vz^2\right)+20\,az\,t\left(vx^2+3\,vz^2\right)\right)+5\left(az\,t+2\,vz\right)\left(az^4\,t^4+4\,az^3\,t^3\,vz+6\,az\,t\,vz\left(vx^2+vz^2\right)+3\left(vx^2+vz^2\right)^2+az^2\,t^2\left(3\,vx^2+7\,vz^2\right)\right)+ax^2\,t^2\left(10\,az^3\,t^3+36\,az^2\,t^2\,vz+45\,az\,t\left(vx^2+vz^2\right)+20\left(3\,vx^2\,vz+vz^3\right)\right)\Big)+$
$\frac{3}{8}\left(az\,t+vz\right)\left(ax^2\,t^2+2\,ax\,t\,vx+vx^2+(az\,t+vz)^2\right)\left(ax\,t\,x+vx\,x+(az\,t+vz)\,z\right)\Big)+O\left[\frac{1}{c}\right]^5\Big\}$

In[6]:= (lambda = D[Normal@x0, {coords}]) // MF

Out[6]//MatrixForm=

$1+\frac{3\left(ax^2\,t^2+2\,ax\,t\,vx+vx^2+(az\,t+vz)^2\right)^2\left(ax\,x+az\,z\right)}{8\,c^6}+\frac{\frac{1}{6}\,t\left(2\,ax^2\,t+2\,az^2\,t+3\,ax\,vx+3\,az\,vz\right)+\frac{1}{6}\left(ax^2\,t^2+az^2\,t^2+3\,ax\,t\,vx+3\,az\,t\,vz+3\left(vx^2+vz^2\right)\right)+ax\,x+az\,z}{c^2}+\frac{3\left(2\,ax^2\,t+2\,ax\,vx+2\,az\left(az\,t+vz\right)\right)\left(ax^2\,t^2+2\,ax\,t\,vx+vx^2+(az\,t+vz)^2\right)\left(ax\,t\,x+vx\,x+(az\,t+vz)\,z\right)}{4\,c^6}+\frac{\frac{1}{40}\,t\left(12\,ax^4\,t^3+12\,az^4\,t^3+45\,ax^3\,t^2\,vx+45\,az^3\,t^2\,vz+5\,ax\,t\,vx\left(6\,az^2\,t+8\,az\,vz\right)+ax^2\,t^2\left(12\,az^2\,t+15\,az\,vz\right)+30\,az\,vz\left(vx^2+vz^2\right)+20\,az^2\,t\left(vx^2+3\,vz^2\right)+5\,ax\,vx\left(3\,az^2\,t^2+8\,az\,t\,vz+6\left(vx^2+vz^2\right)\right)+2\,ax^2\,t\left(6\,az^2\,t^2+15\,az\,t\,vz+10\left(3\,vx^2+vz^2\right)\right)\right)+\frac{1}{40}\left(3\,a\ldots\right.}{\ldots}$

$ax\,t+vx+\frac{\frac{1}{24}\,t\left(9\,ax^3\,t^2+24\,ax^2\,t\,vx+4\,vx\left(2\,az^2\,t+3\,az\,vz\right)+ax\,t\left(6\,az^2\,t+8\,az\,vz\right)+ax\left(3\,az^2\,t^2+8\,az\,t\,vz+6\left(3\,vx^2+vz^2\right)\right)\right)+\frac{1}{24}\left(3\,ax^3\,t^3+12\,ax^2\,t^2\,vx+4\,vx\left(az^2\,t^2+3\,az\,t\,vz+3\left(vx^2+vz^2\right)\right)+ax\,t\left(3\,az^2\,t^2+8\,az\,t\,vz+6\left(3\,vx^2+vz^2\right)\right)\right)+\frac{1}{2}\left(ax\,t+vx\right)\left(ax\,x+az\,z\right)+\frac{1}{2}\,ax\left(ax\,t\,x+vx\,x+(az\,t+vz)\,z\right)}{c^2}+\frac{\frac{1}{80}\,t\left(25\,ax^5\,t^4+120\,ax^4\,t^3\,vx+ax^3\,t^3\left(20\,az^2\,t+24\,az\,vz\right)+2\,ax^2\,t^2\,vx\left(36\,az^2\,t+45\,az\,vz\right)+4\,ax^2\,t\,vx\left(18\,az^2\,t^2+50\,vx^2+45\,az\,t\,vz+30\,vz^2\right)+ax\,t\left(20\,az^4\,t^3+72\,az^3\,t^2\,vz+90\,az^2\,t\left(vx^2+vz^2\right)+40\,az\,vz\left(3\,vx^2+vz^2\right)\right)+3\ldots\right.}{\ldots}$

0

$az\,t+vz+\frac{\frac{1}{24}\,t\left(3\,ax^2\,az\,t^2+8\,ax\,az\,t\,vx+4\,ax\,vx\left(2\,az\,t+3\,vz\right)+2\,ax^2\,t\left(3\,az\,t+4\,vz\right)+3\left(az\,t+2\,vz\right)\left(2\,az^2\,t+2\,az\,vz\right)+3\,az\left(az^2\,t^2+2\,az\,t\,vz+2\left(vx^2+vz^2\right)\right)\right)+\frac{1}{24}\left(4\,ax\,t\,vx\left(2\,az\,t+3\,vz\right)+ax^2\,t^2\left(3\,az\,t+4\,vz\right)+3\left(az\,t+2\,vz\right)\left(az^2\,t^2+2\,az\,t\,vz+2\left(vx^2+vz^2\right)\right)\right)+\frac{1}{2}\left(az\,t+vz\right)\left(ax\,x+az\,z\right)+\frac{1}{2}\,az\left(ax\,t\,x+vx\,x+(az\,t+vz)\,z\right)}{c^2}+\frac{\frac{1}{80}\,t\left(5\,ax^4\,az\,t^4+24\,ax^3\,az\,t^3\,vx+18\,ax^3\,t^2\,vx\left(4\,az\,t+5\,vz\right)+4\,ax^4\,t^3\left(5\,az\,t+6\,vz\right)+ax^2\,t^2\left(30\,az^3\,t^2+72\,az^2\,t\,vz+45\,az\left(vx^2+vz^2\right)\right)+2\,ax\,t\,vx\left(36\,az^3\,t^2+90\,az^2\,t\,vz+20\,az\left(vx^2+3\,vz^2\right)\right)+2\,ax\,vx\ldots\right.}{\ldots}$

In[7]:= gFS@tW[j2u[Inverse[lambda].uu /. {ax → 0, az → 0}]] // MF

Out[7]//MatrixForm=

$\frac{8\,c^5\,n[t,x,y,z]\left(c^2-vx\,ux[t,x,y,z]-vz\,uz[t,x,y,z]\right)}{\left(c^2-vx^2-vz^2\right)\left(8\,c^4+4\,c^2\left(vx^2+vz^2\right)+3\left(vx^2+vz^2\right)^2\right)\sqrt{-n[t,x,y,z]^2\left(2\,ux[t,x,y,z]\left(-\frac{4\,Wx}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+2\,uy[t,x,y,z]\left(-\frac{4\,Wy}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+2\,uz[t,x,y,z]\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+\left(ux[t,x,y,z]^2+uy[t,x,y,z]^2+uz[t,x,y,z]^2\right)\left(1+\frac{2\,W}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+\left(-c^2+2\,W-\frac{2\,W^2}{c^2}+O\left[\frac{1}{c}\right]^3\right)[t,x,y,z]\right)}}$

$\frac{c\,n[t,x,y,z]\left(-8\,c^6\,vx+\left(8\,c^6-4\,c^4\,vz^2-c^2\,vz^2\left(vx^2+vz^2\right)-3\,vz^2\left(vx^2+vz^2\right)^2\right)ux[t,x,y,z]+vx\,vz\left(4\,c^4+c^2\left(vx^2+vz^2\right)+3\left(vx^2+vz^2\right)^2\right)uz[t,x,y,z]\right)}{\left(c^2-vx^2-vz^2\right)\left(8\,c^4+4\,c^2\left(vx^2+vz^2\right)+3\left(vx^2+vz^2\right)^2\right)\sqrt{-n[t,x,y,z]^2\left(2\,ux[t,x,y,z]\left(-\frac{4\,Wx}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+2\,uy[t,x,y,z]\left(-\frac{4\,Wy}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+2\,uz[t,x,y,z]\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+\left(ux[t,x,y,z]^2+uy[t,x,y,z]^2+uz[t,x,y,z]^2\right)\left(1+\frac{2\,W}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+\left(-c^2+2\,W-\frac{2\,W^2}{c^2}+O\left[\frac{1}{c}\right]^3\right)[t,x,y,z]\right)}}$

$\frac{c\,n[t,x,y,z]\,uy[t,x,y,z]}{\sqrt{-n[t,x,y,z]^2\left(2\,ux[t,x,y,z]\left(-\frac{4\,Wx}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+2\,uy[t,x,y,z]\left(-\frac{4\,Wy}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+2\,uz[t,x,y,z]\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+\left(ux[t,x,y,z]^2+uy[t,x,y,z]^2+uz[t,x,y,z]^2\right)\left(1+\frac{2\,W}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+\left(-c^2+2\,W-\frac{2\,W^2}{c^2}+O\left[\frac{1}{c}\right]^3\right)[t,x,y,z]\right)}}$

$\frac{c\,n[t,x,y,z]\left(-8\,c^6\,vz+vx\,vz\left(4\,c^4+c^2\left(vx^2+vz^2\right)+3\left(vx^2+vz^2\right)^2\right)ux[t,x,y,z]-\left(-8\,c^6+4\,c^4\,vx^2+c^2\,vx^2\left(vx^2+vz^2\right)+3\,vx^2\left(vx^2+vz^2\right)^2\right)uz[t,x,y,z]\right)}{\left(c^2-vx^2-vz^2\right)\left(8\,c^4+4\,c^2\left(vx^2+vz^2\right)+3\left(vx^2+vz^2\right)^2\right)\sqrt{-n[t,x,y,z]^2\left(2\,ux[t,x,y,z]\left(-\frac{4\,Wx}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+2\,uy[t,x,y,z]\left(-\frac{4\,Wy}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+2\,uz[t,x,y,z]\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+\left(ux[t,x,y,z]^2+uy[t,x,y,z]^2+uz[t,x,y,z]^2\right)\left(1+\frac{2\,W}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+\left(-c^2+2\,W-\frac{2\,W^2}{c^2}+O\left[\frac{1}{c}\right]^3\right)[t,x,y,z]\right)}}$

In[8]:= gFS@tW[j2u[uu.gg.Identity[lambda] /. {ax → 0, az → 0}]] // MF

Out[8]//MatrixForm=

$\frac{\left(8\,c^4+4\,c^2\left(vx^2+vz^2\right)+3\left(vx^2+vz^2\right)^2\right)n[t,x,y,z]\left(\left(vx+ux[t,x,y,z]\right)\left(-\frac{4\,Wx}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+uy[t,x,y,z]\left(-\frac{4\,Wy}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+\left(vz+uz[t,x,y,z]\right)\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+\left(vx\,ux[t,x,y,z]+vz\,uz[t,x,y,z]\right)\left(1+\frac{2\,W}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+\left(-c^2+2\,W-\frac{2\,W^2}{c^2}+O\left[\frac{1}{c}\right]^3\right)[t,x,y,z]\right)}{8\,c^3\sqrt{-n[t,x,y,z]^2\left(2\,ux[t,x,y,z]\left(-\frac{4\,Wx}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+2\,uy[t,x,y,z]\left(-\frac{4\,Wy}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+2\,uz[t,x,y,z]\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+\left(ux[t,x,y,z]^2+uy[t,x,y,z]^2+uz[t,x,y,z]^2\right)\left(1+\frac{2\,W}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+\left(-c^2+2\,W-\frac{2\,W^2}{c^2}+O\left[\frac{1}{c}\right]^3\right)[t,x,y,z]\right)}}$

$\frac{n[t,x,y,z]\left(\left(8\,c^6+4\,c^4\,vx^2+3\,c^2\,vx^2\left(vx^2+vz^2\right)+vx\left(8\,c^4+4\,c^2\left(vx^2+vz^2\right)+3\left(vx^2+vz^2\right)^2\right)ux[t,x,y,z]\right)\left(-\frac{4\,Wx}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+vx\left(8\,c^4+4\,c^2\left(vx^2+vz^2\right)+3\left(vx^2+vz^2\right)^2\right)uy[t,x,y,z]\left(-\frac{4\,Wy}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+4\,c^4\,vx\,vz\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+3\,c^2\,vx^3\,vz\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+3\,c^2\,vx\,vz^3\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+8\,c^4\,vx\,uz[t,x,y,z]\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+4\,c^2\,vx^3\,uz[t,x,y,z]\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+3\,vx^5\,uz[t,x,y,z]\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+4\,c^2\,vx\,vz^2\,uz[t,x,y,z]\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+6\,vx^3\,vz^2\,uz[t,x,y\ldots\right.}{8\,c^5\sqrt{-n[t,x,y,z]^2\left(2\,ux[t,x,y,z]\left(-\frac{4\,Wx}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+2\,uy[t,x,y,z]\left(-\frac{4\,Wy}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+2\,uz[t,x,y,z]\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y\ldots}}$

$\frac{c\,n[t,x,y,z]\left(\left(-\frac{4\,Wy}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+uy[t,x,y,z]\left(1+\frac{2\,W}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]\right)}{\sqrt{-n[t,x,y,z]^2\left(2\,ux[t,x,y,z]\left(-\frac{4\,Wx}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+2\,uy[t,x,y,z]\left(-\frac{4\,Wy}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+2\,uz[t,x,y,z]\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+\left(ux[t,x,y,z]^2+uy[t,x,y,z]^2+uz[t,x,y,z]^2\right)\left(1+\frac{2\,W}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+\left(-c^2+2\,W-\frac{2\,W^2}{c^2}+O\left[\frac{1}{c}\right]^3\right)[t,x,y,z]\right)}}$

$\frac{n[t,x,y,z]\left(vz\left(c^2\,vx\left(4\,c^2+3\left(vx^2+vz^2\right)\right)+\left(8\,c^4+4\,c^2\left(vx^2+vz^2\right)+3\left(vx^2+vz^2\right)^2\right)ux[t,x,y,z]\right)\left(-\frac{4\,Wx}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+vz\left(8\,c^4+4\,c^2\left(vx^2+vz^2\right)+3\left(vx^2+vz^2\right)^2\right)uy[t,x,y,z]\left(-\frac{4\,Wy}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+8\,c^6\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+4\,c^4\,vz^2\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+3\,c^2\,vx^2\,vz^2\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+3\,c^2\,vz^4\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+8\,c^4\,vz\,uz[t,x,y,z]\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+4\,c^2\,vx^2\,vz\,uz[t,x,y,z]\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+3\,vx^4\,vz\,uz[t,x,y,z]\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+4\,c^2\,vz^3\,uz[t,x,y,z]\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+\ldots\right.}{8\,c^5\sqrt{-n[t,x,y,z]^2\left(2\,ux[t,x,y,z]\left(-\frac{4\,Wx}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+2\,uy[t,x,y,z]\left(-\frac{4\,Wy}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+2\,uz[t,x,y,z]\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\ldots}}$

In[9]:= {gFS@tW[j2u[uu]] // MF, gFS@tW[j2u[gg.uu]] // MF}

Out[9]= Let $S=\sqrt{-n[t,x,y,z]^2\left(2\,ux[t,x,y,z]\left(-\frac{4\,Wx}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+2\,uy[t,x,y,z]\left(-\frac{4\,Wy}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+2\,uz[t,x,y,z]\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+\left(ux[t,x,y,z]^2+uy[t,x,y,z]^2+uz[t,x,y,z]^2\right)\left(1+\frac{2\,W}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+\left(-c^2+2\,W-\frac{2\,W^2}{c^2}+O\left[\frac{1}{c}\right]^3\right)[t,x,y,z]\right)}$ (the same square root printed in every denominator):

$\Big\{\begin{pmatrix}\frac{c\,n[t,x,y,z]}{S}\\ \frac{c\,n[t,x,y,z]\,ux[t,x,y,z]}{S}\\ \frac{c\,n[t,x,y,z]\,uy[t,x,y,z]}{S}\\ \frac{c\,n[t,x,y,z]\,uz[t,x,y,z]}{S}\end{pmatrix},\ \begin{pmatrix}\frac{c\,n[t,x,y,z]\left(ux[t,x,y,z]\left(-\frac{4\,Wx}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+uy[t,x,y,z]\left(-\frac{4\,Wy}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+uz[t,x,y,z]\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+\left(-c^2+2\,W-\frac{2\,W^2}{c^2}+O\left[\frac{1}{c}\right]^3\right)[t,x,y,z]\right)}{S}\\ \frac{c\,n[t,x,y,z]\left(\left(-\frac{4\,Wx}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+ux[t,x,y,z]\left(1+\frac{2\,W}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]\right)}{S}\\ \frac{c\,n[t,x,y,z]\left(\left(-\frac{4\,Wy}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+uy[t,x,y,z]\left(1+\frac{2\,W}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]\right)}{S}\\ \frac{c\,n[t,x,y,z]\left(\left(-\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]+uz[t,x,y,z]\left(1+\frac{2\,W}{c^2}+O\left[\frac{1}{c}\right]^4\right)[t,x,y,z]\right)}{S}\end{pmatrix}\Big\}$

In[10]:= a0 = D[v0, t]

Out[10]= $\{0,\ ax,\ 0,\ az\}$

In[11]:= aa = Assuming[Append[assut0, v0.v0 < c ^ 2], FS[gammav0 ^ 2 * (a0 + (1 / (v0.v0)) * (gammav0 - 1) * (v0.a0) * v0)]]

Out[11]= $\Big\{0,\ ax+\frac{1}{c^2}\Big(\frac{1}{2}\left(ax\,t+vx\right)\left(ax\left(ax\,t+vx\right)+az\left(az\,t+vz\right)\right)+ax\left(\left(ax\,t+vx\right)^2+\left(az\,t+vz\right)^2\right)\Big)+\frac{1}{8\,c^4}\left(ax^2\,t^2+2\,ax\,t\,vx+vx^2+\left(az\,t+vz\right)^2\right)\left(15\,ax^3\,t^2+30\,ax^2\,t\,vx+15\,ax\,vx^2+7\,az\,vx\left(az\,t+vz\right)+ax\left(az\,t+vz\right)\left(15\,az\,t+8\,vz\right)\right)+O\left[\frac{1}{c}\right]^5,$
$0,\ az+\frac{1}{c^2}\Big(\frac{1}{2}\left(az\,t+vz\right)\left(ax\left(ax\,t+vx\right)+az\left(az\,t+vz\right)\right)+az\left(\left(ax\,t+vx\right)^2+\left(az\,t+vz\right)^2\right)\Big)+\frac{1}{8\,c^4}\left(ax^2\,t^2+2\,ax\,t\,vx+vx^2+\left(az\,t+vz\right)^2\right)\left(ax^2\,t\left(15\,az\,t+7\,vz\right)+ax\,vx\left(23\,az\,t+7\,vz\right)+az\left(8\,vx^2+15\left(az\,t+vz\right)^2\right)\right)+O\left[\frac{1}{c}\right]^5\Big\}$

