This online essay is an extended version of the essay in the printed-edition Handbook, containing all the material of its printed-edition accompaniment, but adding material of its own. The accompanying online table is likewise an extended version of the printed-edition table, *(a)* with extra stars (the brightest 313, allowing for variability, where the printed edition has almost 30 fewer, allowing for variability), and *(b)* with additional remarks for most of the duplicated stars. The online essay and table try to address the needs of three kinds of serious amateur: amateurs who are also astrophysics students (whether or not enrolled formally at some campus); amateurs who, like many in RASC, assist in public outreach, through some form of lecturing; and amateurs who are planning their own private citizen-science observing runs, in the spirit of such "pro-am" organizations as AAVSO.

Our online project, now a couple of years old, must be considered still in its early stages. We cannot claim to have fully satisfied the needs of our three constituencies. Above all, we cannot claim to have covered all the appropriate points from stellar-astronomy news in our "Remarks" column, important though news is to amateurs of all three types. We would hope in coming years to remedy our deficiencies in several ways, above all by relying more in our writing on recent primary-literature journal articles, and by making appropriate citations of the primary literature.

Already at this early stage, we have tried to pick out a few tens of the more important recent journal articles. In so doing, we have made a beginning at citation in the now-preferred astrophysics "bibcode" formalism (as documented in http://simbad.u-strasbg.fr/guide/refcode/refcode-paper.html, and again in section 1.2.3 (headed "Bibliographic Identifiers") in http://adsabs.harvard.edu/abs_doc/help_pages/data.html).

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Our sample of 313 stars, the Sun included ("Sample S"), is found to lie in a region, around 3000 ly in radius, essentially confined to the sandwich-filler, or "thin disk," part of the overall galactic disk. Of the few Sample-S interlopers born outside the sandwich filling, and now temporarily passing through it on orbits oblique to the thin disk, the best known is α Boo. It is convenient here to use the term "Population P" for the ensemble of non-brown-dwarf, non-white-dwarf, stars in the much larger, 3000-ly radius, subdisk-of-the-thin-disk from which our (tiny) Sample S is drawn. This P-region is itself only a (tiny) fraction of the overall galactic thin-disk region, ~50,000 ly in radius.

Sample S, being formally defined by an apparent-magnitude cutoff as opposed to a distance cutoff, is itself far from statistically representative of Population P. *(a)* In P, the O stars are vanishingly rare. A tabulation by Glenn Ledrew, in *JRASC* **95** (2001), pp. 32ff (bibcode 2001JRASC..95…32L) suggests an O-star frequency within P of just 0.00003%. By contrast, O stars comprise a hefty 2% of S. A similar overrepresentation occurs for the B, A, F, G, and K stars, with Ledrew's tabulation suggesting that these MK temperature types might have a respective frequency within P of 0.1%, 0.6%, 3.2%, 8.0%, and 12.9%. (A small caveat: unavoidable rounding errors make our various percentages, throughout this discussion, capable of adding up to 99% instead of 100%, or to 99.9% instead of 100.0%.) By contrast, these five types comprise 28%, 19%, 9%, 13%, and 21%, respectively, of S. *(b)* In P, something on the order of 76% or 78%—different authorities are perhaps mildly discrepant—must be M stars. (Ledrew's tabulation, in particular, suggests an M-star frequency of 78.2%.) Only a few of these (the Ledrew tabulation suggests 0.04%) have evolved to beyond the main-sequence stage of stable core hydrogen fusion. By contrast, the M stars comprise just 7% of S. All of them have evolved beyond the Main Sequence, having started their lives as types hotter than M or K.

The statistically anomalous character of S is further illustrated by the fact that in S, in each of the Big Six MK temperature types hotter than M, the numerical majority comprises the stars that have ended stable core hydrogen fusion (and so have, as a generally reliable rule—we return below to a necessary caveat regarding reliability—evolved out of Main Sequence MK luminosity class V into one of the brighter MK luminosity classes IV, III, II, or I). In Ledrew's tabulation, the percentages of evolved stars in F, G, and K, as a percentage of the overall respective F, G, and K populations, are just 2.0%, 2.5%, and 3.8%. Consistently with this, the 1991 Gliese-Jahreiss catalogue of the nearest 1000 stars (containing, admittedly, not only the local OBAFGKM VI, V, IV, III, II, and I stars, but also at least many of the local white dwarfs) assigns less than 1% of its population to MK luminosity classes IV, III, II, or I.

