Units

- http://www.ivoa.net/cgi-bin/twiki/bin/view/IVOA/UnitsDesc
- v0.2 of « Handling units in the VO »
  - may 22, 2009
- Intense discussion on VOTable, DM IVOA ML

Terminology

- Quantity
  - UCD AND value AND unit AND datatype
- Dimensional equation
  - L+1T-1
- Unit expression
  - m.s-1, m/s
  - combination of basic symbols
- Basic symbols
  - m, s, ...

Problems to solve

- Unit conversion
  - pc into km
  - Jy into W.m-2.Hz-1
- Quantity transformation
  - Frequency into Wavelength
  - Monochromatic flux (per wavelength) into Monochromatic flux (per frequency)
  - Coordinate change (equatorial to galactic)
- Don't confuse with formats
  - decimal/sexagesimal 30.5deg = 30°30'

Dimensional analysis

Usage

- There are several (slightly different) widely used conventions or large collections of units in astronomy:
  - IAU recommendations
  - Heasarc
  - VizieR
  - FITS
- Several libraries and online services that can perform conversions
  - see paper

What can/should IVOA do

- There are several levels
  - map existing user/archival data to VO standards
    - what the hell is a milliCrab?
  - exchange data within the VOsphere
    - VOTable, SIA, SSA, VOSpace, VOQL, etc...
  - display (meta)data in end user applications
    - I want this in CGS because I've always done so
- IVOA is about interoperability
- Beware of precision issues when converting units

Possible approachs

- Enforce standard units (and formats) in some protocols ?
  - I want a pos.eq.ra, in degrees, and decimal value
  - properly fill metadata
- Publish « good practices » ?
  - with units validator service?
- Define minimum set of « unit things » are to be understood within the VO ?
  - common core of existing libraries ?
  - use in VOQL ?

« Unit things »

- What should we recommend / standardize / agree upon ?
  - limited list of predefined unit expressions
    - pro: easy to process
    - con: limited expressiveness
  - grammar, with parsers. Need to agree on symbols, and how they are combined
    - pro: could deal with nearly anything
    - con: becomes complex,
    - BNF to avoid ambiguities?

Bring in the maths

- Multiplication
  - . (dot), or * (star), or whitespace, or _ (underscore)
  - m.s, m*s, m s, m_s
- Powers, exponents
  - m2, m^2, m**2
  - 10+2, 1e2, 10**2, 10^2
- Logarithm
  - log(unit), or [unit]
  - in fact, we take the logarithm of a dimensionless number (e.g. log of number of solar radii)
- Fractional exponents

The infamous MJD

- When all you have is a hammer...
- When all you have is one metadata parameter (usually containing a unit expression), everything looks like a unit
- MJD *looks like* a unit, but is rather a quantity
  - unit is d (days)
  - MJD characterizes what the quantity is (origin)