starType
Useful LaTeX macros for stellar astrophysics

A common chore is the typesetting of units and various symbols. To help with this, I wrote a set of macros, `starType`. You are welcome to use them or modify them to suit your needs.

1 Code Names

command	produces
`\flash`	FLASH
`\kepler`	KEPLER
`\nonsmoker`	NON-SMOKER
`\mesa`,`\MESA`	`MESA`
`\STERN`	STERN
`\ADIPLS`	`ADIPLS`
`\DSEP`	DSEP
`\enzo`	`ENZO`

2 Derivatives

command	produces
`\dif`	d
`\Dif`	D
`\jac{a}{b}{c}{d}`	$\frac{\partial(a,b)}{\partial(c,d)}$
`\tderiv{a}{b}{c}`	$\left(\frac{\partial a}{\partial b}\right)_c$
`\ddt{f}`	$\frac{\partial a}{\partial t}$
`\DDt{f}`	$\frac{\mathrm{d}f}{\mathrm{d}t}$
`\ddx{f}`	$\frac{\partial f}{\partial x}$
`\DDx{f}`	$\frac{\mathrm{d}f}{\mathrm{d}x}$
`\ddy{f}`	$\frac{\partial f}{\partial y}$
`\DDy{f}`	$\frac{\mathrm{d}f}{\mathrm{d}y}$
`\ddz{f}`	$\frac{\partial f}{\partial z}$
`\DDz{f}`	$\frac{\mathrm{d}f}{\mathrm{d}z}$

3 Vectors

command	produces
`\bvec{u}`	$\boldsymbol{u}$
`\grad f`	$\boldsymbol{\nabla} f$
`\divr\bvec{u}`	$\nabla \cdot \boldsymbol{u}$
`\curl\bvec{u}`	$\boldsymbol{\nabla} \times \boldsymbol{u}$
`\lap\phi`	$\nabla^2 \phi$
`\btens{T}`	$\mathsf{\mathbf{T}}$
`\bvec{a}\vcross\bvec{b}`	$\boldsymbol{a} \times \boldsymbol{b}$
`\bvec{a}\vdot\bvec{b}`	$\boldsymbol{a} \cdot \boldsymbol{b}$

4 Nuclides

The `nuclides.tex` macros contain a list of all named elements. Typeing ‘\<element>’ produces the symbol of either the most common, or the longest-lived, isotope of that element. To get a specific isotope, add the atomic number of the isotope in `[]`.

For example, `\carbon` produces ^{12}C, and `\carbon[13]` produces ^{13}C; `\cadmium` produces ^{114}Cd, whereas `\cadmium[116]` produces ^{116}Cd; and so on. The symbols '`\neutron`' (alias '`\nt`') and '`\proton`' (alias '`\pt`') are also defined and produce 'n' and 'p', respectively.

5 Units

To get scientific notation, type '`$3\ee{5}$`' to get 3×10^5; alternatively, use '`\sci{3}{5}`' to get 3×10^5. To typeset a value with its unit, use the `\val` macro: for example, '`$\val{3}{\meter/\second}$`' produces 3 m/s. More complicated expressions are possible: for example,

`$\val{\sci{2.0}{33}}{\ergspersecond}$` produces $2.0 \times 10^{33}\,\mathrm{erg\,s^{-1}}$.

For ranges of numbers, `\rng{2}{3}` produces 2 to 3; `\rng[--]{2}{3}` produces 2–3. To put a range with a value, `\valrng{2}{3}{\meter/\second}` produces (2 to 3) m/s and `\valrng[--]{2}{3}{\meter/\second}` produces (2–3) m/s. Macros for the unit symbols are listed in the following table.

Note that more sophisticated packages, such as 'SIunits' are available as part of a standard LaTeX distribution.

Metric prefixes are defined.

command	produces	meaning
`\yocto`	y	10^{-24}
`\zepto`	z	10^{-21}
`\atto`	a	10^{-18}
`\femto`	f	10^{-15}
`\pico`	p	10^{-12}
`\nano`	n	10^{-9}
`\micro`	μ	10^{-6}
`\milli`	m	10^{-3}
`\centi`	c	10^{-2}
`\deci`	d	10^{-1}
`\deka`	da	10^{1}
`\hecto`	h	10^{2}
`\kilo`	k	10^{3}
`\Mega`	M	10^{6}
`\Giga`	G	10^{9}
`\Tera`	T	10^{12}
`\Peta`	P	10^{15}
`\Exa`	E	10^{18}
`\Zetta`	Z	10^{21}
`\Yotta`	Y	10^{24}

A complete listing of the units are as follows.