Sample S—so rich in varieties of star statistically infrequent within Population P—harbours physical extremes. Although the extremes are for the most part not written into our table, they can be studied easily, from such sources as Prof. James Kaler's http://stars.astro.illinois.edu/sow/sowlist.html.

Around 58 of our 313 each radiate, across the full spectrum from X-ray through UV and optical to IR and radio, at least as much power as is radiated by 10,000 Suns. The most dramatic is ζ Ori, with a bolometric luminosity of 375,000 Suns—making ζ Ori notable not within S alone, but even within the overall galaxy. Several others are not far behind, among them ζ Pup (360,000 Suns, suggests Kaler, as of July 2008 revising his earlier, circa-1999, suggestion of ~750,000 Suns). Just two stars in Sample S, nearby τ Cet and nearby α Cen B, radiate more feebly than our Sun, each at about 0.5 of the Sun's bolometric luminosity.

– The principal determinant of stellar luminosity, for any given phase in stellar evolution, is mass, with even small variations in mass translating into large variations in energy output. The exceptional luminosities of ζ Ori and ζ Pup, in particular, are a consequence of their exceptionally high respective masses, 20 $M_{\odot}$ and 40 $M_{\odot}$. (Kaler now suggests 40 $M_{\odot}$ for ζ Pup, while having previously suggested 60 $M_{\odot}$. He additionally notes from the literature the lower suggested value of 22.5 $M_{\odot}$.)

– Theory does predict, although our small Sample S does not succeed in illustrating, the possibility of masses up to the Eddington stellar-mass limit, somewhere above 100 $M_{\odot}$, and even of some "super-Eddington" stars. (Eddington's limit is by definition attained when luminosity rises so high as to make the outward radiation push, tending to tear a star apart, exceed the inward gravitational pull.)

Rotation periods in Sample S vary from far in excess of our Sun's to far short of our Sun's (which we may here take as a nominal 27 d; refined treatments of solar rotation provide for rotation-period variations both with solar latitude and with solar depth). Spectroscopy yields for γ Cep a period of 781 d, i.e. of 2.14 y. Kaler suggests that the respective rotation periods of α Hya and ε Crv could be as long as 2.4 y and 3.9 y. Perhaps our slowest rotator, however, is α Ori, now (cf 2009A&A...504..115K) assigned the period of 8.4 y. At the other extreme, Kaler suggests for ζ Aql A, α Aql, and ζ Lep, respectively, 16 h, at most10 h, and around 6 h.

Radii (as distance from centre to outermost opaque layer, perpendicular to the axis of stellar rotation) are typically greater than the solar radius. Two notable instances of stellar expansion—in other words, of notably tenuous stellar atmosphere—are α Sco (with a radius of 3.4 AU, not far short of the Sun-Jupiter distance) and α Ori (with a radius of 4.1 AU or 4.6 AU from interferometry, or alternatively 3.1 AU or 3.4 AU from luminosity-temperature deductions). Results in these extreme cases depend strongly on the wavelength selected for evaluating opacity. Observations within Population P do indicate, although our sample S does not succeed in illustrating, the possibility of still more extreme stellar radii, to values approaching ~10 AU. (Among these extreme-radius cases is a vividly red star well known to binocular enthusiasts, though a bit too faint for our table, μ Cep.)

The broad range of temperatures is reflected in the fact that all of the Big Seven temperature-type bins in the MK classification scheme are well occupied, however statistically skewed (as we have argued above) is the distribution in the MK Big Five luminosity-class bins (with 7 O stars, 89 B stars, 61 A stars, 28 F stars, 41 G stars, 66 K stars, and 22 M stars). At the MK temperature extremes are the hot ζ Pup (O5; 42,000 K) and the cool o (omicron) Cet (M5–10; a typical temperature for this variable is variously suggested as ~2000 K or ~3000 K).

Interesting spectral anomalies in Sample S include the sky's brightest Wolf-Rayet star (of exotic MK type W, rather than in the everyday gamut OBAFGKM), as one component in the γ^2 Vel pair, and several Be, or emission-line, stars (marked in our table, and where appropriate accompanied by notations indicating "shell," or circumstellar ejecta disk aligned nearly edge-on with the observatory line of sight). Especially worth monitoring at the moment, both photometrically and (for possible Be behaviour) spectroscopically is δ Sco, a binary system stimulated into outburst by periastron passage in 2000 and 2011, and therefore perhaps due for another outburst around 2022.

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We use the flags "+nP" (n = 1, 2, ...) for companions of sub-stellar mass, such as have been found outside our Solar System, in an accelerating tempo of discovery that has eventually reached even the tiny Sample S, from the 1990s onward. Such companions are typically planets but could in principle also be brown dwarfs. We do not attempt here to define formally the difference between a planet and a brown-dwarf companion.

