
Subject: Re: Physical constants in IDL with !CONST
Posted by [Paul Van Delst\[1\]](#) on Tue, 18 Dec 2012 23:13:37 GMT
[View Forum Message](#) <> [Reply to Message](#)

Cool.

From my "Fundamental_Constants" module (still stuck at the 2006 CODATA numbers. Yoicks!):

```
! Standard atmosphere
! Symbol:P0, Units:Pa, Rel.Uncert.(ppm): exact
! -----
REAL(fp), PARAMETER :: STANDARD_ATMOSPHERE = 101325.0_fp
```

```
! Standard temperature
! (ice point of water, NOT triple point)
! Symbol:T0, Units:Kelvin, Rel.Uncert.(ppm): exact
! -----
REAL(fp), PARAMETER :: STANDARD_TEMPERATURE = 273.15_fp
```

The others I would add are derivatives (as are some in your main list), but what the hell:

```
! First Planck function constant
! Symbol:c1, Units:W.m^2.sr^-1, Rel.Uncert.(ppm): 0.078
!
!  $c1 = 2 \cdot h \cdot c^2$ 
!
!  $= 1.191042722(93)e-16$ 
! -----
REAL(fp), PARAMETER :: C_1 = &
    TWO * PLANCK_CONSTANT * SPEED_OF_LIGHT**2
```

```
! Second Planck function constant
! Symbol:c2, Units:K.m, Rel.Uncert.(ppm): 1.7
!
!  $h \cdot c$ 
!  $c2 = \frac{h \cdot c}{k}$ 
!
!  $= 1.4387752(25)e-02$ 
! -----
REAL(fp), PARAMETER :: C_2 = &
```

PLANCK_CONSTANT * SPEED_OF_LIGHT / BOLTZMANN_CONSTANT

! Molar volume of an ideal gas at standard

! temperature and pressure

! Symbol:Vm, Units:m^3/mol, Rel.Uncert.(ppm): 1.7

!

! R.T0

! Vm = -----

! P0

!

! = 2.2413996(39)e-02

! -----

REAL(fp), PARAMETER :: STP_MOLAR_VOLUME = &

MOLAR_GAS_CONSTANT * STANDARD_TEMPERATURE / STANDARD_ATMOSPHERE

! Loschmidt constant: The number density of one mole

! of an ideal gas at standard temperature and pressure

! Symbol:n0, Units:m^-3, Rel.Uncert.(ppm): 1.7

!

! N(A).P0

! n0 = -----

! R.T0

!

! N(A)

! = -----(1)

! Vm

!

! = 2.6867775(47)e+25

!

! -----

REAL(fp), PARAMETER :: LOSCHMIDT_CONSTANT = &

AVOGADRO_CONSTANT / STP_MOLAR_VOLUME

I use these daily in my conversions of the various units of concentrations of gases in the atmosphere.

Well, except for the first and second Planck constants - those are for computing Planck radiances.

cheers,

paulv

On 12/18/12 17:34, Chris Torrence wrote:

> Hi all,
 >
 > I'm adding a new system variable to IDL, called !CONST. So far, it's
 an IDL structure containing the following physical constants, in MKS
 units. All of these values (except for !const.pi, .e, .phi, and
 .R_earth) are taken from the "2010 CODATA Recommended Values," from NIST.

Name	Description	Value
alpha	Fine structure constant	$7.2973525698 \times 10^{-3}$
c	Speed of light in a vacuum	299792458 m/s
e	Euler's number	2.7182818284590452
ev	elementary charge e, 1 electron volt	$1.602176565 \times 10^{-19}$ C
eps0	electric vacuum permittivity	$8.854187817 \times 10^{-12}$ F/m
F	Faraday constant NAe	96485.3365 C/mol
G	Gravitation constant	6.67384×10^{-11} m ³ /kg/s ²
gn	Earth standard gravity	9.80665 m/s ²
h	Planck constant	$6.62606957 \times 10^{-34}$ J s
hbar	h/(2pi)	$1.054571726 \times 10^{-34}$ J s
k	Boltzmann constant R/NA	$1.3806488 \times 10^{-23}$ J/K
me	electron mass	$9.10938291 \times 10^{-31}$ kg
mn	neutron mass	$1.674927351 \times 10^{-27}$ kg
mp	proton mass	$1.672621777 \times 10^{-27}$ kg
mu0	magnetic vacuum permeability	$12.566370614 \times 10^{-7}$ N/A ²
Na	Avogadro constant NA	$6.02214129 \times 10^{23}$ mol ⁻¹
phi	golden ratio	1.6180339887498948
pi	Pi	3.1415926535897932
R	molar gas constant	8.3144621 J/mol/K
R_earth	Earth radius (spherical)	6370997.0 m
re	classical electron radius	$2.8179403267 \times 10^{-15}$ m
rydberg	Rydberg constant Rinf	10973731.568539 m ⁻¹
sigma	Stefan-Boltzmann constant	5.670373×10^{-8} W/m ² /K ⁴
u	unified atomic mass unit	$1.660538921 \times 10^{-27}$ kg