command	produces	meaning
`\meter`	m	base units, mks
`\kilogram`	kg	
`\second`	s	
`\Kelvin,\K`	K	degrees Kelvin
`\cm`	cm	base units, cgs
`\gram`	g	
`\grampercc,\GramPerCc`	$\mathrm{g\,cm^{-3}}$	mass density
`\grampersquarecm,\GramPerSc,\columnunit`	$\mathrm{g\,cm^{-2}}$	column depth
`\dyne`	dyn	dyne
`\erg,\ergs`	erg	ergs
`\gauss`	G	gauss
`\ergspersecond`	$\mathrm{erg\,s^{-1}}$	
`\ergspergram`	$\mathrm{erg\,g^{-1}}$	
`\cgsflux`	$\mathrm{erg\,cm^{-2}\,s^{-1}}$	cgs flux unit

`\amu`	u	atomic mass unit
`\angstrom`	Å	Angstrom
`\fermi`	fm	fermi, aka femtometer
`\eV`	eV	electron volt
`\keV`	keV	
`\MeV`	MeV	
`\GeV`	GeV	
`\MeVA`	MeV$/A$	MeV per nucleon
`\GeVA`	GeV$/A$	GeV per nucleon
`\minute`	min	minute
`\hour`	hr	hour
`\yr`	yr	year
`\km`	km	kilometers
`\Hz`	Hz	Hertz
`\ksec`	ks	kilosecond
`\mol`	mol	mole
`\barn`	b	barn
`\Msun`	$M_\odot$	solar mass
`\Lsun`	$L_\odot$	solar luminosity
`\Rsun`	$R_\odot$	solar radius
`\Myr`	Myr	
`\Gyr`	Gyr	
`\AU`	AU	astronomical unit
`\parsec`	pc	parsec
`\kpc`	kpc	kiloparsec
`\Jansky`	Jy	Jansky
`\mJy`	μJy	micro Jansky
`\Msunperyr`	$M_\odot\,\mathrm{yr}^{-1}$	solar masses per year

6 Symbols

command	produces	meaning
`\abohr`	a_B	Bohr radius
`\alphaF`	α_F	Fine structure
`\alphaMLT`	α_MLT	mixing length parameter
`\alphasc`	α_sc	semiconvection efficiency parameter

`\alphath`	$\alpha_{\rm th}$	thermohaline efficiency parameter
`\chirho`	χ_ρ	$(\partial \ln P/\partial \ln \rho)_T$
`\chiT`	χ_T	$(\partial \ln P/\partial \ln T)_\rho$
`\CP`	C_P	specific heat at constant pressure
`\cs`	$c_{\rm s}$	adiabatic sound speed
`\Dov`	$D_{\rm ov}$	overshoot diffusion coefficient
`\Dth`	$D_{\rm th}$	thermohaline diffusion coefficient
`\EF`	$E_{\rm F}$	Fermi energy
`\epsgrav`	$\epsilon_{\rm grav}$	gravitational heating rate
`\epsnu`	ϵ_ν	neutrino losses
`\epsnuc`	$\epsilon_{\rm nuc}$	nuclear heating rate
`\Fconv`	$F_{\rm conv}$	convective flux
`\fov`	$f_{\rm ov}$	convective overshoot parameter
`\Frad`	$F_{\rm rad}$	radiative flux
`\Gammaone`	Γ_1	$(\partial \ln P/\partial \ln \rho)_S$
`\Gammatwo`	Γ_2	$[1-(\partial \ln T/\partial \ln P)_S]^{-1}$
`\Gammathree`	Γ_3	$1+(\partial \ln T/\partial \ln \rho)_S$
`\kB`	$k_{\rm B}$	Boltzmann constant
`\lambdaD`	$\lambda_{\rm D}$	Debye length
`\Ledd`	$L_{\rm Edd}$	Eddington Luminosity
`\logg`	$\log g$	log surface gravity
`\Lrad`	$L_{\rm rad}$	radiative luminosity
`\Ma`	Ma	Mach number
`\mb`	$m_{\rm u}$	atomic mass unit
`\Mdot`	$\dot{M}$	mass-loss rate
`\me`	$m_{\rm e}$	electron mass
`\mn`	$m_{\rm n}$	neutron mass
`\mpr`	$m_{\rm p}$	proton mass
`\NA`	$N_{\rm A}$	Avogadro number
`\nablaad`	$\nabla_{\rm ad}$	adiabatic temperature gradient
`\nablaL`	$\nabla_{\rm L}$	Ledoux criterion
`\nablarad`	$\nabla_{\rm rad}$	radiative temperature gradient
`\nablaT`	∇_T	actual temperature gradient
`\nB`	$n_{\rm B}$	baryon density
`\Pc`	$P_{\rm c}$	central pressure
`\pF`	$p_{\rm F}$	Fermi momentum
`\Pgas`	$P_{\rm gas}$	gas pressure
`\Prad`	$P_{\rm rad}$	radiation pressure
`\Rey`	Re	Reynolds number

`\rhoc`	ρ_{c}	central density
`\scaleheight`	λ_P	pressure scale height
`\sigmaSB`	σ_{SB}	Stefan-Boltzmann constant
`\Slamb`	S_ℓ	Lamb frequency
`\Tc`	T_{c}	central temperature
`\Teff,\teff`	T_{eff}	effective temperature
`\tkh`	τ_{KH}	thermal (Kelvin-Helmholtz) timescale