Data for visual doubles are for the brighter component (A), with the last column describing companion(s). Where the double is too close to be resolved conveniently, data are for combined light (AB).

Apparent Visual Magnitude ($\mathbf{m}_V$ = V): Apparent magnitudes, with "v" appended for large-amplitude variables, are from *HIPPARCOS*. From the 2019 edition of this online publication onward (and, we expect, from the 2020 printed-edition Handbook onward), we are trying, without necessarily in all cases attaining full consistency, to take as authoritative the V-magnitude ranges, and also the periods, published in the online AAVSO(VSX) database. Our reasoning here is that AAVSO has critically appraised and filtered data originally presented in more upstream sources, such as the primary (journal-article) literature. Our "V" is the usual "V" of UBV photometry, as introduced by H.L. Johnson and W.W. Morgan (Ap.J., 117 (1953); in the now-preferred "bibcode" formalism, 1953ApJ…117..313J). The (yellow) V filter corresponds roughly to the response of the eye. We accept, without having attempted our own independent error analysis, the assertion of our Handbook predecessor R.F.Garrison that the "probable error" of each of our cited V values is at most 0.03 mag. (in other words, that of the actually and potentially available V measurements from the world's duly competent photometry facilities, at least half will lie within 0.03 mag. of our own cited V values).

Spectral Classification (**MK Type**): The "temperature type" (O, B, A, F, G, K, M) is given first, followed by a finer subtype (0-9) and a "luminosity class" (Roman numerals I-V, with "a" or "b" added occasionally to indicate slightly brighter or fainter stars within the class). O stars are the hottest, M stars coolest; Ia stars are termed the most luminous "supergiants"; III stars are termed "giants"; and V stars are termed "dwarfs." V stars form the largest class in the cosmos, comprising what is termed the "Main Sequence." Other MK symbols include "e" for hydrogen emission; "f" for broad, nonhydrogen emission in hot stars; "m" for strong metallic absorption; "n" or "nn" for unusually broad absorption (a signature of rotation); "p" for peculiarities; "s" for a mixture of broad and sharp lines; and ":" for a minor uncertainty. Where a single star (e.g. α CMa A) is given two types, with the second flagged "m", the first is the type that best characterizes the hydrogen lines, the second the type that best characterizes the metal lines.

"Supergiant," "giant," "dwarf," and "main sequence" are in our present Handbook usage phenomenological labels, serving as mnemonics for referring, in a suitably memorable way, to what is actually seen in the spectra. It is a substantive astrophysical claim, going beyond our phenomenology, that what is spectrally a dwarf, in other words spectrally a Main Sequence star, has a stable hydrogen-fusing core, and that our so-called "giants" and "supergiants" have evolved to differing stages at which core hydrogen fusion is finished. In assigning a star to a luminosity class, we are making a phenomenological, not an astrophysical, claim.

It can occasionally be the case that a star is phenomenologically a dwarf, and yet astrophysically has evolved beyond the core-hydrogen-fusion stage. Conversely, it can occasionally be the case that a star is too luminous (this is phenomenology) to be a dwarf, and yet astrophysically is still in the stable core-hydrogen-fusion stage. Infrequent though such a possibility is, our Sample S does illustrate it, at any rate in the case of stable core-hydrogen-fusers χ Car (B3 IV), α Tel (B3 IV), λ Uma (A1 IV), β Cru (B0.5 III), ν Cen (B2 IV), ζ Cen (B2.5 IV), ι Lup (B2.5 IVn), and the celebrated variable β Cep (B1 III).

This conceptual, phenomenology-versus-astrophysics, point aside, we note (now purely at the level of phenomenology) that MK classifications are in some cases controverted. We have inherited our own phenomenological types for the most part from the judgements of our predecessor R.F. Garrison, who as a principal historical authority in MK classification drew both on what he judged to be the best of the literature and on some of his own unpublished classifications. As of 2018-12-27, we have made only a modest beginning at flagging the cases of controverted MK phenomenology (in our online, but not in our printed-edition, "Remarks" column).

The initial portions of Richard Gray and Chris Corbally, *Stellar Spectral Classification* (Princeton University Press; in the "bibcode" formalism, 2009ssc..book.....G) provide a background briefing on MK classification.

