Special and General Relativity (PHZ 4601/5606) Fall 2017 Solutions

Set 2

5. g in units $[ly]$ and $[y]$.

The following Fortran program returns the result, $g = 1.03$.

```
      program grav ! BB aug 10 2017.
c Gravitational acceleration g in units of [y/ly**2],
c                         (y = year, ly = light year).
c Converted from g in units [m/s^2].
      implicit real*8 (a-h,o-z)
c Speed of light in [m/s], year in [s], light year in [m].
      parameter(iuo=6,c=3.d08,y=365.d0*24.d0*3600.d0,xly=c*y)
c Second in years; meter in light years:
      parameter(s=1.d00/y,xm=1.d00/xly)
c
      g=9.81d00
      write(iuo,'(/," grav.f input:",/)')
      write(iuo,'(" c  [m/s]  =",1g10.3)') c
      write(iuo,'(" year [s]  =",1g10.3)') y
      write(iuo,'(" g [m/s^2] =",1f5.2)') g
c
      write(iuo,'(/," gav.f results (y year, ly light year):",/)')
      g=g*xm/s**2
      write(iuo,'(" m [ly]     =",1g10.3)') xm
      write(iuo,'(" s [y]      =",1g10.3)') s
      write(iuo,'(" c [ly/y]   =",1f6.3,/)') 1.d00
      write(iuo,'(" g [ly/y^2] =",1f5.2,/)') g
c
      stop "grav: all done."
      end
```

Results next page.

```
grav.f input:

c  [m/s]  = 0.300E+09
year [s]  = 0.315E+08
g [m/s^2] = 9.81

gav.f results (y year, ly light year):

m [ly]     = 0.106E-15
s [y]      = 0.317E-07
c [ly/y]   = 1.000

g [ly/y^2] = 1.03
```