> Here's my question: What am I missing? Are there any physical
 > constants that most people would find useful for their day-to-day
 > work. The key is "most" people - nothing too esoteric, or limited to
 > a single scientific discipline, etc.

> Thanks!

> -Chris
 > ExelisVis

> p.s. please limit your comments to !CONST. Our new
 > widget system team is currently hard at work in a secret underground
 > bunker, and cannot be disturbed.

Subject: Re: Physical constants in IDL with !CONST
Posted by [Craig Markwardt](#) on Wed, 19 Dec 2012 07:49:25 GMT
[View Forum Message](#) <> [Reply to Message](#)

On Tuesday, December 18, 2012 5:34:53 PM UTC-5, Chris Torrence wrote:

> Here's my question: What am I missing? Are there any physical constants that most people would find useful for their day-to-day work. The key is "most" people - nothing too esoteric, or limited to a single scientific discipline, etc.

That's a nice idea. I would suggest some form of traceability field, a string, like 'CODATA2010', so people know the source of the data. After all, when CODATA2013 comes out and you update IDL, your "constants" will change, right? At least with some kind of traceability, people can figure out why the results of their programs changed.

I would suggest a few additions. The mass of the Sun and Earth. Also the definition of the astronomical unit "au". The most recent versions are here:

http://maia.usno.navy.mil/NSFA/IAU2009_consts.html

The table gives the adopted 2009 International Astronomical Union values, including "GMsun" and "GMearth". You would divide those values by your value of Newton's G. There are TCB-, TDB- and TT-compatible values, but for your purposes you can use TCB (and document that choice).

Craig

Subject: Re: Physical constants in IDL with !CONST
Posted by [lecacheux.alain](#) on Fri, 21 Dec 2012 09:57:56 GMT
[View Forum Message](#) <> [Reply to Message](#)

Le mercredi 19 décembre 2012 00:13:37 UTC+1, Paul van Delst a écrit :

> Cool.

>

>

>

> From my "Fundamental_Constants" module (still stuck at the 2006 CODATA

>

> numbers. Yoicks!):

>

>

>

>

>

> ! Standard atmosphere

>

> ! Symbol:P0, Units:Pa, Rel.Uncert.(ppm): exact

>

> ! -----

>

> REAL(fp), PARAMETER :: STANDARD_ATMOSPHERE = 101325.0_fp

```

>
>
>
> ! Standard temperature
>
> ! (ice point of water, NOT triple point)
>
> ! Symbol:T0, Units:Kelvin, Rel.Uncert.(ppm): exact
>
> ! -----
>
> REAL(fp), PARAMETER :: STANDARD_TEMPERATURE = 273.15_fp
>
>
>
>
> The others I would add are derivatives (as are some in your main list),
>
> but what the hell:
>
>
>
>
>
> ! First Planck function constant
>
> ! Symbol:c1, Units:W.m^2.sr^-1, Rel.Uncert.(ppm): 0.078
>
> !
>
> !  $c_1 = 2.h.c^2$ 
>
> !
>
> !  $= 1.191042722(93)e-16$ 
>
> ! -----
>
> REAL(fp), PARAMETER :: C_1 = &
>
> TWO * PLANCK_CONSTANT * SPEED_OF_LIGHT**2
>
>
>
>
>
> ! Second Planck function constant

```

```

>
> ! Symbol:c2, Units:K.m, Rel.Uncert.(ppm): 1.7
>
> !
>
> !      h.c
>
> !  c2 = -----
>
> !      k
>
> !
>
> !      = 1.4387752(25)e-02
>
> !
>
> ! -----
>
> REAL(fp), PARAMETER :: C_2 = &
>
>   PLANCK_CONSTANT * SPEED_OF_LIGHT / BOLTZMANN_CONSTANT
>
>
>
>
>
> ! Molar volume of an ideal gas at standard
>
> ! temperature and pressure
>
> ! Symbol:Vm, Units:m^3/mol, Rel.Uncert.(ppm): 1.7
>
> !
>
> !      R.T0
>
> !  Vm = -----
>
> !      P0
>
> !
>
> !      = 2.2413996(39)e-02
>
> ! -----
>
> REAL(fp), PARAMETER :: STP_MOLAR_VOLUME = &