Parallax (**π**), *Proper Motion* (**μ**), and *Position Angle* (**PA**): Parallaxes, in milliarcseconds (mas), proper-motion vector norms (″/y), and vector position-angles (degrees, from N through E) are derived from the *HIPPARCOS* 2007 data reduction, with a few exceptions. In coming years, it may be hoped that more precise parallaxes will be forthcoming from the *Gaia* mission, which we understand has now found an engineering solution overcoming its initial restriction to the fainter stars. (Detector overload had been feared.) Like *HIPPARCOS*, *Gaia* has to cope with the special challenge posed in measuring to high precision the parallax of an orbitally wobbling star possessing a gravitationally bound, and not necessarily well documented, companion.

Absolute Visual Magnitude (**M**$_V$) and *Distance in Light-Years* (**D**): Absolute magnitudes and distances are determined from parallaxes, except where a colon follows the absolute magnitude; in these cases, both quantities are determined from a calibration of the spectral classification. The absolute magnitude is left uncorrected for interstellar absorption. The appropriate correction is typically ~+0.06 mag. per 100 ly outside the Local Bubble, i.e. beyond ~100 ly.

We take account of uncertainties in parallaxes by stating the derived distances, in ly, to no more than the appropriate number of significant figures (rounding where necessary). In cases where rounding would itself be misleading, we use a tilde as an indicator of imprecision.

Radial Velocity (**V**$_{rad}$): Radial velocities are from BSC5. "SB" indicates a spectroscopic binary, an unresolved system whose duplicity is revealed by periodic Doppler oscillations in its spectrum and for which an orbit is possibly known. If the lines of both stars are detectable, "SB2" is used; "+" and "–" indicate, respectively, motion away from and toward the observer. "V" indicates a variable velocity in a star not observable as a spectroscopic binary. (In most "V" cases, the orbit is unknown.)

Remarks: Remarks include data on variability and spectra, particulars of any companions, and (for the most part, only in our online table) prominent bits of observational-astronomy news. In a departure from our practice prior to 2017, we now give star names in all and only those cases in which star names are formally promulgated in the International Astronomical Union (IAU) star-naming project, as launched in 2016 at www.iau.org/public/themes/naming_stars. In contrast with traditional naming practice, IAU names are meant never to apply to an entire binary (or higher-multiplicity) system, but only to the primary star. Readers requiring further information on names could start with the individual star descriptions in http://stars.astro.illinois.edu/sow/sowlist.html. Richard Hinckley Allen's 1899 book *Star Names: Their Lore and Meaning* has been much cited over the decades. More recent scholarship, with duly professional attention to Arabic philology, is however, presented in Paul Kunitzsch and Tim Smart, *Short Guide to Modern Star Names and their Derivations* (Wiesbaden, 1986), and (by the same pair of authors) *Dictionary of Modern Star Names: A Short Guide to 254 Star Names and their Derivations* (Cambridge, MA, circa 2006).
The pilcrow (¶) symbol marks a change of theme in Remarks (separating, for example, the discussion of γ2 Vel spectral features from the astrophysically unrelated topic of γ2 Vel distance uncertainty).

In the following **Remarks** column, a **BOLDFACE** star name indicates a navigation star.

Star Name	RA (2019.5) h m	Dec ° ′	m_V	$B-V$	MK Type	π mas	M_V	D ly	μ ″/y	PA °	V_{rad} km/s	Remarks	
Sun			−26.75	0.63	G2 V		4.8	8 lm					
α And	0 09.4	+29 12	2.07	−0.04	B9p IV: (HgMn)	34	−0.3	97	0.214	140	−12 SB	Hg, Mn overabundant the (brightest star with this anomaly)	**Alpheratz**
β Cas	0 10.2	+59 15	2.28v	0.38	F2 III	60	1.2	55	0.554	109	+12 SB	var.: 2.25–2.31, 0.10 d ¶ the brightest of the δ Sct variables ¶ in Hertzsprung Gap (in state of rapid evolution, with core hydrogen fusion recently finished) ¶ E(B–V) =0.00	Caph
γ Peg	0 14.2	+15 18	2.83v	−0.19	B2 IV	8	−2.6	400	0.009	168	+4 SB	var.: 2.78–2.89, 0.15 d variable in the β Cep class ¶ E(B–V) =+0.01	Algenib
β Hyi	0 26.8	−77 09	2.82	0.62	G1 IV	134.1	3.5	24.3	2.243	82	+23	high space velocity (interloper from remoter galactic region?)	
α Phe	0 27.2	−42 12	2.40	1.08	K0 IIIb	38.5	0.3	~85	0.426	147	+75 SB		Ankaa
δ And A	0 40.4	+30 58	3.27	1.27	K3 III	~30.9	0.7	106	0.142	126	−7 SB	possible debris disk	
α Cas	0 41.6	+56 39	2.24	1.17	K0 IIIa	~14.3	−2.0	230	0.060	122	−4 V?	limb darkening observed interferometrically (disk 5.25 mas) ¶ 19th-century claims of variability to mag. ~3.5 are uncorroborated later	Schedar
β Cet	0 44.6	−17 53	2.04	1.02	K0 III	~33.9	−0.3	96	0.235	82	+13 V?	anomalous in being X-ray-bright and yet a slow rotator ¶ evolutionary status uncertain (He core ignited already, or still contracting?)	Diphda
η Cas A	0 50.3	+57 55	3.46	0.59	G0 V	168	4.6	19.4	1.222	117	+9 SB	B:7.51, K4 Ve, 13.4″, PA:62°→325°, 1779→2016	Achird