In[12]:=
```
(* argument-transformation functions to temporarily remove coord-dep *)
(* -W is the potential gravitational energy: W=GM/r
  that is, F_g(downwards)=grad W *)
tW[xx_] := (xx /. {
     gtt → -c^2*(
          (1 + aa.coords / c^2)^2 - 2*(W0 - g*(x0[[4]])) / c^2 + 2*(W0 - g*(x0[[4]]))^2 / c^4
           - 4*(W0 - g*(x0[[4]]))*aa.coords / c^4
         ) + O[c, +Infinity]^2,
     grr → 1 + 2*(W0 - g*(x0[[4]])) / c^2 + O[c, +Infinity]^4,
     gtx → -4*Wx[t, x, y, z] / c^2 + O[c, +Infinity]^4,
     gty → -4*Wy[t, x, y, z] / c^2 + O[c, +Infinity]^4,
     gtz → -4*Wz[t, x, y, z] / c^2 + O[c, +Infinity]^4,

     n → n[t, x, y, z], jx → jx[t, x, y, z], jy → jy[t, x, y, z], jz → jz[t, x, y, z], ux → ux[t, x, y, z], uy → uy[t, x, y, z], uz → uz[t, x, y, z]});

itW[xx_] := (xx /. {yy_[t, x, y, z] → yy});
(*itW[xx_]:=(xx/.{
     Wx[t,x,y,z]→Wx,Wy[t,x,y,z]→Wy,Wz[t,x,y,z]→Wz,

     n[t,x,y,z]→n,jx[t,x,y,z]→jx,jy[t,x,y,z]→jy,jz[t,x,y,z]→jz,ux[t,x,y,z]→ux,uy[t,x,y,z]→uy,uz[t,x,y,z]→uz,aa[t,x,y,z]→aa});*)

gFS[x_] := aFS[itW[x]];
```

In[15]:= gFS@tW@gg // MF

Out[15]//MatrixForm=

$$\begin{pmatrix} -c^2+\left(-g\,t\left(az\,t+2\,vz\right)+2\left(W0-ax\,x\right)-2\left(az+g\right)z\right)+O\left[\frac{1}{c}\right]^2 & -\frac{4\,Wx}{c^2}+O\left[\frac{1}{c}\right]^4 & -\frac{4\,Wy}{c^2}+O\left[\frac{1}{c}\right]^4 & -\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4 \\ -\frac{4\,Wx}{c^2}+O\left[\frac{1}{c}\right]^4 & 1+\frac{2\left(W0-g\left(\frac{az\,t^2}{2}+t\,vz+z\right)\right)}{c^2}+O\left[\frac{1}{c}\right]^4 & 0 & 0 \\ -\frac{4\,Wy}{c^2}+O\left[\frac{1}{c}\right]^4 & 0 & 1+\frac{2\left(W0-g\left(\frac{az\,t^2}{2}+t\,vz+z\right)\right)}{c^2}+O\left[\frac{1}{c}\right]^4 & 0 \\ -\frac{4\,Wz}{c^2}+O\left[\frac{1}{c}\right]^4 & 0 & 0 & 1+\frac{2\left(W0-g\left(\frac{az\,t^2}{2}+t\,vz+z\right)\right)}{c^2}+O\left[\frac{1}{c}\right]^4 \end{pmatrix}$$

In[16]:= gFS[tW@gg /. {z → 0, az → 0, ax → 0, vz → 0, vx → 0}] // MF

Out[16]//MatrixForm=

$$\begin{pmatrix} -c^2+2\,W0+O\left[\frac{1}{c}\right]^2 & -\frac{4\,Wx[t,x,y,0]}{c^2}+O\left[\frac{1}{c}\right]^4 & -\frac{4\,Wy[t,x,y,0]}{c^2}+O\left[\frac{1}{c}\right]^4 & -\frac{4\,Wz[t,x,y,0]}{c^2}+O\left[\frac{1}{c}\right]^4 \\ -\frac{4\,Wx[t,x,y,0]}{c^2}+O\left[\frac{1}{c}\right]^4 & 1+\frac{2\,W0}{c^2}+O\left[\frac{1}{c}\right]^4 & 0 & 0 \\ -\frac{4\,Wy[t,x,y,0]}{c^2}+O\left[\frac{1}{c}\right]^4 & 0 & 1+\frac{2\,W0}{c^2}+O\left[\frac{1}{c}\right]^4 & 0 \\ -\frac{4\,Wz[t,x,y,0]}{c^2}+O\left[\frac{1}{c}\right]^4 & 0 & 0 & 1+\frac{2\,W0}{c^2}+O\left[\frac{1}{c}\right]^4 \end{pmatrix}$$

In[17]:=
```
tW0[xx_] := (xx /. {
     gtt → -c^2*(
          1 - 2*(W0 - g*(x0[[4]])) / c^2 + 2*(W0 - g*(x0[[4]]))^2 / c^4
         ) + O[c, +Infinity]^2,
     grr → 1 + 2*(W0 - g*(x0[[4]])) / c^2 + O[c, +Infinity]^4,
     gtx → -4*Wx[t, x, y, z] / c^2 + O[c, +Infinity]^4,
     gty → -4*Wy[t, x, y, z] / c^2 + O[c, +Infinity]^4,
     gtz → -4*Wz[t, x, y, z] / c^2 + O[c, +Infinity]^4,

     n → n[t, x, y, z], jx → jx[t, x, y, z], jy → jy[t, x, y, z], jz → jz[t, x, y, z], ux → ux[t, x, y, z], uy → uy[t, x, y, z], uz → uz[t, x, y, z]});
```

In[18]:=
```
gFS@tW0[T[Identity[lambda]].gg.Identity[lambda]] // MF
```

Out[18]//MatrixForm=

$$\begin{pmatrix} -c^2+\left(-g\,t\left(az\,t+2\,vz\right)+2\left(W0-ax\,x\right)-2\,(az+g)\,z\right)+O[\tfrac{1}{c}]^2 & \frac{-2\left(ax\,t+vx\right)\left(g\,t\left(az\,t+2\,vz\right)-2\,W0\right)-4\,Wx-\frac{1}{2}\left(az\,vx+8\,g\left(ax\,t+vx\right)-ax\,vz\right)z}{c^2}+O[\tfrac{1}{c}]^4 & -\frac{4\,Wy}{c^2}+O[\tfrac{1}{c}]^4 & \frac{-4\,az^2\,g\,t^3+8\,vz\,W0-8\,Wz-ax\,vz\,x-8\,g\,vz\left(t\,vz+z\right)+az\left(8\,t\,W0+vx\,x-4\,g\,t\left(3\,t\,vz+2\,z\right)\right)}{2\,c^2}+O[\tfrac{1}{c}]^4 \\ \frac{-2\left(ax\,t+vx\right)\left(g\,t\left(az\,t+2\,vz\right)-2\,W0\right)-4\,Wx-\frac{1}{2}\left(az\,vx+8\,g\left(ax\,t+vx\right)-ax\,vz\right)z}{c^2}+O[\tfrac{1}{c}]^4 & 1+\frac{-az\,g\,t^2+2\,W0-2\,g\left(t\,vz+z\right)}{c^2}+O[\tfrac{1}{c}]^4 & -\frac{4\left(\left(ax\,t+vx\right)Wy\right)}{c^4}+O[\tfrac{1}{c}]^6 & -\frac{2\left(az^2\,g\,t^3\,vx+2\left(vz\,Wx+vx\left(-vz\,W0+Wz\right)+g\,vx\,vz\left(t\,vz+z\right)\right)+az\,t\left(-2\,vx\,W0+2\,Wx+g\,vx\left(3\,t\,vz+2\,z\right)\right)+ax\,t\left(2\,Wz+\left(az\,t+vz\right)\left(az\,g\,t^2-2\,W0+2\,g\left(t\,vz+z\right)\right)\right)\right)}{c^4}+O[\tfrac{1}{c}]^6 \\ -\frac{4\,Wy}{c^2}+O[\tfrac{1}{c}]^4 & -\frac{4\left(\left(ax\,t+vx\right)Wy\right)}{c^4}+O[\tfrac{1}{c}]^6 & 1+\frac{2\left(W0-g\left(\frac{az\,t^2}{2}+t\,vz+z\right)\right)}{c^2}+O[\tfrac{1}{c}]^4 & -\frac{4\left(\left(az\,t+vz\right)Wy\right)}{c^4}+O[\tfrac{1}{c}]^6 \\ \frac{-4\,az^2\,g\,t^3+8\,vz\,W0-8\,Wz-ax\,vz\,x-8\,g\,vz\left(t\,vz+z\right)+az\left(8\,t\,W0+vx\,x-4\,g\,t\left(3\,t\,vz+2\,z\right)\right)}{2\,c^2}+O[\tfrac{1}{c}]^4 & -\frac{2\left(az^2\,g\,t^3\,vx+2\left(vz\,Wx+vx\left(-vz\,W0+Wz\right)+g\,vx\,vz\left(t\,vz+z\right)\right)+az\,t\left(-2\,vx\,W0+2\,Wx+g\,vx\left(3\,t\,vz+2\,z\right)\right)+ax\,t\left(2\,Wz+\left(az\,t+vz\right)\left(az\,g\,t^2-2\,W0+2\,g\left(t\,vz+z\right)\right)\right)\right)}{c^4}+O[\tfrac{1}{c}]^6 & -\frac{4\left(\left(az\,t+vz\right)Wy\right)}{c^4}+O[\tfrac{1}{c}]^6 & 1+\frac{-az\,g\,t^2+2\,W0-2\,g\left(t\,vz+z\right)}{c^2}+O[\tfrac{1}{c}]^4 \end{pmatrix}$$

In[19]:=
```
FS[gFS@tW@gg - gFS@tW0[T[Identity[lambda]].gg.Identity[lambda]]] // MF
```

Out[19]//MatrixForm=

$$\begin{pmatrix} O[\tfrac{1}{c}]^2 & \frac{2\left(ax\,t+vx\right)\left(g\,t\left(az\,t+2\,vz\right)-2\,W0\right)+\frac{1}{2}\left(az\,vx+8\,g\left(ax\,t+vx\right)-ax\,vz\right)z}{c^2}+O[\tfrac{1}{c}]^4 & O[\tfrac{1}{c}]^4 & \frac{4\,az^2\,g\,t^3+vz\left(-8\,W0+ax\,x+8\,g\left(t\,vz+z\right)\right)+az\left(-8\,t\,W0-vx\,x+4\,g\,t\left(3\,t\,vz+2\,z\right)\right)}{2\,c^2}+O[\tfrac{1}{c}]^4 \\ \frac{2\left(ax\,t+vx\right)\left(g\,t\left(az\,t+2\,vz\right)-2\,W0\right)+\frac{1}{2}\left(az\,vx+8\,g\left(ax\,t+vx\right)-ax\,vz\right)z}{c^2}+O[\tfrac{1}{c}]^4 & O[\tfrac{1}{c}]^4 & \frac{4\left(ax\,t+vx\right)Wy}{c^4}+O[\tfrac{1}{c}]^6 & \frac{2\left(az^2\,g\,t^3\,vx+2\left(vz\,Wx+vx\left(-vz\,W0+Wz\right)+g\,vx\,vz\left(t\,vz+z\right)\right)+az\,t\left(-2\,vx\,W0+2\,Wx+g\,vx\left(3\,t\,vz+2\,z\right)\right)+ax\,t\left(2\,Wz+\left(az\,t+vz\right)\left(az\,g\,t^2-2\,W0+2\,g\left(t\,vz+z\right)\right)\right)\right)}{c^4}+O[\tfrac{1}{c}]^6 \\ O[\tfrac{1}{c}]^4 & \frac{4\left(ax\,t+vx\right)Wy}{c^4}+O[\tfrac{1}{c}]^6 & O[\tfrac{1}{c}]^4 & \frac{4\left(az\,t+vz\right)Wy}{c^4}+O[\tfrac{1}{c}]^6 \\ \frac{4\,az^2\,g\,t^3+vz\left(-8\,W0+ax\,x+8\,g\left(t\,vz+z\right)\right)+az\left(-8\,t\,W0-vx\,x+4\,g\,t\left(3\,t\,vz+2\,z\right)\right)}{2\,c^2}+O[\tfrac{1}{c}]^4 & \frac{2\left(az^2\,g\,t^3\,vx+2\left(vz\,Wx+vx\left(-vz\,W0+Wz\right)+g\,vx\,vz\left(t\,vz+z\right)\right)+az\,t\left(-2\,vx\,W0+2\,Wx+g\,vx\left(3\,t\,vz+2\,z\right)\right)+ax\,t\left(2\,Wz+\left(az\,t+vz\right)\left(az\,g\,t^2-2\,W0+2\,g\left(t\,vz+z\right)\right)\right)\right)}{c^4}+O[\tfrac{1}{c}]^6 & \frac{4\left(az\,t+vz\right)Wy}{c^4}+O[\tfrac{1}{c}]^6 & O[\tfrac{1}{c}]^4 \end{pmatrix}$$

In[20]:=
```
cc = gFS[ChristoffelSymbol[tW[gg], coords]]
```

Out[20]=

$$\left\{\left\{\left\{\frac{g\left(az\,t+vz\right)}{c^2}+O[\tfrac{1}{c}]^4,\ \frac{ax}{c^2}+O[\tfrac{1}{c}]^4,\ O[\tfrac{1}{c}]^6,\ \frac{az+g}{c^2}+O[\tfrac{1}{c}]^4\right\},\left\{\frac{ax}{c^2}+O[\tfrac{1}{c}]^4,\ \frac{-g\left(az\,t+vz\right)+4\,Wx^{(0,1,0,0)}}{c^4}+O[\tfrac{1}{c}]^6,\ \frac{2\left(Wx^{(0,0,1,0)}+Wy^{(0,1,0,0)}\right)}{c^4}+O[\tfrac{1}{c}]^6,\ \frac{2\left(Wx^{(0,0,0,1)}+Wz^{(0,1,0,0)}\right)}{c^4}+O[\tfrac{1}{c}]^6\right\},\right.\right.$$

$$\left\{O[\tfrac{1}{c}]^6,\ \frac{2\left(Wx^{(0,0,1,0)}+Wy^{(0,1,0,0)}\right)}{c^4}+O[\tfrac{1}{c}]^6,\ \frac{-g\left(az\,t+vz\right)+4\,Wy^{(0,0,1,0)}}{c^4}+O[\tfrac{1}{c}]^6,\ \frac{2\left(Wy^{(0,0,0,1)}+Wz^{(0,0,1,0)}\right)}{c^4}+O[\tfrac{1}{c}]^6\right\},\left\{\frac{az+g}{c^2}+O[\tfrac{1}{c}]^4,\ \frac{2\left(Wx^{(0,0,0,1)}+Wz^{(0,1,0,0)}\right)}{c^4}+O[\tfrac{1}{c}]^6,\ \frac{2\left(Wy^{(0,0,0,1)}+Wz^{(0,0,1,0)}\right)}{c^4}+O[\tfrac{1}{c}]^6,\ \frac{-g\left(az\,t+vz\right)+4\,Wz^{(0,0,0,1)}}{c^4}+O[\tfrac{1}{c}]^6\right\}\right\},$$

$$\left\{\left\{ax+O[\tfrac{1}{c}]^2,\ -\frac{g\left(az\,t+vz\right)}{c^2}+O[\tfrac{1}{c}]^4,\ \frac{-2\,Wx^{(0,0,1,0)}+2\,Wy^{(0,1,0,0)}}{c^2}+O[\tfrac{1}{c}]^4,\ \frac{-2\,Wx^{(0,0,0,1)}+2\,Wz^{(0,1,0,0)}}{c^2}+O[\tfrac{1}{c}]^4\right\},\left\{-\frac{g\left(az\,t+vz\right)}{c^2}+O[\tfrac{1}{c}]^4,\ -\frac{4\left(Wx\left(g\left(az\,t+vz\right)-4\,Wx^{(0,1,0,0)}\right)\right)}{c^6}+O[\tfrac{1}{c}]^8,\ \frac{8\,Wx\left(Wx^{(0,0,1,0)}+Wy^{(0,1,0,0)}\right)}{c^6}+O[\tfrac{1}{c}]^8,\ -\frac{g}{c^2}+O[\tfrac{1}{c}]^4\right\},$$

$$\left\{\frac{-2\,Wx^{(0,0,1,0)}+2\,Wy^{(0,1,0,0)}}{c^2}+O[\tfrac{1}{c}]^4,\ \frac{8\,Wx\left(Wx^{(0,0,1,0)}+Wy^{(0,1,0,0)}\right)}{c^6}+O[\tfrac{1}{c}]^8,\ -\frac{4\left(Wx\left(g\left(az\,t+vz\right)-4\,Wy^{(0,0,1,0)}\right)\right)}{c^6}+O[\tfrac{1}{c}]^8,\ \frac{8\,Wx\left(Wy^{(0,0,0,1)}+Wz^{(0,0,1,0)}\right)}{c^6}+O[\tfrac{1}{c}]^8\right\},\left\{\frac{-2\,Wx^{(0,0,0,1)}+2\,Wz^{(0,1,0,0)}}{c^2}+O[\tfrac{1}{c}]^4,\ -\frac{g}{c^2}+O[\tfrac{1}{c}]^4,\ \frac{8\,Wx\left(Wy^{(0,0,0,1)}+Wz^{(0,0,1,0)}\right)}{c^6}+O[\tfrac{1}{c}]^8,\ -\frac{4\left(Wx\left(g\left(az\,t+vz\right)-4\,Wz^{(0,0,0,1)}\right)\right)}{c^6}+O[\tfrac{1}{c}]^8\right\}\right\},$$

$$\left\{\left\{-\frac{4\,Wy^{(1,0,0,0)}}{c^2}+O[\tfrac{1}{c}]^4,\ \frac{2\,Wx^{(0,0,1,0)}-2\,Wy^{(0,1,0,0)}}{c^2}+O[\tfrac{1}{c}]^4,\ -\frac{g\left(az\,t+vz\right)}{c^2}+O[\tfrac{1}{c}]^4,\ \frac{-2\,Wy^{(0,0,0,1)}+2\,Wz^{(0,0,1,0)}}{c^2}+O[\tfrac{1}{c}]^4\right\},\left\{\frac{2\,Wx^{(0,0,1,0)}-2\,Wy^{(0,1,0,0)}}{c^2}+O[\tfrac{1}{c}]^4,\ -\frac{4\left(Wy\left(g\left(az\,t+vz\right)-4\,Wx^{(0,1,0,0)}\right)\right)}{c^6}+O[\tfrac{1}{c}]^8,\ \frac{8\,Wy\left(Wx^{(0,0,1,0)}+Wy^{(0,1,0,0)}\right)}{c^6}+O[\tfrac{1}{c}]^8,\ \frac{8\,Wy\left(Wx^{(0,0,0,1)}+Wz^{(0,1,0,0)}\right)}{c^6}+O[\tfrac{1}{c}]^8\right\},$$

$$\left\{-\frac{g\left(az\,t+vz\right)}{c^2}+O[\tfrac{1}{c}]^4,\ \frac{8\,Wy\left(Wx^{(0,0,1,0)}+Wy^{(0,1,0,0)}\right)}{c^6}+O[\tfrac{1}{c}]^8,\ -\frac{4\left(Wy\left(g\left(az\,t+vz\right)-4\,Wy^{(0,0,1,0)}\right)\right)}{c^6}+O[\tfrac{1}{c}]^8,\ -\frac{g}{c^2}+O[\tfrac{1}{c}]^4\right\},\left\{\frac{-2\,Wy^{(0,0,0,1)}+2\,Wz^{(0,0,1,0)}}{c^2}+O[\tfrac{1}{c}]^4,\ \frac{8\,Wy\left(Wx^{(0,0,0,1)}+Wz^{(0,1,0,0)}\right)}{c^6}+O[\tfrac{1}{c}]^8,\ -\frac{g}{c^2}+O[\tfrac{1}{c}]^4,\ -\frac{4\left(Wy\left(g\left(az\,t+vz\right)-4\,Wz^{(0,0,0,1)}\right)\right)}{c^6}+O[\tfrac{1}{c}]^8\right\}\right\},$$

$$\left\{\left\{(az+g)+O[\tfrac{1}{c}]^2,\ \frac{2\,Wx^{(0,0,0,1)}-2\,Wz^{(0,1,0,0)}}{c^2}+O[\tfrac{1}{c}]^4,\ \frac{2\,Wy^{(0,0,0,1)}-2\,Wz^{(0,0,1,0)}}{c^2}+O[\tfrac{1}{c}]^4,\ -\frac{g\left(az\,t+vz\right)}{c^2}+O[\tfrac{1}{c}]^4\right\},\left\{\frac{2\,Wx^{(0,0,0,1)}-2\,Wz^{(0,1,0,0)}}{c^2}+O[\tfrac{1}{c}]^4,\ \frac{g}{c^2}+O[\tfrac{1}{c}]^4,\ \frac{8\,Wz\left(Wx^{(0,0,1,0)}+Wy^{(0,1,0,0)}\right)}{c^6}+O[\tfrac{1}{c}]^8,\ \frac{8\,Wz\left(Wx^{(0,0,0,1)}+Wz^{(0,1,0,0)}\right)}{c^6}+O[\tfrac{1}{c}]^8\right\},$$

$$\left.\left\{\frac{2\,Wy^{(0,0,0,1)}-2\,Wz^{(0,0,1,0)}}{c^2}+O[\tfrac{1}{c}]^4,\ \frac{8\,Wz\left(Wx^{(0,0,1,0)}+Wy^{(0,1,0,0)}\right)}{c^6}+O[\tfrac{1}{c}]^8,\ \frac{g}{c^2}+O[\tfrac{1}{c}]^4,\ \frac{8\,Wz\left(Wy^{(0,0,0,1)}+Wz^{(0,0,1,0)}\right)}{c^6}+O[\tfrac{1}{c}]^8\right\},\left\{-\frac{g\left(az\,t+vz\right)}{c^2}+O[\tfrac{1}{c}]^4,\ \frac{8\,Wz\left(Wx^{(0,0,0,1)}+Wz^{(0,1,0,0)}\right)}{c^6}+O[\tfrac{1}{c}]^8,\ \frac{8\,Wz\left(Wy^{(0,0,0,1)}+Wz^{(0,0,1,0)}\right)}{c^6}+O[\tfrac{1}{c}]^8,\ -\frac{g}{c^2}+O[\tfrac{1}{c}]^4\right\}\right\}\right\}$$