```

```

>
>   MOLAR_GAS_CONSTANT * STANDARD_TEMPERATURE / STANDARD_ATMOSPHERE
>
>
>
>
>
>
>   ! Loschmidt constant: The number density of one mole
>
>   ! of an ideal gas at standard temperature and pressure
>
>   ! Symbol:n0, Units:m^-3, Rel.Uncert.(ppm): 1.7
>
>   !
>
>   !      N(A).P0
>
>   !  n0 = -----
>
>   !      R.T0
>
>   !
>
>   !      N(A)
>
>   !  = -----   .....(1)
>
>   !      Vm
>
>   !
>
>   !  = 2.6867775(47)e+25
>
>   !
>   ! -----
>
>   REAL(fp), PARAMETER :: LOSCHMIDT_CONSTANT = &
>
>   AVOGADRO_CONSTANT / STP_MOLAR_VOLUME
>
>
>
>
>   I use these daily in my conversions of the various units of
>
>   concentrations of gases in the atmosphere.

```

>
>
>
> Well, except for the first and second Planck constants - those are for
>
> computing Planck radiances.
>
>
>
>
>
> cheers,
>
>
>
> paulv
>
>
>
> On 12/18/12 17:34, Chris Torrence wrote:
>
>> Hi all,
>
>>
>
>> I'm adding a new system variable to IDL, called !CONST. So far, it's
>
> an IDL structure containing the following physical constants, in MKS
>
> units. All of these values (except for !const.pi, .e, .phi, and
>
> .R_earth) are taken from the "2010 CODATA Recommended Values," from NIST.
>
>>
>
>> Name Description Value
>
>> alpha Fine structure constant 7.2973525698 x 10-3
>
>> c Speed of light in a vacuum 299792458 m/s
>
>> e Euler's number 2.7182818284590452
>
>> ev elementary charge e, 1 electron volt 1.602176565 x 10-19 C
>
>> eps0 electric vacuum permittivity 8.854187817 x 10-12 F/m
>
>> F Faraday constant NAe 96485.3365 C/mol

```

>
>> G          Gravitation constant          6.67384 x 10-11 m3/kg/s2
>
>> gn         Earth standard gravity        9.80665 m/s2
>
>> h          Planck constant               6.62606957 x 10-34 J s
>
>> hbar       h/(2pi)                     1.054571726 x 10-34 J s
>
>> k          Boltzmann constant R/NA       1.3806488 x 10-23 J/K
>
>> me         electron mass                 9.10938291 x 10-31 kg
>
>> mn         neutron mass                  1.674927351 x 10-27 kg
>
>> mp         proton mass                   1.672621777 x 10-27 kg
>
>> mu0        magnetic vacuum permeability 12.566370614 x 10-7 N/A2
>
>> Na         Avogadro constant NA          6.02214129e23 mol-1
>
>> phi        golden ratio                  1.6180339887498948
>
>> pi         Pi                           3.1415926535897932
>
>> R          molar gas constant            8.3144621 J/mol/K
>
>> R_earth    Earth radius (spherical)      6370997.0 m
>
>> re         classical electron radius     2.8179403267 x 10-15 m
>
>> rydberg    Rydberg constant Rinf        10973731.568539 m-1
>
>> sigma      Stefan-Boltzmann constant     5.670373 x 10-8 W/m2/K4
>
>> u          unified atomic mass unit      1.660538921 x 10-27 kg
>
>>
>
>> Here's my question: What am I missing? Are there any physical
>
>> constants that most people would find useful for their day-to-day
>
>> work. The key is "most" people - nothing too esoteric, or limited to
>
>> a single scientific discipline, etc.
>
>>

```

>
>> Thanks!
>
>>
>
>> -Chris
>
>> ExelisVis
>
>
>
>> p.s. please limit your comments to !CONST. Our new
>
>> widget system team is currently hard at work in a secret underground
>
>> bunker, and cannot be disturbed.

Why not, simply, change the existing !Radeg and !Dtor constants to double ?
That should not imply any important loss of compatibility.

For the rest, the !CONST initiative looks pretty useful to me. Please only not to be too specific to a particular scientific discipline!

alain.