In[22]:=
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gFS@tW@dust // MF
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Out[22]//MatrixForm=

$$\begin{pmatrix} -n\,\rho\,c^2+\left(-n\,\epsilon-\frac{\left(jx^2+jy^2+jz^2+n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\right)\rho}{2\,n}\right)+O[\tfrac{1}{c}]^1 & jx\,\rho+\frac{jx\,\epsilon+\frac{\left(jx^3-8\,n^3\,Wx+jx\left(jy^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\right)\rho}{2\,n^2}}{c^2}+O[\tfrac{1}{c}]^3 & jy\,\rho+\frac{2\,jy\,n^2\,\epsilon+jy^3\,\rho-8\,n^3\,Wy\,\rho+jy\left(jx^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\rho}{2\,n^2\,c^2}+O[\tfrac{1}{c}]^3 & jz\,\rho+\frac{2\,jz\,n^2\,\epsilon+jz^3\,\rho-8\,n^3\,Wz\,\rho+jz\left(jx^2+jy^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\rho}{2\,n^2\,c^2}+O[\tfrac{1}{c}]^3 \\ -jx\,\rho\,c^2-\frac{jx\left(\left(jx^2+jy^2+jz^2\right)\rho+n^2\left(2\,\epsilon+\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\rho\right)\right)}{2\,n^2}+O[\tfrac{1}{c}]^1 & \frac{jx^2\,\rho}{n}+\frac{jx\left(2\,jx\,n^2\,\epsilon+\left(jx^3-8\,n^3\,Wx+jx\left(jy^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\right)\rho\right)}{2\,n^3\,c^2}+O[\tfrac{1}{c}]^3 & \frac{jx\,jy\,\rho}{n}+\frac{jx\left(2\,jy\,n^2\,\epsilon+jy^3\,\rho-8\,n^3\,Wy\,\rho+jy\left(jx^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\rho\right)}{2\,n^3\,c^2}+O[\tfrac{1}{c}]^3 & \frac{jx\,jz\,\rho}{n}+\frac{jx\left(2\,jz\,n^2\,\epsilon+jz^3\,\rho-8\,n^3\,Wz\,\rho+jz\left(jx^2+jy^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\rho\right)}{2\,n^3\,c^2}+O[\tfrac{1}{c}]^3 \\ -jy\,\rho\,c^2-\frac{jy\left(\left(jx^2+jy^2+jz^2\right)\rho+n^2\left(2\,\epsilon+\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\rho\right)\right)}{2\,n^2}+O[\tfrac{1}{c}]^1 & \frac{jx\,jy\,\rho}{n}+\frac{\frac{jx\,jy\,\epsilon}{n}+\frac{jy\left(jx^3-8\,n^3\,Wx+jx\left(jy^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\right)\rho}{2\,n^3}}{c^2}+O[\tfrac{1}{c}]^3 & \frac{jy^2\,\rho}{n}+\frac{jy\left(2\,jy\,n^2\,\epsilon+jy^3\,\rho-8\,n^3\,Wy\,\rho+jy\left(jx^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\rho\right)}{2\,n^3\,c^2}+O[\tfrac{1}{c}]^3 & \frac{jy\,jz\,\rho}{n}+\frac{jy\left(2\,jz\,n^2\,\epsilon+jz^3\,\rho-8\,n^3\,Wz\,\rho+jz\left(jx^2+jy^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\rho\right)}{2\,n^3\,c^2}+O[\tfrac{1}{c}]^3 \\ -jz\,\rho\,c^2-\frac{jz\left(\left(jx^2+jy^2+jz^2\right)\rho+n^2\left(2\,\epsilon+\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\rho\right)\right)}{2\,n^2}+O[\tfrac{1}{c}]^1 & \frac{jx\,jz\,\rho}{n}+\frac{\frac{jx\,jz\,\epsilon}{n}+\frac{jz\left(jx^3-8\,n^3\,Wx+jx\left(jy^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\right)\rho}{2\,n^3}}{c^2}+O[\tfrac{1}{c}]^3 & \frac{jy\,jz\,\rho}{n}+\frac{jz\left(2\,jy\,n^2\,\epsilon+jy^3\,\rho-8\,n^3\,Wy\,\rho+jy\left(jx^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\rho\right)}{2\,n^3\,c^2}+O[\tfrac{1}{c}]^3 & \frac{jz^2\,\rho}{n}+\frac{jz\left(2\,jz\,n^2\,\epsilon+jz^3\,\rho-8\,n^3\,Wz\,\rho+jz\left(jx^2+jy^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\rho\right)}{2\,n^3\,c^2}+O[\tfrac{1}{c}]^3 \end{pmatrix}$$

In[23]:=
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gFS@tW@S // MF
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Out[23]//MatrixForm=

$$\begin{pmatrix} -\frac{jx^2\,sxx+jx\,jy\,(sxy+syx)+jy^2\,syy+jx\,jz\,(sxz+szx)+jy\,jz\,(syz+szy)+jz^2\,szz}{n^2\,c^2}+\frac{4\,n\left(jx\left(sxx\,Wx+syx\,Wy+szx\,Wz\right)+jy\left(sxy\,Wx+syy\,Wy+szy\,Wz\right)+jz\left(sxz\,Wx+syz\,Wy+szz\,Wz\right)\right)+\left(jx^2\,sxx+jx\,jy\,(sxy+syx)+jy^2\,syy+jx\,jz\,(sxz+szx)+jy\,jz\,(syz+szy)+jz^2\,szz\right)\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)-2\left(jx^2\,sxx+jx\,jy\,(sxy+syx)+jy^2\,syy+jx\,jz\,(sxz+szx)+jy\,jz\,(syz+szy)+jz^2\,szz\right)\left(W0-g\left(\frac{az\,t^2}{2}+t\,vz+z\right)\right)}{n^2\,c^4}+O[\tfrac{1}{c}]^6 & \frac{jx\,sxx+jy\,syx+jz\,szx}{n\,c^2}-\frac{2\left(2\left(-jx\,sxx\,W0-jy\,syx\,W0-jz\,szx\,W0+n\,sxx\,Wx+n\,syx\,Wy+n\,szx\,W\ldots\right.\right.}{\ldots} \\ -\frac{jx\,sxx+jy\,sxy+jz\,sxz}{n} & sxx \\ -\frac{jx\,syx+jy\,syy+jz\,syz}{n} & syx \\ -\frac{jx\,szx+jy\,szy+jz\,szz}{n} & szx \end{pmatrix}$$

In[25]:=
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gFS@tW@Qtens // MF
```

Out[25]//MatrixForm=

$$\begin{pmatrix} -\frac{jx\,qx+jy\,qy+jz\,qz}{n\,c^2}-\frac{jx^3\,qx+jy^3\,qy+jy^2\,jz\,qz+jz^3\,qz+jx^2\left(jy\,qy+jz\,qz\right)-3\,az\,g\,jz\,n^2\,qz\,t^2-6\,g\,jz\,n^2\,qz\,t\,vz+6\,jz\,n^2\,qz\,W0-8\,n^3\,qx\,Wx-8\,n^3\,qy\,Wy-8\,n^3\,qz\,Wz-2\,ax\,jz\,n^2\,qz\,x-2\left(az+3\,g\right)jz\,n^2\,qz\,z+jy\,qy\left(jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)+jx\,qx\left(jy^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)}{2\,n^3\,c^4}+O[\tfrac{1}{c}]^5 & \frac{jx\left(jx\,qx+jy\,qy+jz\,qz\right)}{n^2\,c^4}+\frac{jx^4\,qx+jx^3\left(jy\,qy+jz\,qz\right)-8\,n^3\left(jy\,qy+jz\,qz\right)Wx+jx^2\,qx\left(jy^2+jz^2-n^2\left(7\,g\,t\left(az\,t+2\,vz\right)-14\,W0+6\,ax\,x+2\left(3\,az+7\,g\right)z\right)\right)+jx\left(jy^3\,qy+jy^2\,jz\,qz+\ldots\right.}{\ldots} \\ -qx+\frac{-\frac{qx\left(jx^2+jy^2+jz^2+n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x\right)\right)}{2\,n^2}-(az+g)\,qx\,z}{c^2}+O[\tfrac{1}{c}]^3 & \frac{jx\,qx}{n\,c^2}+\frac{qx\left(jx^3-8\,n^3\,Wx+jx\left(jy^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\right)}{2\,n^3\,c^4}+O[\tfrac{1}{c}]^5 \\ -qy+\frac{-\frac{qy\left(jx^2+jy^2+jz^2+n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x\right)\right)}{2\,n^2}-(az+g)\,qy\,z}{c^2}+O[\tfrac{1}{c}]^3 & \frac{jx\,qy}{n\,c^2}+\frac{qy\left(jx^3-8\,n^3\,Wx+jx\left(jy^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\right)}{2\,n^3\,c^4}+O[\tfrac{1}{c}]^5 \\ -qz+\frac{-\frac{qz\left(jx^2+jy^2+jz^2+n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x\right)\right)}{2\,n^2}-(az+g)\,qz\,z}{c^2}+O[\tfrac{1}{c}]^3 & \frac{jx\,qz}{n\,c^2}+\frac{qz\left(jx^3-8\,n^3\,Wx+jx\left(jy^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\right)}{2\,n^3\,c^4}+O[\tfrac{1}{c}]^5 \end{pmatrix}$$

In[26]:=
```
gFS@tW@Ptens // MF
```

Out[26]//MatrixForm=

$$\begin{pmatrix} -\frac{jx\,px+jy\,py+jz\,pz}{n\,c^2}-\frac{\left(jx\,px+jy\,py+jz\,pz\right)\left(jx^2+jy^2+jz^2-n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\right)}{2\,n^3\,c^4}+O[\tfrac{1}{c}]^5 & \frac{px}{c^2}+\frac{px\left(jx^2+jy^2+jz^2-n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\right)}{2\,n^2\,c^4}+O[\tfrac{1}{c}]^5 & \frac{py}{c^2}+\frac{py\left(jx^2+jy^2+jz^2-n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\right)}{2\,n^2\,c^4}+O[\tfrac{1}{c}]^5 & \frac{pz}{c^2}+\frac{pz\left(jx^2+jy^2+jz^2-n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\right)}{2\,n^2\,c^4}+O[\tfrac{1}{c}]^5 \\ -\frac{jx\left(jx\,px+jy\,py+jz\,pz\right)}{n^2\,c^2}-\frac{jx\left(jx\,px+jy\,py+jz\,pz\right)\left(jx^2+jy^2+jz^2-n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\right)}{2\,n^4\,c^4}+O[\tfrac{1}{c}]^5 & \frac{jx\,px}{n\,c^2}+\frac{jx\,px\left(jx^2+jy^2+jz^2-n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\right)}{2\,n^3\,c^4}+O[\tfrac{1}{c}]^5 & \frac{jx\,py}{n\,c^2}+\frac{jx\,py\left(jx^2+jy^2+jz^2-n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\right)}{2\,n^3\,c^4}+O[\tfrac{1}{c}]^5 & \frac{jx\,pz}{n\,c^2}+\frac{jx\,pz\left(jx^2+jy^2+jz^2-n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\right)}{2\,n^3\,c^4}+O[\tfrac{1}{c}]^5 \\ -\frac{jy\left(jx\,px+jy\,py+jz\,pz\right)}{n^2\,c^2}-\frac{jy\left(jx\,px+jy\,py+jz\,pz\right)\left(jx^2+jy^2+jz^2-n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\right)}{2\,n^4\,c^4}+O[\tfrac{1}{c}]^5 & \frac{jy\,px}{n\,c^2}+\frac{jy\,px\left(jx^2+jy^2+jz^2-n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\right)}{2\,n^3\,c^4}+O[\tfrac{1}{c}]^5 & \frac{jy\,py}{n\,c^2}+\frac{jy\,py\left(jx^2+jy^2+jz^2-n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\right)}{2\,n^3\,c^4}+O[\tfrac{1}{c}]^5 & \frac{jy\,pz}{n\,c^2}+\frac{jy\,pz\left(jx^2+jy^2+jz^2-n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\right)}{2\,n^3\,c^4}+O[\tfrac{1}{c}]^5 \\ -\frac{jz\left(jx\,px+jy\,py+jz\,pz\right)}{n^2\,c^2}-\frac{jz\left(jx\,px+jy\,py+jz\,pz\right)\left(jx^2+jy^2+jz^2-n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\right)}{2\,n^4\,c^4}+O[\tfrac{1}{c}]^5 & \frac{jz\,px}{n\,c^2}+\frac{jz\,px\left(jx^2+jy^2+jz^2-n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\right)}{2\,n^3\,c^4}+O[\tfrac{1}{c}]^5 & \frac{jz\,py}{n\,c^2}+\frac{jz\,py\left(jx^2+jy^2+jz^2-n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\right)}{2\,n^3\,c^4}+O[\tfrac{1}{c}]^5 & \frac{jz\,pz}{n\,c^2}+\frac{jz\,pz\left(jx^2+jy^2+jz^2-n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\right)}{2\,n^3\,c^4}+O[\tfrac{1}{c}]^5 \end{pmatrix}$$

In[27]:=
```
(gFS@tW@dust + gFS@tW@S + gFS@tW@Qtens + gFS@tW@Ptens) // MF
```

Out[27]//MatrixForm=

$$\begin{pmatrix} -n\,\rho\,c^2+\left(-n\,\epsilon-\frac{\left(jx^2+jy^2+jz^2+n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\right)\rho}{2\,n}\right)+O[\tfrac{1}{c}]^1 & jx\,\rho+\frac{px+\frac{jx\,sxx+jy\,syx+jz\,szx}{n}+jx\,\epsilon+\frac{\left(jx^3-8\,n^3\,Wx+jx\left(jy^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\right)\rho}{2\,n^2}}{c^2}+O[\tfrac{1}{c}]^3 & jy\,\rho+\frac{py+\frac{jx\,sxy+jy\,syy+jz\,szy}{n}+\frac{2\,jy\,n^2\,\epsilon+jy^3\,\rho-8\,n^3\,Wy\,\rho+jy\left(jx^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\rho}{2\,n^2}}{c^2}+O[\tfrac{1}{c}]^3 & jz\,\rho+\frac{pz+\frac{jx\,sxz+jy\,syz+jz\,szz}{n}+\frac{2\,jz\,n^2\,\epsilon+jz^3\,\rho-8\,n^3\,Wz\,\rho+jz\left(jx^2+jy^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\rho}{2\,n^2}}{c^2}+O[\tfrac{1}{c}]^3 \\ -jx\,\rho\,c^2+\left(-qx-\frac{jx\,sxx+jy\,sxy+jz\,sxz}{n}-\frac{jx\left(\left(jx^2+jy^2+jz^2\right)\rho+n^2\left(2\,\epsilon+\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\rho\right)\right)}{2\,n^2}\right)+O[\tfrac{1}{c}]^1 & \left(sxx+\frac{jx^2\,\rho}{n}\right)+\frac{\frac{jx\,px}{n}+\frac{jx\,qx}{n}+\frac{jx\left(2\,jx\,n^2\,\epsilon+\left(jx^3-8\,n^3\,Wx+jx\left(jy^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\right)\rho\right)}{2\,n^3}}{c^2}+O[\tfrac{1}{c}]^3 & \left(sxy+\frac{jx\,jy\,\rho}{n}\right)+\frac{\frac{jx\,py}{n}+\frac{jy\,qx}{n}+\frac{jx\left(2\,jy\,n^2\,\epsilon+jy^3\,\rho-8\,n^3\,Wy\,\rho+jy\left(jx^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\rho\right)}{2\,n^3}}{c^2}+O[\tfrac{1}{c}]^3 & \left(sxz+\frac{jx\,jz\,\rho}{n}\right)+\frac{\frac{jx\,pz}{n}+\frac{jz\,qx}{n}+\frac{jx\left(2\,jz\,n^2\,\epsilon+jz^3\,\rho-8\,n^3\,Wz\,\rho+jz\left(jx^2+jy^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\rho\right)}{2\,n^3}}{c^2}+O[\tfrac{1}{c}]^3 \\ -jy\,\rho\,c^2+\left(-qy-\frac{jx\,syx+jy\,syy+jz\,syz}{n}-\frac{jy\left(\left(jx^2+jy^2+jz^2\right)\rho+n^2\left(2\,\epsilon+\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\rho\right)\right)}{2\,n^2}\right)+O[\tfrac{1}{c}]^1 & \left(syx+\frac{jx\,jy\,\rho}{n}\right)+\frac{\frac{jy\,px}{n}+\frac{jx\,qy}{n}+\frac{jx\,jy\,\epsilon}{n}+\frac{jy\left(jx^3-8\,n^3\,Wx+jx\left(jy^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\right)\rho}{2\,n^3}}{c^2}+O[\tfrac{1}{c}]^3 & \left(syy+\frac{jy^2\,\rho}{n}\right)+\frac{\frac{jy\,py}{n}+\frac{jy\,qy}{n}+\frac{jy\left(2\,jy\,n^2\,\epsilon+jy^3\,\rho-8\,n^3\,Wy\,\rho+jy\left(jx^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\rho\right)}{2\,n^3}}{c^2}+O[\tfrac{1}{c}]^3 & \left(syz+\frac{jy\,jz\,\rho}{n}\right)+\frac{\frac{jy\,pz}{n}+\frac{jz\,qy}{n}+\frac{jy\left(2\,jz\,n^2\,\epsilon+jz^3\,\rho-8\,n^3\,Wz\,\rho+jz\left(jx^2+jy^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\rho\right)}{2\,n^3}}{c^2}+O[\tfrac{1}{c}]^3 \\ -jz\,\rho\,c^2+\left(-qz-\frac{jx\,szx+jy\,szy+jz\,szz}{n}-\frac{jz\left(\left(jx^2+jy^2+jz^2\right)\rho+n^2\left(2\,\epsilon+\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\rho\right)\right)}{2\,n^2}\right)+O[\tfrac{1}{c}]^1 & \left(szx+\frac{jx\,jz\,\rho}{n}\right)+\frac{\frac{jz\,px}{n}+\frac{jx\,qz}{n}+\frac{jx\,jz\,\epsilon}{n}+\frac{jz\left(jx^3-8\,n^3\,Wx+jx\left(jy^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\right)\rho}{2\,n^3}}{c^2}+O[\tfrac{1}{c}]^3 & \left(szy+\frac{jy\,jz\,\rho}{n}\right)+\frac{\frac{jz\,py}{n}+\frac{jy\,qz}{n}+\frac{jz\left(2\,jy\,n^2\,\epsilon+jy^3\,\rho-8\,n^3\,Wy\,\rho+jy\left(jx^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\rho\right)}{2\,n^3}}{c^2}+O[\tfrac{1}{c}]^3 & \left(szz+\frac{jz^2\,\rho}{n}\right)+\frac{\frac{jz\,pz}{n}+\frac{jz\,qz}{n}+\frac{jz\left(2\,jz\,n^2\,\epsilon+jz^3\,\rho-8\,n^3\,Wz\,\rho+jz\left(jx^2+jy^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\rho\right)}{2\,n^3}}{c^2}+O[\tfrac{1}{c}]^3 \end{pmatrix}$$

In[∘]:=

(* Balanced quantities constructed from energy–momentum tensor, and their supplies *)

In[∘]:=
```
nabla[xx_] := Module[{temp = gFS@tW[xx]}, T@gFS[D[Normal@aFS@tW[xx], {coords}] + Sum[temp[[ii]] * cc[[ ;; ,  ;; , ii]], {ii, 1, 4}]]];
nablasym[xx_] := Module[{temp = nabla[xx], tempgg = gFS@tW@gg, tempigg = gFS@tW@igg}, aFS[(temp + tempgg.T[temp].tempigg) / 2]];
```

In[∘]:=
```
(* Symmetrized energy-stress tensor, with explicit dep. on coords *)
(TTx = gFS@tW@EPS) // MF
(*(TTxsym=aFS[(TTx+igg.T[TTx].gg)/2])//MF;*)
```

Out[∘]//MatrixForm=

$$\begin{pmatrix} -n\,\rho\,c^2+\left(-n\,\epsilon-\frac{\left(jx^2+jy^2+jz^2+n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\right)\rho}{2\,n}\right)+O[\tfrac{1}{c}]^1 & jx\,\rho+\frac{px+\frac{jx\,sxx+jy\,syx+jz\,szx}{n}+jx\,\epsilon+\frac{jx\left(jx^2+jy^2+jz^2\right)\rho}{2\,n^2}-4\,n\,Wx\,\rho-\frac{1}{2}\,jx\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\rho}{c^2}+O[\tfrac{1}{c}]^3 & jy\,\rho+\frac{py+\frac{jx\,sxy+jy\,syy+jz\,szy}{n}+jy\,\epsilon+\frac{jy\left(jx^2+jy^2+jz^2\right)\rho}{2\,n^2}-4\,n\,Wy\,\rho-\frac{1}{2}\,jy\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\rho}{c^2}+O[\tfrac{1}{c}]^3 & jz\,\rho+\frac{pz+\frac{jx\,sxz+jy\,syz+jz\,szz}{n}+jz\,\epsilon+\frac{jz\left(jx^2+jy^2+jz^2\right)\rho}{2\,n^2}-4\,n\,Wz\,\rho-\frac{1}{2}\,jz\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\rho}{c^2}+\ldots \\ -jx\,\rho\,c^2-\frac{2\,n\left(jx\,sxx+jy\,sxy+jz\,sxz+n\left(qx+jx\,\epsilon\right)\right)+jx\left(jx^2+jy^2+jz^2+n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\right)\rho}{2\,n^2}+O[\tfrac{1}{c}]^1 & \left(sxx+\frac{jx^2\,\rho}{n}\right)+\frac{\frac{jx\left(px+qx+jx\,\epsilon\right)}{n}+\frac{jx\left(jx^3-8\,n^3\,Wx+jx\left(jy^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\right)\rho}{2\,n^3}}{c^2}+O[\tfrac{1}{c}]^3 & \left(sxy+\frac{jx\,jy\,\rho}{n}\right)+\frac{\frac{jx\,py+jy\,qx+jx\,jy\,\epsilon}{n}+\frac{jx\left(jx^2\,jy+jy^3-8\,n^3\,Wy+jy\left(jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\right)\rho}{2\,n^3}}{c^2}+O[\tfrac{1}{c}]^3 & \left(sxz+\frac{jx\,jz\,\rho}{n}\right)+\frac{2\,jz\,n^2\,qx+jx^3\,jz\,\rho+jx\left(jz\left(jy^2+jz^2\right)\rho-8\,n^3\,Wz\,\rho+n^2\left(2\,pz+2\,jz\,\epsilon-jz\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W\ldots\right.\right.\right.}{2\,n^3\,c^2} \\ -jy\,\rho\,c^2-\frac{2\,n\left(jx\,syx+jy\,syy+jz\,syz+n\left(qy+jy\,\epsilon\right)\right)+jy\left(jx^2+jy^2+jz^2+n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\right)\rho}{2\,n^2}+O[\tfrac{1}{c}]^1 & \left(syx+\frac{jx\,jy\,\rho}{n}\right)+\frac{\frac{jy\,px+jx\,qy+jx\,jy\,\epsilon}{n}+\frac{jy\left(jx^3-8\,n^3\,Wx+jx\left(jy^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\right)\rho}{2\,n^3}}{c^2}+O[\tfrac{1}{c}]^3 & \left(syy+\frac{jy^2\,\rho}{n}\right)+\frac{jy\left(jy\left(jx^2+jy^2+jz^2\right)\rho-8\,n^3\,Wy\,\rho+n^2\left(2\left(py+qy+jy\,\epsilon\right)-jy\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\rho\right)\right)}{2\,n^3\,c^2}+O[\tfrac{1}{c}]^3 & \left(syz+\frac{jy\,jz\,\rho}{n}\right)+\frac{2\,jz\,n^2\,qy+jy^3\,jz\,\rho+jy\left(jz\left(jx^2+jz^2\right)\rho-8\,n^3\,Wz\,\rho+n^2\left(2\,pz+2\,jz\,\epsilon-jz\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W\ldots\right.\right.\right.}{2\,n^3\,c^2} \\ -jz\,\rho\,c^2-\frac{2\,n\left(jx\,szx+jy\,szy+jz\,szz+n\left(qz+jz\,\epsilon\right)\right)+jz\left(jx^2+jy^2+jz^2+n^2\left(g\,t\left(az\,t+2\,vz\right)-2\,W0+2\,ax\,x+2\,(az+g)\,z\right)\right)\rho}{2\,n^2}+O[\tfrac{1}{c}]^1 & \left(szx+\frac{jx\,jz\,\rho}{n}\right)+\frac{\frac{jz\,px+jx\,qz+jx\,jz\,\epsilon}{n}+\frac{jz\left(jx^3-8\,n^3\,Wx+jx\left(jy^2+jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\right)\rho}{2\,n^3}}{c^2}+O[\tfrac{1}{c}]^3 & \left(szy+\frac{jy\,jz\,\rho}{n}\right)+\frac{\frac{jz\,py+jy\,qz+jy\,jz\,\epsilon}{n}+\frac{jz\left(jx^2\,jy+jy^3-8\,n^3\,Wy+jy\left(jz^2-n^2\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az+3\,g\right)z\right)\right)\right)\rho}{2\,n^3}}{c^2}+O[\tfrac{1}{c}]^3 & \left(szz+\frac{jz^2\,\rho}{n}\right)+\frac{jz\left(jz\left(jx^2+jy^2+jz^2\right)\rho-8\,n^3\,Wz\,\rho+n^2\left(2\left(pz+qz+jz\,\epsilon\right)-jz\left(3\,g\,t\left(az\,t+2\,vz\right)-6\,W0+2\,ax\,x+2\left(az\ldots\right.\right.\right.\right.}{2\,n^3\,c^2} \end{pmatrix}$$

(* Energy *)

In[∘]:=
```
(* Energy current and supply according to 4-velocity *)
pvec = gFS@tW[-uu]; Dpvec = nablasym[-uu];
MF@(MF /@ {Efluxuu = gFS[({{1, 0, 0, 0}, surface / (Δt)}.TTx.pvec)], Esupplyuu = gFS[Tr[TTx.T@Dpvec]]})
```

Out[∘]//MatrixForm=

$$\begin{pmatrix} \begin{pmatrix} n\,\rho\,c^2+n\,\epsilon+O[\tfrac{1}{c}]^1 \\ \left(Ay\,jy+Az\,jz+Ax\left(jx-n\,Vx\right)-n\left(Ay\,Vy+Az\,Vz\right)\right)\rho\,c^2+\left(Ax\,qx+Ay\,qy+Az\,qz+\left(Ay\,jy+Az\,jz+Ax\left(jx-n\,Vx\right)-n\left(Ay\,Vy+Az\,Vz\right)\right)\epsilon\right)+O[\tfrac{1}{c}]^1 \end{pmatrix} \\ -\frac{n\,(sxz+szx)\,jx^{(0,0,0,1)}+n\,(syz+szy)\,jy^{(0,0,0,1)}+2\,n\,szz\,jz^{(0,0,0,1)}-\left(jx\,(sxz+szx)+jy\,(syz+szy)\right)n^{(0,0,0,1)}-2\,jz\,szz\,n^{(0,0,0,1)}+n\,sxy\,jx^{(0,0,1,0)}+n\,syx\,jx^{(0,0,1,0)}+2\,n\,syy\,jy^{(0,0,1,0)}+n\,syz\,jz^{(0,0,1,0)}+n\,szy\,jz^{(0,0,1,0)}-jx\,sxy\,n^{(0,0,1,0)}-jx\,syx\,n^{(0,0,1,0)}-2\,jy\,syy\,n^{(0,0,1,0)}-jz\,syz\,n^{(0,0,1,0)}-jz\,szy\,n^{(0,0,1,0)}+2\,n\,sxx\,jx^{(0,1,0,0)}+n\,sxy\,jy^{(0,1,0,0)}+n\,syx\,jy^{(0,1,0,0)}+n\,sxz\,jz^{(0,1,0,0)}+n\,szx\,jz^{(0,1,0,0)}-\left(2\,jx\,sxx+jy\,(sxy+syx)+jz\,(sxz+szx)\right)n^{(0,1,0,0)}}{2\,n^2}+O[\tfrac{1}{c}]^2 \end{pmatrix}$$

In[∘]:=
```
MF@(MF /@ (aFS@u2U@j2u[{Efluxuu, Esupplyuu}]))
```

Out[∘]//MatrixForm=

$$\begin{pmatrix} \begin{pmatrix} n\,\rho\,c^2+n\,\epsilon+O[\tfrac{1}{c}]^1 \\ n\left(Ax\,(ux-Vx)+Ay\,(uy-Vy)+Az\,(uz-Vz)\right)\rho\,c^2+\left(Ax\,qx+Ay\,qy+Az\,qz+n\left(Ax\,(ux-Vx)+Ay\,(uy-Vy)+Az\,(uz-Vz)\right)\epsilon\right)+O[\tfrac{1}{c}]^1 \end{pmatrix} \\ -\frac{-\left(\left((sxz+szx)\,ux+(syz+szy)\,uy+2\,szz\,uz\right)n^{(0,0,0,1)}\right)+2\,szz\left(n\,uz\right)^{(0,0,0,1)}-\left((sxy+syx)\,ux+2\,syy\,uy\right)n^{(0,0,1,0)}+(syz+szy)\left(\left(n\,uy\right)^{(0,0,0,1)}-uz\,n^{(0,0,1,0)}+\left(n\,uz\right)^{(0,0,1,0)}\right)+2\left(syy\left(n\,uy\right)^{(0,0,1,0)}+sxx\left(-ux\,n^{(0,1,0,0)}+\left(n\,ux\right)^{(0,1,0,0)}\right)\right)+(sxy+syx)\left(\left(n\,ux\right)^{(0,0,1,0)}-uy\,n^{(0,1,0,0)}+\left(n\,uy\right)^{(0,1,0,0)}\right)+(sxz+szx)\left(\left(n\,ux\right)^{(0,0,0,1)}-uz\,n^{(0,1,0,0)}+\left(n\,uz\right)^{(0,1,0,0)}\right)}{2\,n}+O[\tfrac{1}{c}]^2 \end{pmatrix}$$

In[∘]:=
```
MF@FS[% /. {ax → 0, az → 0, vx → 0, vz → 0}]
```

Out[∘]//MatrixForm=

$$\begin{pmatrix} \begin{pmatrix} n\,\rho\,c^2+n\,\epsilon+O[\tfrac{1}{c}]^1 \\ n\left(Ax\,(ux-Vx)+Ay\,(uy-Vy)+Az\,(uz-Vz)\right)\rho\,c^2+\left(Ax\,qx+Ay\,qy+Az\,qz+n\left(Ax\,(ux-Vx)+Ay\,(uy-Vy)+Az\,(uz-Vz)\right)\epsilon\right)+O[\tfrac{1}{c}]^1 \end{pmatrix} \\ -\frac{-\left(\left((sxz+szx)\,ux+(syz+szy)\,uy+2\,szz\,uz\right)n^{(0,0,0,1)}\right)+2\,szz\left(n\,uz\right)^{(0,0,0,1)}-\left((sxy+syx)\,ux+2\,syy\,uy\right)n^{(0,0,1,0)}+(syz+szy)\left(\left(n\,uy\right)^{(0,0,0,1)}-uz\,n^{(0,0,1,0)}+\left(n\,uz\right)^{(0,0,1,0)}\right)+2\left(syy\left(n\,uy\right)^{(0,0,1,0)}+sxx\left(-ux\,n^{(0,1,0,0)}+\left(n\,ux\right)^{(0,1,0,0)}\right)\right)+(sxy+syx)\left(\left(n\,ux\right)^{(0,0,1,0)}-uy\,n^{(0,1,0,0)}+\left(n\,uy\right)^{(0,1,0,0)}\right)+(sxz+szx)\left(\left(n\,ux\right)^{(0,0,0,1)}-uz\,n^{(0,1,0,0)}+\left(n\,uz\right)^{(0,1,0,0)}\right)}{2\,n}+O[\tfrac{1}{c}]^2 \end{pmatrix}$$

In[∘]:=
```
(* Energy current and supply according to t-vector *)
pvec = - {1, 0, 0, 0}; Dpvec = nablasym[pvec];
MF@(MF /@ ({Efluxt = aFS[({{1, 0, 0, 0}, surface / (Δt)}.TTx.pvec)], Esupplyt = gFS[Tr[TTx.T@Dpvec]]}))
```
Out[∘]//MatrixForm=
```
((n ρ c^2 + (n ϵ + ((jx^2+jy^2+jz^2+n^2 (g t (az t+2 vz)-2 W0+2 ax x+2 (az+g) z)) ρ)/(2 n)) + O[1/c]^1
  (Ay jy + Az jz + Ax (jx - n Vx) - n (Ay Vy + Az Vz)) ρ c^2 + (2 n (Ay (jx syx+jy syy+jz syz+n (qy+jy ϵ-n Vy ϵ))+Az (jx szx+jy szy+jz szz+n (qz+jz ϵ-n Vz ϵ)))+(Ay (jy-n Vy)+Az (jz-n Vz)) (jx^2+jy^2+jz^2+n^2 (g t (az t+2 vz)-2 W0+2 ax x+2 (az+g) z)) ρ+Ax (2 n (jx sxx+jy sxy+jz sxz+n (qx+(jx-n Vx) ϵ))+(jx-n Vx) (jx^2+jy^2+jz^2+n^2 (g t (az t+2 vz)-2 W0+2 ax x+2 (az+g) z)) ρ))/(2 n^2) + O[1/c]^1)
 g n (az t + vz) ρ + O[1/c]^2)
```

In[∘]:=
```
MF@(MF /@ (aFS@u2U@j2u[{Efluxt, Esupplyt}]))
```
Out[∘]//MatrixForm=
```
((n ρ c^2 + (n ϵ + 1/2 n (U^2 + g t (az t + 2 vz) - 2 W0 + 2 ax x + 2 (az + g) z) ρ) + O[1/c]^1
  n (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) ρ c^2 + (Ax qx + Ay qy + Az qz + Ax sxx ux + Ay syx ux + Az szx ux + Ax sxy uy + Ay syy uy + Az szy uy + Ax sxz uz + Ay syz uz + Az szz uz + Ax n ux ϵ + Ay n uy ϵ + Az n uz ϵ - Ax n Vx ϵ - Ay n Vy ϵ - Az n Vz ϵ + 1/2 n (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) (U^2 + g t (az t + 2 vz) - 2 W0 + 2 ax x + 2 (az + g) z) ρ) + O[1/c
 g n (az t + vz) ρ + O[1/c]^2)
```

In[∘]:=
```
MF@FS[% /. {ax → 0, az → 0, vx → 0, vz → 0}]
```
Out[∘]//MatrixForm=
```
((n ρ c^2 + n (ϵ + 1/2 (U^2 - 2 W0 + 2 g z) ρ) + O[1/c]^1
  n (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) ρ c^2 + (Ax qx + Ay qy + Az qz + Ax sxx ux + Ay syx ux + Az szx ux + Ax sxy uy + Ay syy uy + Az szy uy + Ax sxz uz + Ay syz uz + Az szz uz + Ax n ux ϵ + Ay n uy ϵ + Az n uz ϵ - Ax n Vx ϵ - Ay n Vy ϵ - Az n Vz ϵ + 1/2 n (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) (U^2 - 2 W0 + 2 g z) ρ) + O[1/c]^1)
 O[1/c]^2)
```

In[∘]:=
```
(* Energy current and supply according to norm. t-vector *)
pvec = gFS@tW[- c * {1, 0, 0, 0} / Sqrt[-gg[[1, 1]]]]; Dpvec = nablasym[pvec];
MF@(MF /@ {Efluxnt = aFS[({{1, 0, 0, 0}, surface / (Δt)}.TTx.pvec)], Esupplynt = gFS[Tr[TTx.T@Dpvec]]})
```
Out[∘]//MatrixForm=
```
((n ρ c^2 + (n ϵ + ((jx^2+jy^2+jz^2) ρ)/(2 n)) + O[1/c]^1
  (Ay jy + Az jz + Ax (jx - n Vx) - n (Ay Vy + Az Vz)) ρ c^2 + (2 n (Ax (jx sxx+jy sxy+jz sxz+n (qx+(jx-n Vx) ϵ))+Ay (jx syx+jy syy+jz syz+n (qy+jy ϵ-n Vy ϵ))+Az (jx szx+jy szy+jz szz+n (qz+jz ϵ-n Vz ϵ)))+(jx^2+jy^2+jz^2) (Ay jy+Az jz+Ax (jx-n Vx)-n (Ay Vy+Az Vz)) ρ)/(2 n^2) + O[1/c]^1)
 -(ax jx + (az + g) jz) ρ + O[1/c]^2)
```

In[∘]:=
```
MF@(MF /@ (aFS@u2U@j2u[{Efluxnt, Esupplynt}]))
```
Out[∘]//MatrixForm=
```
((n ρ c^2 + n (ϵ + (U^2 ρ)/2) + O[1/c]^1
  n (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) ρ c^2 + (Ax (qx + sxx ux + sxy uy + sxz uz + n (ux - Vx) ϵ) + Ay (qy + syx ux + syy uy + syz uz + n (uy - Vy) ϵ) + Az (qz + szx ux + szy uy + szz uz + n (uz - Vz) ϵ) + 1/2 n U^2 (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) ρ) + O[1/c]^1)
 -(ax n ux + (az + g) n uz) ρ + O[1/c]^2)
```

In[∘]:=
```
MF@FS[% /. {ax → 0, az → 0, vx → 0, vz → 0}]
```
Out[∘]//MatrixForm=
```
((n ρ c^2 + n (ϵ + (U^2 ρ)/2) + O[1/c]^1
  n (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) ρ c^2 + (Ax (qx + sxx ux + sxy uy + sxz uz + n (ux - Vx) ϵ) + Ay (qy + syx ux + syy uy + syz uz + n (uy - Vy) ϵ) + Az (qz + szx ux + szy uy + szz uz + n (uz - Vz) ϵ) + 1/2 n U^2 (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) ρ) + O[1/c]^1)
 -g n uz ρ + O[1/c]^2)
```

In[∘]:=
```
(* Energy current and supply according to cov. t-vector *)
pvec = gFS@tW[c^2 * igg.{1, 0, 0, 0}]; Dpvec = nablasym[pvec];
MF@(MF /@ {Efluxcovt = aFS[({{1, 0, 0, 0}, surface / (Δt)}.TTx.pvec)], Esupplycovt = gFS[Tr[TTx.T@Dpvec]]})
```
Out[∘]//MatrixForm=
```
((n ρ c^2 + ((jx^2+jy^2+jz^2) ρ+n^2 (2 ϵ-(g t (az t+2 vz)-2 W0+2 ax x+2 (az+g) z) ρ))/(2 n) + O[1/c]^1
  (Ay jy + Az jz + Ax (jx - n Vx) - n (Ay Vy + Az Vz)) ρ c^2 + (2 n (Ay (jx syx+jy syy+jz syz+n (qy+jy ϵ-n Vy ϵ))+Az (jx szx+jy szy+jz szz+n (qz+jz ϵ-n Vz ϵ)))+(Ay (jy-n Vy)+Az (jz-n Vz)) (jx^2+jy^2+jz^2-n^2 (g t (az t+2 vz)-2 W0+2 ax x+2 (az+g) z)) ρ+Ax (2 n (jx sxx+jy sxy+jz sxz+n (qx+(jx-n Vx) ϵ))+(jx-n Vx) (jx^2+jy^2+jz^2-n^2 (g t (az t+2 vz)-2 W0+2 ax x+2 (az+g) z)) ρ))/(2 n^2) + O[1/c]^1)
 -(2 ax jx + 2 az jz + 2 g jz + az g n t + g n vz) ρ + O[1/c]^2)
```

In[∘]:=
```
MF@(MF /@ (aFS@u2U@j2u[{Efluxcovt, Esupplycovt}]))
```
Out[∘]//MatrixForm=
```
((n ρ c^2 + (n ϵ - 1/2 n (-U^2 + g t (az t + 2 vz) - 2 W0 + 2 ax x + 2 (az + g) z) ρ) + O[1/c]^1
  n (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) ρ c^2 + (Ax qx + Ay qy + Az qz + Ax sxx ux + Ay syx ux + Az szx ux + Ax sxy uy + Ay syy uy + Az szy uy + Ax sxz uz + Ay syz uz + Az szz uz + Ax n ux ϵ + Ay n uy ϵ + Az n uz ϵ - Ax n Vx ϵ - Ay n Vy ϵ - Az n Vz ϵ - 1/2 n (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) (-U^2 + g t (az t + 2 vz) - 2 W0 + 2 ax x + 2 (az + g) z) ρ) + O[
 -n (az g t + 2 ax ux + 2 az uz + 2 g uz + g vz) ρ + O[1/c]^2)
```

In[∘]:=
```
MF@FS[% /. {ax → 0, az → 0, vx → 0, vz → 0}]
```
Out[∘]//MatrixForm=
```
((n ρ c^2 + n (ϵ + 1/2 (U^2 + 2 W0 - 2 g z) ρ) + O[1/c]^1
  n (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) ρ c^2 + (Ax qx + Ay qy + Az qz + Ax sxx ux + Ay syx ux + Az szx ux + Ax sxy uy + Ay syy uy + Az szy uy + Ax sxz uz + Ay syz uz + Az szz uz + Ax n ux ϵ + Ay n uy ϵ + Az n uz ϵ - Ax n Vx ϵ - Ay n Vy ϵ - Az n Vz ϵ + 1/2 n (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) (U^2 + 2 W0 - 2 g z) ρ) + O[1/c]^1)
 -2 (g n uz ρ) + O[1/c]^2)
```

In[∘]:=
```
(* Energy current and supply according to norm. cov. t-vector *)
pvec = aFS@itW@tW[c * igg.{1, 0, 0, 0} / Sqrt[-igg[[1, 1]]]]; Dpvec = nablasym[pvec];
MF@(MF /@ {Efluxncovt = aFS[({{1, 0, 0, 0}, surface / (Δt)}.TTx.pvec)], Esupplyncovt = aFS[itW[FS[Tr[TTx.T@Dpvec]]]]})
```
Out[∘]//MatrixForm=
```
((n ρ c^2 + (n ϵ + ((jx^2+jy^2+jz^2) ρ)/(2 n)) + O[1/c]^1
  (Ay jy + Az jz + Ax (jx - n Vx) - n (Ay Vy + Az Vz)) ρ c^2 + (2 n (Ax (jx sxx+jy sxy+jz sxz+n (qx+(jx-n Vx) ϵ))+Ay (jx syx+jy syy+jz syz+n (qy+jy ϵ-n Vy ϵ))+Az (jx szx+jy szy+jz szz+n (qz+jz ϵ-n Vz ϵ)))+(jx^2+jy^2+jz^2) (Ay jy+Az jz+Ax (jx-n Vx)-n (Ay Vy+Az Vz)) ρ)/(2 n^2) + O[1/c]^1)
 -(ax jx + (az + g) jz) ρ + O[1/c]^2)
```

In[∘]:=
```
MF@(MF /@ (aFS@u2U@j2u[{Efluxncovt, Esupplyncovt}]))
```
Out[∘]//MatrixForm=
```
((n ρ c^2 + n (ϵ + (U^2 ρ)/2) + O[1/c]^1
  n (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) ρ c^2 + (Ax (qx + sxx ux + sxy uy + sxz uz + n (ux - Vx) ϵ) + Ay (qy + syx ux + syy uy + syz uz + n (uy - Vy) ϵ) + Az (qz + szx ux + szy uy + szz uz + n (uz - Vz) ϵ) + 1/2 n U^2 (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) ρ) + O[1/c]^1)
 -(ax n ux + (az + g) n uz) ρ + O[1/c]^2)
```

In[∘]:=
```
MF@FS[% /. {ax → 0, az → 0, vx → 0, vz → 0}]
```
Out[∘]//MatrixForm=
```
((n ρ c^2 + n (ϵ + (U^2 ρ)/2) + O[1/c]^1
  n (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) ρ c^2 + (Ax (qx + sxx ux + sxy uy + sxz uz + n (ux - Vx) ϵ) + Ay (qy + syx ux + syy uy + syz uz + n (uy - Vy) ϵ) + Az (qz + szx ux + szy uy + szz uz + n (uz - Vz) ϵ) + 1/2 n U^2 (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) ρ) + O[1/c]^1)
 -g n uz ρ + O[1/c]^2)
```

In[∘]:=

(* x-Momentum *)

In[∘]:=
```
(* Momentum current and supply according to x-vector *)
pvec = {0, 1, 0, 0}; Dpvec = nablasym[pvec];
MF@(MF /@ {Pfluxx = aFS[({{1, 0, 0, 0}, surface / (Δt)}.TTx.pvec)], Psupplyx = gFS[Tr[TTx.T@Dpvec]]})
```
Out[∘]//MatrixForm=
```
((jx ρ + (px+(jx sxx+jy syx+jz szx)/n+jx ϵ+(jx (jx^2+jy^2+jz^2) ρ)/(2 n^2)-4 n Wx ρ-1/2 jx (3 g t (az t+2 vz)-6 W0+2 ax x+2 (az+3 g) z) ρ)/c^2 + O[1/c]^3
  (Ax sxx + Ay syx + Az szx + (jx (Ay jy+Az jz+Ax (jx-n Vx)-n (Ay Vy+Az Vz)) ρ)/n) + (-2 Ax n^2 ((n px+jy syx+jz szx) Vx-jx^2 ϵ-jx (px+qx-Vx (sxx+n ϵ)))-2 n^2 (Az (-jx qz-jz (px-szx Vz+jx ϵ)+Vz (jx sxx+jy syx+n (px+jx ϵ)))+Ay (-jx qy-jy (px-syx Vy+jx ϵ)+Vy (jx sxx+jz szx+n (px+jx ϵ))))+Ax (jx-n Vx) (jx^3-8 n^3 Wx+jx (jy^2+jz^2-n^2 (3 g t (az t+2 vz)-6 W0+2 ax x+2 (az+3 g) z))) ρ+(Ay (jy-n Vy)+Az (jz-n Vz)) (jx^3-8 n^3 Wx+jx (jy^2+jz^2-n^2 (3 g t (az t+2 vz)-6 W0+2 ax x+2 (az+3 g) z))) ρ)/(2 n^3 c^2) + O[1/c]^3
 -ax n ρ + O[1/c]^2)
```

In[∘]:=
```
MF@(MF /@ (aFS@u2U@j2u[{Pfluxx, Psupplyx}]))
```
Out[∘]//MatrixForm=
```
((n ux ρ + (px+sxx ux+syx uy+szx uz+n ux ϵ-1/2 n (8 Wx+ux (-U^2+3 g t (az t+2 vz)-6 W0+2 ax x+2 (az+3 g) z)) ρ)/c^2 + O[1/c]^3
  (Ax sxx + Ay syx + Az szx + n ux (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) ρ) + (Ax px ux+Ax qx ux+Ay qy ux+Az qz ux+Ay px uy+Az px uz-Ax px Vx-Ax sxx ux Vx-Ax syx uy Vx-Ax szx uz Vx-Ay px Vy-Ay sxx ux Vy-Ay syx uy Vy-Ay szx uz Vy-Az px Vz-Az sxx ux Vz-Az syx uy Vz-Az szx uz Vz+Ax n U^2 ϵ+Ay n ux uy ϵ-Ax n uy^2 ϵ+Az n ux uz ϵ-Ax n uz^2 ϵ-Ax n ux Vx ϵ-Ay n ux Vy ϵ-Az n ux Vz ϵ-1/2 n (Ax (ux-Vx)+Ay (uy-Vy)+Az (uz-Vz)) (8 Wx+ux (-U^2+3 g t (az t+2 vz)-6 W0+2
 -ax n ρ + O[1/c]^2)
```

In[∘]:=
```
MF@FS[% /. {ax → 0, az → 0, vx → 0, vz → 0}]
```
Out[∘]//MatrixForm=
```
((n ux ρ + (px+sxx ux+syx uy+szx uz+n ux ϵ+1/2 n (-8 Wx+ux (U^2+6 W0-6 g z)) ρ)/c^2 + O[1/c]^3
  (Ax sxx + Ay syx + Az szx + n ux (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) ρ) + (Ax px ux+Ax qx ux+Ay qy ux+Az qz ux+Ay px uy+Az px uz-Ax px Vx-Ax sxx ux Vx-Ax syx uy Vx-Ax szx uz Vx-Ay px Vy-Ay sxx ux Vy-Ay syx uy Vy-Ay szx uz Vy-Az px Vz-Az sxx ux Vz-Az syx uy Vz-Az szx uz Vz+Ax n U^2 ϵ+Ay n ux uy ϵ-Ax n uy^2 ϵ+Az n ux uz ϵ-Ax n uz^2 ϵ-Ax n ux Vx ϵ-Ay n ux Vy ϵ-Az n ux Vz ϵ+1/2 n (Ax (ux-Vx)+Ay (uy-Vy)+Az (uz-Vz)) (-8 Wx+ux (U^2+6 W0-6 g z)) ρ)/c^2 + O[1/c]^3
 O[1/c]^2)
```

In[∘]:=
```
(* Momentum current and supply according to cov. x-vector *)
pvec = gFS@tW[igg.{0, 1, 0, 0}]; Dpvec = nablasym[pvec];
MF@(MF /@ {Pfluxcovx = aFS[({{1, 0, 0, 0}, surface / (Δt)}.TTx.pvec)], Psupplycovx = gFS[Tr[TTx.T@Dpvec]]})
```
Out[∘]//MatrixForm=
```
((jx ρ + (2 n (jx sxx+jy syx+jz szx+n (px+jx ϵ))+jx (jx^2+jy^2+jz^2-n^2 (g t (az t+2 vz)-2 W0+2 ax x+2 (az+g) z)) ρ)/(2 n^2 c^2) + O[1/c]^3
  (Ax sxx + Ay syx + Az szx + (jx (Ay jy+Az jz+Ax (jx-n Vx)-n (Ay Vy+Az Vz)) ρ)/n) + (-2 Ay n^2 (-jx qy-az g n syx t^2+n px Vy+jz szx Vy+2 n syx (W0-g (t vz+z))-jy (px-syx Vy+jx ϵ)+jx Vy (sxx+n ϵ))-2 Az n^2 (-jx qz-az g n szx t^2+n px Vz+jy syx Vz+2 n szx (W0-g (t vz+z))-jz (px-szx Vz+jx ϵ)+jx Vz (sxx+n ϵ))-2 Ax n^2 (-az g n sxx t^2+n px Vx+(jy syx+jz szx) Vx+2 n sxx (W0-g (t vz+z))-jx^2 ϵ-jx (px+qx-Vx (sxx+n ϵ)))+jx (Ay jy+Az jz+Ax (jx-n Vx)-n (Ay Vy+Az Vz)) (jx^2+jy^2+jz^2-n^2 (g t (az t+
 -ax n ρ + O[1/c]^2)
```

In[∘]:=
```
MF@(MF /@ (aFS@u2U@j2u[{Pfluxcovx, Psupplycovx}]))
```
Out[∘]//MatrixForm=
```
((n ux ρ + (px+sxx ux+syx uy+szx uz+n ux ϵ-1/2 n ux (-U^2+g t (az t+2 vz)-2 W0+2 ax x+2 (az+g) z) ρ)/c^2 + O[1/c]^3
  (Ax sxx + Ay syx + Az szx + n ux (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) ρ) + (-Ax (-az g sxx t^2-(px+qx) ux+px Vx+(syx uy+szx uz) Vx+sxx (ux Vx+2 W0-2 g (t vz+z))-n U^2 ϵ+n (uy^2+uz^2+ux Vx) ϵ)-Az (-qz ux-px uz+(px+sxx ux+syx uy) Vz+szx (-az g t^2+uz Vz+2 W0-2 g (t vz+z))+n ux (-uz+Vz) ϵ)-Ay (-az g syx t^2-qy ux+px Vy+szx uz Vy+2 syx (W0-g (t vz+z))+ux Vy (sxx+n ϵ)-uy (px-syx Vy+n ux ϵ))-1/2 n ux (Ax (ux-Vx)+Ay (uy-Vy)+Az (uz-Vz)) (-U^2+g t (az t+2 vz)-2 W0+2 a
 -ax n ρ + O[1/c]^2)
```

In[∘]:=
```
MF@FS[% /. {ax → 0, az → 0, vx → 0, vz → 0}]
```
Out[∘]//MatrixForm=
```
((n ux ρ + (px+sxx ux+syx uy+szx uz+n ux ϵ+1/2 n ux (U^2+2 W0-2 g z) ρ)/c^2 + O[1/c]^3
  (Ax sxx + Ay syx + Az szx + n ux (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) ρ) + (-Ax (-qx ux+sxx ux Vx+syx uy Vx+szx uz Vx+px (-ux+Vx)+2 sxx W0-2 g sxx z+n (-U^2+uy^2+uz^2+ux Vx) ϵ)-Ay (-qy ux+sxx ux Vy+syx uy Vy+szx uz Vy+px (-uy+Vy)+2 syx W0-2 g syx z+n ux (-uy+Vy) ϵ)-Az (-qz ux-px uz+(px+sxx ux+syx uy) Vz+szx (uz Vz+2 W0-2 g z)+n ux (-uz+Vz) ϵ)+1/2 n ux (Ax (ux-Vx)+Ay (uy-Vy)+Az (uz-Vz)) (U^2+2 W0-2 g z) ρ)/c^2 + O[1/c]^3)
 O[1/c]^2)
```

In[∘]:=
```
(* Momentum current and supply according to norm. x-vector *)
pvec = gFS@tW[{0, 1, 0, 0}/Sqrt[gg[[2, 2]]]]; Dpvec = nablasym[pvec];
MF@(MF/@{Pfluxnx = aFS[({{1, 0, 0, 0}, surface/(Δt)}.TTx.pvec)], Psupplynx = gFS[Tr[TTx.T@Dpvec]]})
```
Out[∘]//MatrixForm=
```
jx ρ + (px + (jx sxx+jy syx+jz szx)/n + jx(jx²+jy²+jz²)ρ/(2 n²) − 4 n Wx ρ + jx(ϵ−(−2 W0+ax x+az(g t²+z)+2 g(t vz+z))ρ))/c² + O[1/c]³
(Ax sxx + Ay syx + Az szx + jx(Ay jy+Az jz+Ax(jx−n Vx)−n(Ay Vy+Az Vz))ρ/n) + (2 n²(W0−g(az t²/2+t vz+z))(−n(Ax sxx+Ay syx+Az szx)+jx(−Ax jx−Ay jy−Az jz+Ax n Vx+Ay n Vy+Az n Vz)ρ)+Ay(2 n²(jx qy+jy(px+jx ϵ))+jy(jx³−8 n³ Wx+jx(jy²+jz²−n²(3 g t(az t+2 vz)−6 W0+2 ax x+2(az+3 g) z)))ρ)+Az(2 n²(jx qz+jz(px+jx ϵ))+jz(jx³−8 n³ Wx+jx(jy²+jz²−n²(3 g t(az t+2 vz)−6 W0+2 ax x+2(az+3 g) z)))ρ)−n(Ax Vx+Ay Vy+Az Vz)(2 n(jx sxx+jy syx+jz szx)+jx(jx²+jy²+jz²)ρ−8 n³ Wx …)/(2 n³ c²)
−ax n ρ + O[1/c]²
```

In[∘]:=
```
MF@(MF/@(aFS@u2U@j2u[{Pfluxnx, Psupplynx}]))
```
Out[∘]//MatrixForm=
```
n ux ρ + (px+sxx ux+syx uy+szx uz+n ux ϵ−1/2 n(8 Wx+ux(−U²−4 W0+2 ax x+2 az(g t²+z)+4 g(t vz+z)))ρ)/c² + O[1/c]³
(Ax sxx + Ay syx + Az szx + n ux(Ax(ux − Vx) + Ay(uy − Vy) + Az(uz − Vz))ρ) + (1/2 Ax az g sxx t²+1/2 Ay az g syx t²+1/2 az Az g szx t²+Ax px ux+Ax qx ux+Ay qy ux+Az qz ux+Ay px uy+Az px uz−Ax px Vx−Ax sxx ux Vx−Ax syx uy Vx−Ax szx uz Vx−Ay px Vy−Ay sxx ux Vy−Ay syx uy Vy−Ay szx uz Vy+Ax g sxx t vz+Ay g syx t vz+Az g szx t vz−Az px Vz−Az sxx ux Vz−Az syx uy Vz−Az szx uz Vz−Ax sxx W0−Ay syx W0−Az szx W0+Ax g sxx z+Ay g syx z+Az g szx z+Ax n ux² ϵ …)/c²
−ax n ρ + O[1/c]²
```

In[∘]:=
```
MF@FS[% /. {ax → 0, az → 0, vx → 0, vz → 0}]
```
Out[∘]//MatrixForm=
```
n ux ρ + (px+sxx ux+syx uy+szx uz+n ux ϵ+1/2 n(−8 Wx+ux(U²+4 W0−4 g z))ρ)/c² + O[1/c]³
(Ax sxx + Ay syx + Az szx + n ux(Ax(ux − Vx) + Ay(uy − Vy) + Az(uz − Vz))ρ) + (Ax px ux+Ax qx ux+Ay qy ux+Az qz ux+Ay px uy+Az px uz−Ax px Vx−Ax sxx ux Vx−Ax syx uy Vx−Ax szx uz Vx−Ay px Vy−Ay sxx ux Vy−Ay syx uy Vy−Ay szx uz Vy−Az px Vz−Az sxx ux Vz−Az syx uy Vz−Az szx uz Vz−Ax sxx W0−Ay syx W0−Az szx W0+Ax g sxx z+Ay g syx z+Az g szx z+Ax n ux² ϵ+Ay n ux uy ϵ+Az n ux uz ϵ−Ax n ux Vx ϵ−Ay n ux Vy ϵ−Az n ux Vz ϵ+1/2 n(Ax(ux−Vx)+Ay(uy−Vy)+Az …)/c²
O[1/c]²
```

(* z-Momentum *)

In[∘]:=
```
(* Momentum current and supply according to z-vector *)
pvec = {0, 0, 0, 1}; Dpvec = nablasym[pvec];
MF@(MF/@{Pfluxz = aFS[({{1, 0, 0, 0}, surface/(Δt)}.TTx.pvec)], Psupplyz = gFS[Tr[TTx.T@Dpvec]]})
```
Out[∘]//MatrixForm=
```
jz ρ + (pz + (jx sxz+jy syz+jz szz)/n + jz ϵ + jz(jx²+jy²+jz²)ρ/(2 n²) − 4 n Wz ρ − 1/2 jz(3 g t(az t+2 vz)−6 W0+2 ax x+2(az+3 g) z)ρ)/c² + O[1/c]³
(Ax sxz + Ay syz + Az szz + jz(Ay jy+Az jz+Ax(jx−n Vx)−n(Ay Vy+Az Vz))ρ/n) + (−2 Ax n²(−jz qx−jx(pz−sxz Vx+jz ϵ)+Vx(jy syz+jz szz+n(pz+jz ϵ)))−2 n²(Ay(−jz qy−jy(pz−syz Vy+jz ϵ)+Vy(jx sxz+jz szz+n(pz+jz ϵ)))+Az((n pz+jx sxz+jy syz) Vz−jz² ϵ−jz(pz+qz−Vz(szz+n ϵ))))+Ax(jx−n Vx)(jx² jz+jy² jz+jz³−3 az g jz n² t²−6 g jz n² t vz+6 jz n² W0−8 n³ Wz−2 ax jz n² x−2(az+3 g) jz n² z)ρ+(Ay(jy−n Vy)+Az(jz−n Vz))(jx² jz+jy² jz+jz³−3 az g jz n² t²−6 g jz n² t vz+6 jz n² …)/(2 n³ c²)
−(az + g) n ρ + O[1/c]²
```

In[∘]:=
```
MF@(MF/@(aFS@u2U@j2u[{Pfluxz, Psupplyz}]))
```
Out[∘]//MatrixForm=
```
n uz ρ + (pz+sxz ux+syz uy+szz uz+n uz ϵ−1/2 n(8 Wz+uz(−U²+3 g t(az t+2 vz)−6 W0+2 ax x+2(az+3 g) z))ρ)/c² + O[1/c]³
(Ax sxz + Ay syz + Az szz + n uz(Ax(ux − Vx) + Ay(uy − Vy) + Az(uz − Vz))ρ) + (Ax pz ux+Ay pz uy+Az pz uz+Ax qx uz+Ay qy uz+Az qz uz−Ax pz Vx−Ax sxz ux Vx−Ax syz uy Vx−Ax szz uz Vx−Ay pz Vy−Ay sxz ux Vy−Ay syz uy Vy−Ay szz uz Vy−Az pz Vz−Az sxz ux Vz−Az syz uy Vz−Az szz uz Vz+Ax n ux uz ϵ+Ay n uy uz ϵ+Az n uz² ϵ−Ax n uz Vx ϵ−Ay n uz Vy ϵ−Az n uz Vz ϵ−1/2 n(Ax(ux−Vx)+Ay(uy−Vy)+Az(uz−Vz))(8 Wz+uz(−U²+3 g t(az t+2 vz)−6 W0+2 ax x+2(az+3 g) z))ρ …)/c²
−(az + g) n ρ + O[1/c]²
```

In[∘]:=
```
MF@FS[% /. {ax → 0, az → 0, vx → 0, vz → 0}]
```
Out[∘]//MatrixForm=
```
n uz ρ + (pz+sxz ux+syz uy+szz uz+n uz ϵ+1/2 n(−8 Wz+uz(U²+6 W0−6 g z))ρ)/c² + O[1/c]³
(Ax sxz + Ay syz + Az szz + n uz(Ax(ux − Vx) + Ay(uy − Vy) + Az(uz − Vz))ρ) + (Ax pz ux+Ay pz uy+Az pz uz+Ax qx uz+Ay qy uz+Az qz uz−Ax pz Vx−Ax sxz ux Vx−Ax syz uy Vx−Ax szz uz Vx−Ay pz Vy−Ay sxz ux Vy−Ay syz uy Vy−Ay szz uz Vy−Az pz Vz−Az sxz ux Vz−Az syz uy Vz−Az szz uz Vz+Ax n ux uz ϵ+Ay n uy uz ϵ+Az n uz² ϵ−Ax n uz Vx ϵ−Ay n uz Vy ϵ−Az n uz Vz ϵ+1/2 n(Ax(ux−Vx)+Ay(uy−Vy)+Az(uz−Vz))(−8 Wz+uz(U²+6 W0−6 g z))ρ)/c² + O[1/c]³
−g n ρ + O[1/c]²
```

In[∘]:=
```
(* Momentum current and supply according to cov. z-vector *)
pvec = gFS@tW[igg.{0, 0, 0, 1}]; Dpvec = nablasym[pvec];
MF@(MF/@{Pfluxcovz = aFS[({{1, 0, 0, 0}, surface/(Δt)}.TTx.pvec)], Psupplycovz = gFS[Tr[TTx.T@Dpvec]]})
```
Out[∘]//MatrixForm=
```
jz ρ + (2 n(jx sxz+jy syz+jz szz+n(pz+jz ϵ))+jz(jx²+jy²+jz²−n²(g t(az t+2 vz)−2 W0+2 ax x+2(az+g) z))ρ)/(2 n² c²) + O[1/c]³
(Ax sxz + Ay syz + Az szz + jz(Ay jy+Az jz+Ax(jx−n Vx)−n(Ay Vy+Az Vz))ρ/n) + (−2 Ax n²(−jz qx−az g n sxz t²+(jy syz+jz szz) Vx+2 n sxz(W0−g(t vz+z))+n Vx(pz+jz ϵ)−jx(pz−sxz Vx+jz ϵ))−2 Ay n²(−jz qy−az g n syz t²+(jx sxz+jz szz) Vy+2 n syz(W0−g(t vz+z))+n Vy(pz+jz ϵ)−jy(pz−syz Vy+jz ϵ))−2 Az n²(−g n szz t(az t+2 vz)+n pz Vz+jx sxz Vz+jy syz Vz+2 n szz W0−2 g n szz z−jz² ϵ−jz(pz+qz−Vz(szz+n ϵ)))+jz(Ay jy+Az jz+Ax(jx−n Vx)−n(Ay Vy+Az Vz))(jx²+jy²+jz²−n²(g …)/(2 n³ c²)
−(az + g) n ρ + O[1/c]²
```

In[∘]:=
```
MF@(MF/@(aFS@u2U@j2u[{Pfluxcovz, Psupplycovz}]))
```
Out[∘]//MatrixForm=
```
n uz ρ + (pz+sxz ux+syz uy+szz uz+n uz ϵ−1/2 n uz(−U²+g t(az t+2 vz)−2 W0+2 ax x+2(az+g) z)ρ)/c² + O[1/c]³
(Ax sxz + Ay syz + Az szz + n uz(Ax(ux − Vx) + Ay(uy − Vy) + Az(uz − Vz))ρ) + (−Ax(−az g sxz t²−qx uz+(syz uy+szz uz) Vx+pz(−ux+Vx)+sxz(ux Vx+2 W0−2 g(t vz+z))+n uz(−ux+Vx) ϵ)−Ay(−az g syz t²−qy uz+sxz ux Vy+szz uz Vy+pz(−uy+Vy)+syz(uy Vy+2 W0−2 g(t vz+z))+n uz(−uy+Vy) ϵ)−Az(−((pz+qz) uz)+(pz+sxz ux+syz uy) Vz+szz(−az g t²+uz Vz+2 W0−2 g(t vz+z))+n uz(−uz+Vz) ϵ)−1/2 n uz(Ax(ux−Vx)+Ay(uy−Vy)+Az(uz−Vz))(−U²+g t(az t+2 vz)−2 W0+2 ax x+2(a …)/c²
−(az + g) n ρ + O[1/c]²
```

In[∘]:=
```
MF@FS[% /. {ax → 0, az → 0, vx → 0, vz → 0}]
```
Out[∘]//MatrixForm=
```
n uz ρ + (pz+sxz ux+syz uy+szz uz+n uz ϵ+1/2 n uz(U²+2 W0−2 g z)ρ)/c² + O[1/c]³
(Ax sxz + Ay syz + Az szz + n uz(Ax(ux − Vx) + Ay(uy − Vy) + Az(uz − Vz))ρ) + (−Ay(−qy uz+sxz ux Vy+syz uy Vy+szz uz Vy+pz(−uy+Vy)+2 syz W0−2 g syz z+n uz(−uy+Vy) ϵ)−Az(−((pz+qz) uz)+(pz+sxz ux+syz uy) Vz+szz(uz Vz+2 W0−2 g z)+n uz(−uz+Vz) ϵ)−Ax(syz uy Vx+pz(−ux+Vx)+sxz(ux Vx+2 W0−2 g z)+uz(−qx+szz Vx+n(−ux+Vx) ϵ))+1/2 n uz(Ax(ux−Vx)+Ay(uy−Vy)+Az(uz−Vz))(U²+2 W0−2 g z)ρ)/c² + O[1/c]³
−g n ρ + O[1/c]²
```

In[∘]:=
```
(* Momentum current and supply according to norm. z-vector *)
pvec = gFS@tW[{0, 0, 0, 1}/Sqrt[gg[[2, 2]]]]; Dpvec = nablasym[pvec];
MF@(MF/@{Pfluxnz = aFS[({{1, 0, 0, 0}, surface/(Δt)}.TTx.pvec)], Psupplynz = gFS[Tr[TTx.T@Dpvec]]})
```
Out[∘]//MatrixForm=
```
jz ρ + (pz + (jx sxz+jy syz+jz szz)/n + jz(jx²+jy²+jz²)ρ/(2 n²) − 4 n Wz ρ + jz(ϵ−(−2 W0+ax x+az(g t²+z)+2 g(t vz+z))ρ))/c² + O[1/c]³
(Ax sxz + Ay syz + Az szz + jz(Ay jy+Az jz+Ax(jx−n Vx)−n(Ay Vy+Az Vz))ρ/n) + (2 n²(W0−g(az t²/2+t vz+z))(−n(Ax sxz+Ay syz+Az szz)+jz(−Ax jx−Ay jy−Az jz+Ax n Vx+Ay n Vy+Az n Vz)ρ)−n(Ax Vx+Ay Vy+Az Vz)(2 n(jx sxz+jy syz+jz szz)+jz(jx²+jy²+jz²)ρ−8 n³ Wz ρ+n²(2 pz+2 jz ϵ−jz(3 g t(az t+2 vz)−6 W0+2 ax x+2(az+3 g) z)ρ))+Az jz(jz(jx²+jy²+jz²)ρ−8 n³ Wz ρ+n²(2(pz+qz+jz ϵ)−jz(3 g t(az t+2 vz)−6 W0+2 ax x+2(az+3 g) z)ρ))+Ay(2 jz n² qy+jy³ jz ρ+jy(jz(jx²+jz²)ρ−8 …)/(2 n³ c²)
−(az + g) n ρ + O[1/c]²
```

In[∘]:=
```
MF@(MF/@(aFS@u2U@j2u[{Pfluxnz, Psupplynz}]))
```
Out[∘]//MatrixForm=
```
n uz ρ + (pz+sxz ux+syz uy+szz uz+n uz ϵ−1/2 n(8 Wz+uz(−U²−4 W0+2 ax x+2 az(g t²+z)+4 g(t vz+z)))ρ)/c² + O[1/c]³
(Ax sxz + Ay syz + Az szz + n uz(Ax(ux − Vx) + Ay(uy − Vy) + Az(uz − Vz))ρ) + (1/2 Ax az g sxz t²+1/2 Ay az g syz t²+1/2 az Az g szz t²+Ax pz ux+Ay pz uy+Az pz uz+Ax qx uz+Ay qy uz+Az qz uz−Ax pz Vx−Ax sxz ux Vx−Ax syz uy Vx−Ax szz uz Vx−Ay pz Vy−Ay sxz ux Vy−Ay syz uy Vy−Ay szz uz Vy+Ax g sxz t vz+Ay g syz t vz+Az g szz t vz−Az pz Vz−Az sxz ux Vz−Az syz uy Vz−Az szz uz Vz−Ax sxz W0−Ay syz W0−Az szz W0+Ax g sxz z+Ay g syz z+Az g szz z+Ax n ux uz …)/c²
−(az + g) n ρ + O[1/c]²
```

In[∘]:=
```
MF@FS[% /. {ax → 0, az → 0, vx → 0, vz → 0}]
```
Out[∘]//MatrixForm=
```
n uz ρ + (pz+sxz ux+syz uy+szz uz+n uz ϵ+1/2 n(−8 Wz+uz(U²+4 W0−4 g z))ρ)/c² + O[1/c]³
(Ax sxz + Ay syz + Az szz + n uz(Ax(ux − Vx) + Ay(uy − Vy) + Az(uz − Vz))ρ) + (Ax pz ux+Ay pz uy+Az pz uz+Ax qx uz+Ay qy uz+Az qz uz−Ax pz Vx−Ax sxz ux Vx−Ax syz uy Vx−Ax szz uz Vx−Ay pz Vy−Ay sxz ux Vy−Ay syz uy Vy−Ay szz uz Vy−Az pz Vz−Az sxz ux Vz−Az syz uy Vz−Az szz uz Vz−Ax sxz W0−Ay syz W0−Az szz W0+Ax g sxz z+Ay g syz z+Az g szz z+Ax n ux uz ϵ+Ay n uy uz ϵ+Az n uz² ϵ−Ax n uz Vx ϵ−Ay n uz Vy ϵ−Az n uz Vz ϵ+1/2 n(Ax(ux−Vx)+Ay(uy−Vy)+Az …)/c²
−g n ρ + O[1/c]²
```

(* Angular momentum *)

In[∘]:=
```
(* Ang.momentum current and supply according to xy-vector *)
pvec = x*{0, 0, 1, 0} − y*{0, 1, 0, 0}; Dpvec = nablasym[pvec];
MF@(MF/@{Lfluxx = aFS[({{1, 0, 0, 0}, surface/(Δt)}.TTx.pvec)], Lsupplyx = gFS[Tr[TTx.T@Dpvec]]})
```
Out[∘]//MatrixForm=
```
(jy x − jx y)ρ + (2 n(jx sxy+jy syy+jz szy) x−2 n(jx sxx+jy syx+jz szx) y−(jx²+jy²+jz²)(−jy x+jx y)ρ+8 n³(−Wy x+Wx y)ρ+n²(2 py x−2 px y−(jy x−jx y)(−2 ϵ+(3 g t(az t+2 vz)−6 W0+2 ax x+2(az+3 g) z)ρ)))/(2 n² c²) + O[1/c]³
((Ax sxy + Ay syy + Az szy) x − (Ax sxx + Ay syx + Az szx) y + (Ay jy+Az jz+Ax(jx−n Vx)−n(Ay Vy+Az Vz))(jy x−jx y)ρ/n) + (Ax x(2 n²(jy qx+jx(py+jy ϵ))+jx(jx² jy+jy³−8 n³ Wy+jy(jz²−n²(3 g t(az t+2 vz)−6 W0+2 ax x+2(az+3 g) z)))ρ)+Az x(2 n²(jy qz+jz(py+jy ϵ))+jz(jx² jy+jy³−8 n³ Wy+jy(jz²−n²(3 g t(az t+2 vz)−6 W0+2 ax x+2(az+3 g) z)))ρ)−Ay y(2 n²(jx qy+jy(px+jx ϵ))+jy(jx³−8 n³ Wx+jx(jy²+jz²−n²(3 g t(az t+2 vz)−6 W0+2 ax x+2(az+3 g) z)))ρ)−Az y(2 n²( …
ax n y ρ + O[1/c]²
```

In[∘]:=
```
MF@(MF/@(aFS@u2U@j2u[{Lfluxx, Lsupplyx}]))
```
Out[∘]//MatrixForm=
```
n(uy x − ux y)ρ + (py x+(sxy ux+syy uy+szy uz) x−px y−(sxx ux+syx uy+szx uz) y+1/2 n U²(uy x−ux y)ρ+4 n(−Wy x+Wx y)ρ−1/2 n(uy x−ux y)(−2 ϵ+(3 g t(az t+2 vz)−6 W0+2 ax x+2(az+3 g) z)ρ))/c² + O[1/c]³
((Ax sxy + Ay syy + Az szy) x − (Ax sxx + Ay syx + Az szx) y + n(Ax(ux − Vx) + Ay(uy − Vy) + Az(uz − Vz))(uy x − ux y)ρ) + ((Ax Vx+Ay Vy+Az Vz) y(2(px+sxx ux+syx uy+szx uz+n ux ϵ)−n(8 Wx+ux(−U²+3 g t(az t+2 vz)−6 W0+2 ax x+2(az+3 g) z))ρ)+(Ax Vx+Ay Vy+Az Vz) x(−2(py+sxy ux+syy uy+szy uz+n uy ϵ)+n(8 Wy+uy(−U²+3 g t(az t+2 vz)−6 W0+2 ax x+2(az+3 g) z))ρ)−Ax ux y(2 px+2 qx+n(2 ux ϵ−8 Wx ρ+ux(U²−3 g t(az t+2 vz)+6 W0−2 ax x−2(az+3 …
ax n y ρ + O[1/c]²
```

In[∘]:=
```
MF@FS[% /. {ax → 0, az → 0, vx → 0, vz → 0}]
```
Out[∘]//MatrixForm=
```
n(uy x − ux y)ρ + (py x+(sxy ux+syy uy+szy uz) x−px y−(sxx ux+syx uy+szx uz) y+1/2 n U²(uy x−ux y)ρ+4 n(−Wy x+Wx y)ρ+n(uy x−ux y)(ϵ+3(W0−g z)ρ))/c² + O[1/c]³
((Ax sxy + Ay syy + Az szy) x − (Ax sxx + Ay syx + Az szx) y + n(Ax(ux − Vx) + Ay(uy − Vy) + Az(uz − Vz))(uy x − ux y)ρ) + (−Ax ux y(2 px+2 qx+2 n ux ϵ+n(−8 Wx+ux(U²+6 W0−6 g z))ρ)+(Ax Vx+Ay Vy+Az Vz) y(2(px+sxx ux+syx uy+szx uz+n ux ϵ)+n(−8 Wx+ux(U²+6 W0−6 g z))ρ)+(Ax Vx+Ay Vy+Az Vz) x(−2(py+sxy ux+syy uy+szy uz+n uy ϵ)+n(8 Wy−uy(U²+6 W0−6 g z))ρ)+Ay uy x(2 py+2 qy+2 n uy ϵ+n(−8 Wy+uy(U²+6 W0−6 g z))ρ)−Ay y(2 qy ux+2 px uy+n u …)/(2 c²)
O[1/c]²
```

In[∘]:=
```
(* Ang.momentum current and supply according to cov. xy-vector *)
pvec = gFS@tW[igg.(x*{0, 0, 1, 0} − y*{0, 1, 0, 0})]; Dpvec = nablasym[pvec];
MF@(MF/@{Lfluxcx = aFS[({{1, 0, 0, 0}, surface/(Δt)}.TTx.pvec)], Lsupplycx = gFS[Tr[TTx.T@Dpvec]]})
```
Out[∘]//MatrixForm=
```
(jy x − jx y)ρ + (2 n(jx sxy+jy syy+jz szy) x−2 n(jx sxx+jy syx+jz szx) y−(jx²+jy²+jz²)(−jy x+jx y)ρ+n²(2 py x−2 px y−(jy x−jx y)(−2 ϵ+(g t(az t+2 vz)−2 W0+2 ax x+2(az+g) z)ρ)))/(2 n² c²) + O[1/c]³
((Ax sxy + Ay syy + Az szy) x − (Ax sxx + Ay syx + Az szx) y + (Ay jy+Az jz+Ax(jx−n Vx)−n(Ay Vy+Az Vz))(jy x−jx y)ρ/n) + (−8 n³(−Ax jx−Ay jy−Az jz+Ax n Vx+Ay n Vy+Az n Vz)(Wy x−Wx y)ρ+2 n² y(az g t²−2 W0+2 g(t vz+z))(−n(Ax sxx+Ay syx+Az szx)+jx(−Ax jx−Ay jy−Az jz+Ax n Vx+Ay n Vy+Az n Vz)ρ)−2 n² x(az g t²−2 W0+2 g(t vz+z))(−n(Ax sxy+Ay syy+Az szy)+jy(−Ax jx−Ay jy−Az jz+Ax n Vx+Ay n Vy+Az n Vz)ρ)+x(−2 Ax n²(−jy qx−jx(py−sxy Vx+jy ϵ)+Vx(jy syy+j …
ax n y ρ + O[1/c]²
```

In[∘]:=
```
MF@(MF/@(aFS@u2U@j2u[{Lfluxcx, Lsupplycx}]))
```
Out[∘]//MatrixForm=
```
n(uy x − ux y)ρ + (py x+sxy ux x+syy uy x+szy uz x−(px+sxx ux) y−syx uy y−szx uz y+n uy x ϵ−n ux y ϵ−1/2 n(uy x−ux y)(−U²+g t(az t+2 vz)−2 W0+2 ax x+2(az+g) z)ρ)/c² + O[1/c]³
((Ax sxy + Ay syy + Az szy) x − (Ax sxx + Ay syx + Az szx) y + n(Ax(ux − Vx) + Ay(uy − Vy) + Az(uz − Vz))(uy x − ux y)ρ) + (8 n²(Ax(ux−Vx)+Ay(uy−Vy)+Az(uz−Vz))(Wy x−Wx y)ρ+2 y(az g t²−2 W0+2 g(t vz+z))(−n(Ax sxx+Ay syx+Az szx)+n² ux(Ax(−ux+Vx)+Ay(−uy+Vy)+Az(−uz+Vz))ρ)−2 x(az g t²−2 W0+2 g(t vz+z))(−n(Ax sxy+Ay syy+Az szy)+n² uy(Ax(−ux+Vx)+Ay(−uy+Vy)+Az(−uz+Vz))ρ)+n y(2 Ax(−qx ux+(sxx ux+syx uy+szx uz) Vx+px(−ux+Vx)+n …
ax n y ρ + O[1/c]²
```

In[∘]:=
```
MF@FS[% /. {ax → 0, az → 0, vx → 0, vz → 0}]
```
Out[∘]//MatrixForm=
```
n(uy x − ux y)ρ + (py x+sxy ux x+syy uy x+szy uz x−(px+sxx ux) y−syx uy y−szx uz y+n uy x ϵ−n ux y ϵ+1/2 n(uy x−ux y)(U²+2 W0−2 g z)ρ)/c² + O[1/c]³
((Ax sxy + Ay syy + Az szy) x − (Ax sxx + Ay syx + Az szx) y + n(Ax(ux − Vx) + Ay(uy − Vy) + Az(uz − Vz))(uy x − ux y)ρ) + (Ax py(ux−Vx) x+Ay(qy uy x+py(uy−Vy) x−sxy ux Vy x−syy uy Vy x−szy uz Vy x−2 syy W0 x−qy ux y−px uy y+px Vy y+sxx ux Vy y+syx uy Vy y+szx uz Vy y+2 syx W0 y+2 g syy x z−2 g syx y z+n(uy−Vy)(uy x−ux y) ϵ)+Az(py(uz−Vz) x−sxy ux Vz x−syy uy Vz x−szy uz Vz x−2 szy W0 x−px uz y+px Vz y+sxx ux Vz y+syx uy Vz y+sz …
O[1/c]²
```

In[∘]:=
```
(* Ang.momentum current and supply according to yz-vector as g_{ab} x^{a} (Kopeinik & al.) *)
pvec = gFS@tW[(gg.coords)[[3]] * {0, 0, 0, 1} - (gg.coords)[[4]] * {0, 0, 1, 0}]; Dpvec = nablasym[pvec];
MF@(MF /@ {Lfluxkx = aFS[({{1, 0, 0, 0}, surface / (Δt)}.TTx.pvec)], Lsupplykx = gFS[Tr[TTx.T@Dpvec]]})
```
Out[∘]//MatrixForm=
```
( ( (jz y - jy z) ρ + (2 n (jx sxz+jy syz+jz szz) y-2 n (jx sxy+jy syy+jz szy) z+(jx²+jy²+jz²) (jz y-jy z) ρ+8 n³ (-Wz y+Wy z) ρ+n² (2 pz y+2 jz y ϵ-2 z (py+jy ϵ)+jy (8 t Wz+5 g t (az t+2 vz) z+2 (-5 W0+ax x) z+2 (az+5 g) z²) ρ-jz (5 az g t² y+2 t (4 Wy+5 g vz y)+2 y (-5 W0+ax x+az z+5 g z)) ρ)) / (2 n² c²) + O[1/c]³
    ((Ax sxz + Ay syz + Az szz) y - (Ax sxy + Ay syy + Az szy) z + ((Ay jy+Az jz+Ax (jx-n Vx)-n (Ay Vy+Az Vz)) (jz y-jy z) ρ)/n) + (-2 n² (4 t Wz-2 W0 z+g z (az t²+2 (t vz+z))) (-n (Ax sxy+Ay syy+Az szy)+jy (-Ax jx-Ay jy-Az jz+Ax n Vx+Ay n Vy+Az n Vz) ρ)+2 n² (4 t Wy-2 W0 y+g y (az t²+2 (t vz+z))) (-n (Ax sxz+Ay syz+Az szz)+jz (-Ax jx-Ay jy-Az jz+Ax n Vx+Ay n Vy+Az n Vz) ρ)+y (-2 Ax n² (-jz qx-jx (pz-sxz Vx+jz ϵ)+Vx (jy syz+jz szz+n (pz+jz ϵ)))-2 n² (Ay (-jz qy-jy (pz-syz …
  -(az + g) n y ρ + O[1/c]² )
```

In[∘]:=
```
MF@(MF /@ (aFS@u2U@j2u[{Lfluxkx, Lsupplykx}]))
```
Out[∘]//MatrixForm=
```
( ( n (uz y - uy z) ρ + (pz y+sxz ux y+syz uy y+szz uz y-py z-sxy ux z-syy uy z-szy uz z+n uz y ϵ-n uy z ϵ+1/2 n (-8 Wz y+uz (U²+10 W0-2 ax x) y+8 Wy z-uy (U²+10 W0-2 ax x) z-2 (az+5 g) uz y z+2 (az+5 g) uy z²+5 az g t² (-uz y+uy z)+2 t (-4 uz Wy+4 uy Wz-5 g uz vz y+5 g uy vz z)) ρ) / c² + O[1/c]³
    ((Ax sxz + Ay syz + Az szz) y - (Ax sxy + Ay syy + Az szy) z + n (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) (uz y - uy z) ρ) + (-2 (4 t Wz-2 W0 z+g z (az t²+2 (t vz+z))) (-n (Ax sxy+Ay syy+Az szy)+n² uy (Ax (-ux+Vx)+Ay (-uy+Vy)+Az (-uz+Vz)) ρ)+2 (4 t Wy-2 W0 y+g y (az t²+2 (t vz+z))) (-n (Ax sxz+Ay syz+Az szz)+n² uz (Ax (-ux+Vx)+Ay (-uy+Vy)+Az (-uz+Vz)) ρ)+n z (2 Ax (-qx uy+sxy ux Vx+syy uy Vx+szy uz Vx+py (-ux+Vx)+n uy (-ux+Vx) ϵ)+2 (Ay (-qy uy+sx …
  -(az + g) n y ρ + O[1/c]² )
```

In[∘]:=
```
MF@FS[% /. {ax → 0, az → 0, vx → 0, vz → 0}]
```
Out[∘]//MatrixForm=
```
( ( n (uz y - uy z) ρ + (pz y+sxz ux y+syz uy y+szz uz y-(py+sxy ux) z-syy uy z-szy uz z+n uz y ϵ-n uy z ϵ+1/2 n (t (-8 uz Wy+8 uy Wz)-8 Wz y+10 uz y (W0-g z)+U² (uz y-uy z)+2 z (-5 uy W0+4 Wy+5 g uy z)) ρ) / c² + O[1/c]³
    ((Ax sxz + Ay syz + Az szz) y - (Ax sxy + Ay syy + Az szy) z + n (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) (uz y - uy z) ρ) + (-2 (4 t Wz+2 z (-W0+g z)) (-n (Ax sxy+Ay syy+Az szy)+n² uy (Ax (-ux+Vx)+Ay (-uy+Vy)+Az (-uz+Vz)) ρ)+2 (4 t Wy-2 W0 y+2 g y z) (-n (Ax sxz+Ay syz+Az szz)+n² uz (Ax (-ux+Vx)+Ay (-uy+Vy)+Az (-uz+Vz)) ρ)+n z (2 Ax (-qx uy+sxy ux Vx+syy uy Vx+szy uz Vx+py (-ux+Vx)+n uy (-ux+Vx) ϵ)+2 (Ay (-qy uy+sxy ux Vy+syy uy Vy+szy uz Vy …
  -g n y ρ + O[1/c]² )
```

(* Boost momentum *)

In[∘]:=
```
(* Ang.boost-momentum current and supply according to tx-vector *)
pvec = t * {0, 1, 0, 0} + x * {1, 0, 0, 0} / c ^ 2; Dpvec = nablasym[pvec];
MF@(MF /@ {Bfluxx = aFS[({{1, 0, 0, 0}, surface / (Δt)}.TTx.pvec)], Bsupplyx = gFS[Tr[TTx.T@Dpvec]]})
```
Out[∘]//MatrixForm=
```
( ( (jx t - n x) ρ + (t (px+(jx sxx+jy syx+jz szx)/n+jx ϵ+(jx (jx²+jy²+jz²) ρ)/(2 n²)-4 n Wx ρ-1/2 jx (3 g t (az t+2 vz)-6 W0+2 ax x+2 (az+3 g) z) ρ)+x (-n ϵ-((jx²+jy²+jz²+n² (g t (az t+2 vz)-2 W0+2 ax x+2 (az+g) z)) ρ)/(2 n))) / c² + O[1/c]³
    ((Ax sxx + Ay syx + Az szx) t + ((Ay jy+Az jz+Ax (jx-n Vx)-n (Ay Vy+Az Vz)) (jx t-n x) ρ)/n) + (n x (2 n (-Ay (n qy+jx syx+jy syy+jz syz)-Az (n qz+jx szx+jy szy+jz szz)+n (-Ay jy-Az jz+Ay n Vy+Az n Vz) ϵ)-2 Ax n (jx sxx+jy sxy+jz sxz+n (qx+(jx-n Vx) ϵ))-Ax (jx-n Vx) (jx²+jy²+jz²+n² (g t (az t+2 vz)-2 W0+2 ax x+2 (az+g) z)) ρ-(Ay (jy-n Vy)+Az (jz-n Vz)) (jx²+jy²+jz²+n² (g t (az t+2 vz)-2 W0+2 ax x+2 (az+g) z)) ρ)+t (-2 Ax n² ((n px+jy syx+jz szx) Vx-jx² ϵ-jx (px+qx-Vx (sxx+n ϵ)))-2 … ) / (2 n³ c²)
  -ax n t ρ + O[1/c]² )
```

In[∘]:=
```
MF@(MF /@ (aFS@u2U@j2u[{Bfluxx, Bsupplyx}]))
```
Out[∘]//MatrixForm=
```
( ( n (t ux - x) ρ + (px t+sxx t ux+syx t uy+szx t uz+n t ux ϵ-n x ϵ-1/2 n (6 g t² ux vz+az g t² (3 t ux+x)+2 az (t ux+x) z+x (U²-2 W0+2 ax x+2 g z)+t (-U² ux-6 ux W0+8 Wx+2 ax ux x+2 g vz x+6 g ux z)) ρ) / c² + O[1/c]³
    ((Ax sxx + Ay syx + Az szx) t + n (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) (t ux - x) ρ) + (x (-2 Ax (qx+sxx ux+sxy uy+sxz uz+n (ux-Vx) ϵ)-2 Ay (qy+syx ux+syy uy+syz uz+n (uy-Vy) ϵ)-2 Az (qz+szx ux+szy uy+szz uz+n (uz-Vz) ϵ)-n (Ax (ux-Vx)+Ay (uy-Vy)+Az (uz-Vz)) (U²+g t (az t+2 vz)-2 W0+2 ax x+2 (az+g) z) ρ)+t (-2 Ax (-qx ux+(sxx ux+syx uy+szx uz) Vx+px (-ux+Vx)+n (-U²+uy²+uz²+ux Vx) ϵ)+2 (Ay (qy ux+px (uy-Vy)-(sxx ux+syx uy+szx uz) Vy+n ux (uy-Vy) ϵ)+ … ) / (2 c²)
  -ax n t ρ + O[1/c]² )
```

In[∘]:=
```
MF@FS[% /. {ax → 0, az → 0, vx → 0, vz → 0}]
```
Out[∘]//MatrixForm=
```
( ( n (t ux - x) ρ + (px t+sxx t ux+syx t uy+szx t uz+n t ux ϵ-n x ϵ+1/2 n (-8 t Wx+t ux (U²+6 W0-6 g z)-x (U²-2 W0+2 g z)) ρ) / c² + O[1/c]³
    ((Ax sxx + Ay syx + Az szx) t + n (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) (t ux - x) ρ) + (x (-2 Ax (qx+sxx ux+sxy uy+sxz uz+n (ux-Vx) ϵ)-2 Ay (qy+syx ux+syy uy+syz uz+n (uy-Vy) ϵ)-2 Az (qz+szx ux+szy uy+szz uz+n (uz-Vz) ϵ)-n (Ax (ux-Vx)+Ay (uy-Vy)+Az (uz-Vz)) (U²-2 W0+2 g z) ρ)+t (-2 Ax (-qx ux+(sxx ux+syx uy+szx uz) Vx+px (-ux+Vx)+n (-U²+uy²+uz²+ux Vx) ϵ)+2 (Ay (qy ux+px (uy-Vy)-(sxx ux+syx uy+szx uz) Vy+n ux (uy-Vy) ϵ)+Az (qz ux+px (uz-Vz)-(sxx u … ) / (2 c²)
  O[1/c]² )
```

In[∘]:=
```
(* Ang.boost-momentum current and supply according to cov. tx-vector *)
pvec = gFS@tW[igg.(t * {0, 1, 0, 0} - x * {1, 0, 0, 0})]; Dpvec = nablasym[pvec];
MF@(MF /@ {Bfluxcx = aFS[({{1, 0, 0, 0}, surface / (Δt)}.TTx.pvec)], Bsupplycx = gFS[Tr[TTx.T@Dpvec]]})
```
Out[∘]//MatrixForm=
```
( ( (jx t - n x) ρ + (2 n ((n px+jx sxx+jy syx+jz szx) t+n (jx t-n x) ϵ)+(jx t-n x) (jx²+jy²+jz²-n² (g t (az t+2 vz)-2 W0+2 ax x+2 (az+g) z)) ρ) / (2 n² c²) + O[1/c]³
    ((Ax sxx + Ay syx + Az szx) t + ((Ay jy+Az jz+Ax (jx-n Vx)-n (Ay Vy+Az Vz)) (jx t-n x) ρ)/n) + (2 n³ (Ay jy+Az jz+Ax (jx-n Vx)-n (Ay Vy+Az Vz)) (4 t Wx+x (g t (az t+2 vz)-2 W0+2 ax x+2 (az+g) z)) ρ-2 n² t (az g t²-2 W0+2 g (t vz+z)) (-n (Ax sxx+Ay syx+Az szx)+jx (-Ax jx-Ay jy-Az jz+Ax n Vx+Ay n Vy+Az n Vz) ρ)+n x (2 n (-Ay (n qy+jx syx+jy syy+jz syz)-Az (n qz+jx szx+jy szy+jz szz)+n (-Ay jy-Az jz+Ay n Vy+Az n Vz) ϵ)-2 Ax n (jx sxx+jy sxy+jz sxz+n (qx+(jx-n Vx) ϵ))-Ax (jx-n Vx) (j …
  -ax n t ρ + O[1/c]² )
```

In[∘]:=
```
MF@(MF /@ (aFS@u2U@j2u[{Bfluxcx, Bsupplycx}]))
```
Out[∘]//MatrixForm=
```
( ( n (t ux - x) ρ + (px t+sxx t ux+syx t uy+szx t uz+n t ux ϵ-n x ϵ-1/2 n (t ux-x) (-U²+g t (az t+2 vz)-2 W0+2 ax x+2 (az+g) z) ρ) / c² + O[1/c]³
    ((Ax sxx + Ay syx + Az szx) t + n (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) (t ux - x) ρ) + (-2 Ay (-az g syx t³-px t uy+px t Vy+sxx t ux Vy+syx t uy Vy+szx t uz Vy-2 g syx t² vz+2 syx t W0+syx ux x+syy uy x+syz uz x+qy (-t ux+x)-2 g syx t z-n (uy-Vy) (t ux-x) ϵ)-2 Az (-az g szx t³-px t uz-2 g szx t² vz+px t Vz+sxx t ux Vz+syx t uy Vz+szx t uz Vz+2 szx t W0+szx ux x+szy uy x+szz uz x+qz (-t ux+x)-2 g szx t z-n (uz-Vz) (t ux-x) ϵ)-n (Ay (uy-Vy)+Az (uz-V … ) / (2 c²)
  -ax n t ρ + O[1/c]² )
```

In[∘]:=
```
MF@FS[% /. {ax → 0, az → 0, vx → 0, vz → 0}]
```
Out[∘]//MatrixForm=
```
( ( n (t ux - x) ρ + (px t+sxx t ux+syx t uy+szx t uz+n t ux ϵ-n x ϵ+1/2 n (t ux-x) (U²+2 W0-2 g z) ρ) / c² + O[1/c]³
    ((Ax sxx + Ay syx + Az szx) t + n (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) (t ux - x) ρ) + (-2 Ay (sxx t ux Vy+syx t uy Vy+szx t uz Vy+px t (-uy+Vy)+2 syx t W0+syx ux x+syy uy x+syz uz x+qy (-t ux+x)-2 g syx t z+n (-uy+Vy) (t ux-x) ϵ)-2 Az (sxx t ux Vz+syx t uy Vz+szx t uz Vz+px t (-uz+Vz)+2 szx t W0+szx ux x+szy uy x+szz uz x+qz (-t ux+x)-2 g szx t z+n (-uz+Vz) (t ux-x) ϵ)-2 Ax (-qx t ux+sxx t ux Vx+syx t uy Vx+szx t uz Vx+px t (-ux+Vx)+2 sxx t W0+q … ) / (2 c²)
  O[1/c]² )
```

In[∘]:=
```
(* Ang.boost-momentum current and supply according to cov. tx-vector as g_{ab} x^{a} (Kopeinik & al.) *)
pvec = gFS@tW[-((gg.coords)[[1]] * {0, 1, 0, 0} - (gg.coords)[[2]] * {1, 0, 0, 0}) / c ^ 2]; Dpvec = nablasym[pvec];
MF@(MF /@ {Bfluxkx = aFS[({{1, 0, 0, 0}, surface / (Δt)}.TTx.pvec)], Bsupplykx = gFS[Tr[TTx.T@Dpvec]]})
```
Out[∘]//MatrixForm=
```
( ( (jx t - n x) ρ + (2 n ((n px+jx sxx+jy syx+jz szx) t+n (jx t-n x) ϵ)+(jx t-n x) (jx²+jy²+jz²+n² (-g t (az t+2 vz)+2 (W0+ax x)+2 (az-g) z)) ρ) / (2 n² c²) + O[1/c]³
    ((Ax sxx + Ay syx + Az szx) t + ((Ay jy+Az jz+Ax (jx-n Vx)-n (Ay Vy+Az Vz)) (jx t-n x) ρ)/n) + (2 n³ (Ay jy+Az jz+Ax (jx-n Vx)-n (Ay Vy+Az Vz)) (4 t Wx-2 W0 x+g x (az t²+2 (t vz+z))) ρ-2 n² t (g t (az t+2 vz)-2 W0+2 ax x+2 (az+g) z) (-n (Ax sxx+Ay syx+Az szx)+jx (-Ax jx-Ay jy-Az jz+Ax n Vx+Ay n Vy+Az n Vz) ρ)+n x (2 n (-Ay (n qy+jx syx+jy syy+jz syz)-Az (n qz+jx szx+jy szy+jz szz)+n (-Ay jy-Az jz+Ay n Vy+Az n Vz) ϵ)-2 Ax n (jx sxx+jy sxy+jz sxz+n (qx+(jx-n Vx) ϵ))-Ax (jx-n Vx) (j …
  -ax n t ρ + O[1/c]² )
```

In[∘]:=
```
MF@(MF /@ (aFS@u2U@j2u[{Bfluxkx, Bsupplykx}]))
```
Out[∘]//MatrixForm=
```
( ( n (t ux - x) ρ + (px t+sxx t ux+syx t uy+szx t uz+n t ux ϵ-n x ϵ-1/2 n (t ux-x) (az g t²-U²+2 g t vz-2 (W0+ax x)-2 az z+2 g z) ρ) / c² + O[1/c]³
    ((Ax sxx + Ay syx + Az szx) t + n (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) (t ux - x) ρ) + (2 n (Ax (ux-Vx)+Ay (uy-Vy)+Az (uz-Vz)) (4 t Wx-2 W0 x+g x (az t²+2 (t vz+z))) ρ-(2 t (g t (az t+2 vz)-2 W0+2 ax x+2 (az+g) z) (-n (Ax sxx+Ay syx+Az szx)+n² ux (Ax (-ux+Vx)+Ay (-uy+Vy)+Az (-uz+Vz)) ρ))/n+x (-2 Ax (qx+sxx ux+sxy uy+sxz uz+n (ux-Vx) ϵ)-2 Ay (qy+syx ux+syy uy+syz uz+n (uy-Vy) ϵ)-2 Az (qz+szx ux+szy uy+szz uz+n (uz-Vz) ϵ)-n (Ax (ux-Vx)+Ay (uy-Vy)+Az (uz-Vz)) (U²+g t (az t+2 vz)-2 W0+2 ax x+2 (a … ) / (2 c²)
  -ax n t ρ + O[1/c]² )
```

In[∘]:=
```
MF@FS[% /. {ax → 0, az → 0, vx → 0, vz → 0}]
```
Out[∘]//MatrixForm=
```
( ( n (t ux - x) ρ + (px t+sxx t ux+syx t uy+szx t uz+n t ux ϵ-n x ϵ+1/2 n (t ux-x) (U²+2 W0-2 g z) ρ) / c² + O[1/c]³
    ((Ax sxx + Ay syx + Az szx) t + n (Ax (ux - Vx) + Ay (uy - Vy) + Az (uz - Vz)) (t ux - x) ρ) + (Ay (px t (uy-Vy)-sxx t ux Vy-syx t uy Vy-szx t uz Vy-2 syx t W0+qy (t ux-x)-syx ux x-syy uy x-syz uz x+2 g syx t z+n (uy-Vy) (t ux-x) ϵ)+Az (px t (uz-Vz)-sxx t ux Vz-syx t uy Vz-szx t uz Vz-2 szx t W0+qz (t ux-x)-szx ux x-szy uy x-szz uz x+2 g szx t z+n (uz-Vz) (t ux-x) ϵ)+Ax (qx t ux+px t (ux-Vx)-sxx t ux Vx-syx t uy Vx-szx t uz Vx-2 sxx t W0-qx x-sxx ux x-s … ) / c²
  O[1/c]² )
```

(* Transf. of energy-momentum components under boost *)

In[∘]:=
```
(genN = gFS@{n, jx, jy, jz}) // MF
```
Out[∘]//MatrixForm=
```
( n
  jx
  jy
  jz )
```

In[∘]:=
```
(genEPS = gFS@Join[
    {Join[{-m * c ^ 2 - ϵ}, p[#] & /@ {x, y, z}]},
    T@Join[{(-c ^ 2 π[#] - q[#]) & /@ {x, y, z}},
      T@Outer[s, {x, y, z}, {x, y, z}]
     ]
   ]) // MF
```
Out[∘]//MatrixForm=

$-c^2 m - \epsilon$	p[x]	p[y]	p[z]
$-c^2 \pi[x] - q[x]$	s[x, x]	s[x, y]	s[x, z]
$-c^2 \pi[y] - q[y]$	s[y, x]	s[y, y]	s[y, z]
$-c^2 \pi[z] - q[z]$	s[z, x]	s[z, y]	s[z, z]

In[∘]:=
```
gam = 1 / Sqrt[1 - v ^ 2 / c ^ 2];
(lorentz = FS@D[{gam * (t - v * x / c ^ 2), gam * (x - v * t), y, z}, {{t, x, y, z}}]) // MF
```
Out[∘]//MatrixForm=

$$\begin{pmatrix} \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} & -\frac{v}{c^2\sqrt{1-\frac{v^2}{c^2}}} & 0 & 0 \\ -\frac{v}{\sqrt{1-\frac{v^2}{c^2}}} & \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

In[∘]:=
```
ExpandAll@FS@Series[
   lorentz.genN / Det[lorentz]
    /. {jx → n * ux, jy → n * uy, jz → n * uz}
   , {c, Infinity, 2}] // MF
```
Out[∘]//MatrixForm=

$$\begin{pmatrix} n + \frac{-n\,ux\,v+\frac{n v^2}{2}}{c^2} + O[\frac{1}{c}]^3 \\ (n\,ux - n\,v) + \frac{\frac{1}{2} n\,ux\,v^2-\frac{n v^3}{2}}{c^2} + O[\frac{1}{c}]^3 \\ n\,uy + O[\frac{1}{c}]^3 \\ n\,uz + O[\frac{1}{c}]^3 \end{pmatrix}$$

In[•]:=
```
ExpandAll@FS@Series[
    lorentz.genEPS.Inverse[lorentz]/Det[lorentz]
    , {c, Infinity, 1}] // MF
```

Out[•]//MatrixForm=

$$\begin{pmatrix} -m\,c^2+\left(-m\,v^2-\epsilon+v\,p[x]+v\,\pi[x]\right)+O\left[\frac{1}{c}\right]^2 & \left(-m\,v+p[x]\right)+O\left[\frac{1}{c}\right]^2 & p[y]+O\left[\frac{1}{c}\right]^2 & p[z]+O\left[\frac{1}{c}\right]^2 \\ \left(m\,v-\pi[x]\right)c^2+\left(m\,v^3+v\,\epsilon-v^2\,p[x]-v^2\,\pi[x]-q[x]+v\,s[x,\,x]\right)+O\left[\frac{1}{c}\right]^2 & \left(m\,v^2-v\,p[x]-v\,\pi[x]+s[x,\,x]\right)+O\left[\frac{1}{c}\right]^2 & \left(-v\,p[y]+s[x,\,y]\right)+O\left[\frac{1}{c}\right]^2 & \left(-v\,p[z]+s[x,\,z]\right)+O\left[\frac{1}{c}\right]^2 \\ -\pi[y]\,c^2+\left(-\frac{1}{2}\,v^2\,\pi[y]-q[y]+v\,s[y,\,x]\right)+O\left[\frac{1}{c}\right]^2 & \left(-v\,\pi[y]+s[y,\,x]\right)+O\left[\frac{1}{c}\right]^2 & s[y,\,y]+O\left[\frac{1}{c}\right]^2 & s[y,\,z]+O\left[\frac{1}{c}\right]^2 \\ -\pi[z]\,c^2+\left(-\frac{1}{2}\,v^2\,\pi[z]-q[z]+v\,s[z,\,x]\right)+O\left[\frac{1}{c}\right]^2 & \left(-v\,\pi[z]+s[z,\,x]\right)+O\left[\frac{1}{c}\right]^2 & s[z,\,y]+O\left[\frac{1}{c}\right]^2 & s[z,\,z]+O\left[\frac{1}{c}\right]^2 \end{pmatrix}$$

```
repn = FS@Solve[m1 == m + (-n * v + m * v^2/2)/c^2, m, Reals][[1]]
```

Out[•]=
$$\left\{m \to \frac{2\left(c^2\,m1+j\,x\,v\right)}{2\,c^2+v^2}\right\}$$

In[•]:=
```
ExpandAll@FS@Series[
    lorentz.genEPS.Inverse[lorentz]/Det[lorentz] /. {p[x] → m * ux, π[x] → m * ux} /. repn /. {jx → j1x + n * v}
    , {c, Infinity, 1}] // MF
```

Out[•]//MatrixForm=

$$\begin{pmatrix} -m1\,c^2+\left(-j1x\,v+2\,m1\,ux\,v-\frac{m1\,v^2}{2}-n\,v^2-\epsilon\right)+O\left[\frac{1}{c}\right]^2 & \left(m1\,ux-m1\,v\right)+O\left[\frac{1}{c}\right]^2 & p[y]+O\left[\frac{1}{c}\right]^2 & p[z]+O\left[\frac{1}{c}\right]^2 \\ \left(-m1\,ux+m1\,v\right)c^2+\left(-j1x\,ux\,v+j1x\,v^2-\frac{3}{2}\,m1\,ux\,v^2-n\,ux\,v^2+\frac{m1\,v^3}{2}+n\,v^3+v\,\epsilon-q[x]+v\,s[x,\,x]\right)+O\left[\frac{1}{c}\right]^2 & \left(-2\,m1\,ux\,v+m1\,v^2+s[x,\,x]\right)+O\left[\frac{1}{c}\right]^2 & \left(-v\,p[y]+s[x,\,y]\right)+O\left[\frac{1}{c}\right]^2 & \left(-v\,p[z]+s[x,\,z]\right)+O\left[\frac{1}{c}\right]^2 \\ -\pi[y]\,c^2+\left(-\frac{1}{2}\,v^2\,\pi[y]-q[y]+v\,s[y,\,x]\right)+O\left[\frac{1}{c}\right]^2 & \left(-v\,\pi[y]+s[y,\,x]\right)+O\left[\frac{1}{c}\right]^2 & s[y,\,y]+O\left[\frac{1}{c}\right]^2 & s[y,\,z]+O\left[\frac{1}{c}\right]^2 \\ -\pi[z]\,c^2+\left(-\frac{1}{2}\,v^2\,\pi[z]-q[z]+v\,s[z,\,x]\right)+O\left[\frac{1}{c}\right]^2 & \left(-v\,\pi[z]+s[z,\,x]\right)+O\left[\frac{1}{c}\right]^2 & s[z,\,y]+O\left[\frac{1}{c}\right]^2 & s[z,\,z]+O\left[\frac{1}{c}\right]^2 \end{pmatrix}$$

In[•]:=
```
(genEPS2 = gFS@Join[
    {Join[{-m * c^2 - ϵ}, {m * u, 0, 0} + (p[#]/c^2 &/@{x, y, z})]},
    T@Join[{{-m * c^2 * u, 0, 0} - (q[#] &/@{x, y, z})},
      T@Outer[s, {x, y, z}, {x, y, z}]
     ]
   ]) // MF
```

Out[•]//MatrixForm=

$$\begin{pmatrix} -c^2\,m-\epsilon & m\,u+\frac{p[x]}{c^2} & \frac{p[y]}{c^2} & \frac{p[z]}{c^2} \\ -c^2\,m\,u-q[x] & s[x,\,x] & s[x,\,y] & s[x,\,z] \\ -q[y] & s[y,\,x] & s[y,\,y] & s[y,\,z] \\ -q[z] & s[z,\,x] & s[z,\,y] & s[z,\,z] \end{pmatrix}$$

In[•]:=
```
gam = 1/Sqrt[1 - v^2/c^2];
(lorentz = FS@D[{gam * (t - v * x/c^2), gam * (x - v * t), y, z}, {{t, x, y, z}}]) // MF
```

Out[•]//MatrixForm=

$$\begin{pmatrix} \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} & -\frac{v}{c^2\sqrt{1-\frac{v^2}{c^2}}} & 0 & 0 \\ -\frac{v}{\sqrt{1-\frac{v^2}{c^2}}} & \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

In[•]:=
```
ExpandAll@FS@Series[
    lorentz.genEPS2.Inverse[lorentz]/Det[lorentz]
    , {c, Infinity, 1}] // MF
```

Out[•]//MatrixForm=

$$\begin{pmatrix} -m\,c^2+\left(2\,m\,u\,v-m\,v^2-\epsilon\right)+O\left[\frac{1}{c}\right]^2 & \left(m\,u-m\,v\right)+O\left[\frac{1}{c}\right]^2 & O\left[\frac{1}{c}\right]^2 & O\left[\frac{1}{c}\right]^2 \\ \left(-m\,u+m\,v\right)c^2+\left(-2\,m\,u\,v^2+m\,v^3+v\,\epsilon-q[x]+v\,s[x,\,x]\right)+O\left[\frac{1}{c}\right]^2 & \left(-2\,m\,u\,v+m\,v^2+s[x,\,x]\right)+O\left[\frac{1}{c}\right]^2 & s[x,\,y]+O\left[\frac{1}{c}\right]^2 & s[x,\,z]+O\left[\frac{1}{c}\right]^2 \\ \left(-q[y]+v\,s[y,\,x]\right)+O\left[\frac{1}{c}\right]^2 & s[y,\,x]+O\left[\frac{1}{c}\right]^2 & s[y,\,y]+O\left[\frac{1}{c}\right]^2 & s[y,\,z]+O\left[\frac{1}{c}\right]^2 \\ \left(-q[z]+v\,s[z,\,x]\right)+O\left[\frac{1}{c}\right]^2 & s[z,\,x]+O\left[\frac{1}{c}\right]^2 & s[z,\,y]+O\left[\frac{1}{c}\right]^2 & s[z,\,z]+O\left[\frac{1}{c}\right]^2 \end{pmatrix}$$

In[•]:=
```
Expand@gFS[
    lorentz.genEPS.Inverse[lorentz]/Det[lorentz] /. {v → β * c}
  ] // MF
```

Out[•]//MatrixForm=

$$\begin{pmatrix} -\frac{e}{-1+\beta^2}-\frac{c\,\beta\,p[x]}{-1+\beta^2}+\frac{\beta\,q[x]}{c\,(-1+\beta^2)}+\frac{\beta^2\,s[x,x]}{-1+\beta^2} & -\frac{e\,\beta}{c\,(-1+\beta^2)}-\frac{p[x]}{-1+\beta^2}+\frac{\beta^2\,q[x]}{c^2\,(-1+\beta^2)}+\frac{\beta\,s[x,x]}{c\,(-1+\beta^2)} & \frac{p[y]}{\sqrt{1-\beta^2}}-\frac{\beta\,s[x,y]}{c\,\sqrt{1-\beta^2}} & \frac{p[z]}{\sqrt{1-\beta^2}}-\frac{\beta\,s[x,z]}{c\,\sqrt{1-\beta^2}} \\ \frac{c\,e\,\beta}{-1+\beta^2}+\frac{c^2\,\beta^2\,p[x]}{-1+\beta^2}-\frac{q[x]}{-1+\beta^2}-\frac{c\,\beta\,s[x,x]}{-1+\beta^2} & \frac{e\,\beta^2}{-1+\beta^2}+\frac{c\,\beta\,p[x]}{-1+\beta^2}-\frac{\beta\,q[x]}{c\,(-1+\beta^2)}-\frac{s[x,x]}{-1+\beta^2} & -\frac{c\,\beta\,p[y]}{\sqrt{1-\beta^2}}+\frac{s[x,y]}{\sqrt{1-\beta^2}} & -\frac{c\,\beta\,p[z]}{\sqrt{1-\beta^2}}+\frac{s[x,z]}{\sqrt{1-\beta^2}} \\ \frac{q[y]}{\sqrt{1-\beta^2}}+\frac{c\,\beta\,s[y,x]}{\sqrt{1-\beta^2}} & \frac{\beta\,q[y]}{c\,\sqrt{1-\beta^2}}+\frac{s[y,x]}{\sqrt{1-\beta^2}} & s[y,\,y] & s[y,\,z] \\ \frac{q[z]}{\sqrt{1-\beta^2}}+\frac{c\,\beta\,s[z,x]}{\sqrt{1-\beta^2}} & \frac{\beta\,q[z]}{c\,\sqrt{1-\beta^2}}+\frac{s[z,x]}{\sqrt{1-\beta^2}} & s[z,\,y] & s[z,\,z] \end{pmatrix}$$

In[•]:=
```
Outer[s, {x, y, z}, {x, y, z}]
```

Out[•]=
$$\{\{s[x,\,x],\,s[x,\,y],\,s[x,\,z]\},\{s[y,\,x],\,s[y,\,y],\,s[y,\,z]\},\{s[z,\,x],\,s[z,\,y],\,s[z,\,z]\}\}$$

In[•]:=
```
p[[a]]
```

Part: The expression a cannot be used as a part specification.

Out[•]=
$$p[[a]]$$