													orbit 480 y	
γ	Cas	0 57.9	+60 49	2.15v	−0.05	B0 IVnpe (shell)	5	−4.2	600	0.026	98	−7 SB	var.:1.6–3.0; B: 8.8, 2.1″, PA:255°→259°, 1888→2002 ¶ orbit > 1500 y ¶ first Be discovery (Secchi, 1866); the prototype for the γ Cas type of eruptive irregular variables; for background on Be phenomena and γ Cas, consult www.aavso.org/vsots_gammacas; 2002ASPC..279..221H summarizes the observational history, including major shell phases in 1935–1936 and 1939–1940; 2007JAVSO.35.357S calls for amateur- astronomer assistance with photometry: has been as bright as V mag. 1.6, as faint as V mag. 3 ¶ rotationally flattened (period = 1.21 d, axial tilt=45°) ¶ an X-ray source (cf, e.g. 2012A&A...537A..59N) ¶ dimming through ISM dust, ~0.35 mag.	
β	Phe AB	1 07.0	−46 37	3.32	0.88	G8 III	16	0.3:	~180	0.088	293	−1	AB similar, 0.7″, PA: 26°→84°, 1891→2016 orbit 168 y, highly eccentric; masses nearly equal	
η	Cet +2P	1 09.6	−10 05	3.46	1.16	K1.5 III CN1	26.3	0.6	124	0.257	123	+12V		
β	And	1 10.8	+35 43	2.07	1.58	M0 IIIa	17	−1.8	200	0.209	123	+3 V	slight variability suspected	Mirach
δ	Cas	1 27.1	+60 20	2.66v	0.16	A5 IV	32.8	0.2	99	0.301	99	+7 SB	ecl.? 2.68–2.76, 759 d E(B–V) =+0.27	Ruchbah
γ	Phe	1 29.2	−43 13	3.41v	1.54	K7 IIIa	14	−0.9	230	0.209	185	+26 SB	irreg. var.: 3.39–3.49	
α	Eri	1 38.4	−57 08	0.45	−0.16	B3 Vnp (shell?)	23	−2.7	140	0.095	114	+16 V	fast rotator (< 2.1 d); interferometry shows deformation into oblate spheroid ¶ variable in λ Eri class (pulsation? or, rather, starspots?)	**Achernar**
τ	Cet	1 45.0	−15 50	3.49	0.73	G8 V	~274.0	5.7	11.9	1.921	296	−16 V	mass < 1 $M_\odot$ (unusual in Sample S, although typical in Population P) ¶ high space velocity, low metallicity: interloper from thick galactic disk ¶ on original Frank Drake (1960) SETI target list **[THIS STAR ONLY IN ONLINE VERSION OF TABLE]**	
α	Tri	1 54.2	+29 40	3.42	0.49	F6 IV	52	2.0	63	0.234	177	−13 SB		Mothallah
β	Ari	1 55.7	+20 54	2.64	0.16	A4 V	56	1.4	59	0.148	138	−2 SB	exceptionally elongated orbit (0.08 AU min, 1.2 AU max, 107 d); the SB companion has been resolved interferometrically; one of only a few tens of binaries in which orbit is ascertainable both with spectroscopy and with micrometer astrometry (this duplication facilitates model-testing)	Sheratan
ε	Cas	1 55.8	+63 46	3.35	−0.15	B3 IV:p (shell?)	8	−2.2	400	0.037	121	−8 V	slow rotator ¶ He-weak (cp α And, α Tel)	
α	Hyi	1 59.4	−61 29	2.86	0.29	F0n III–IV	45	1.1	72	0.265	84	+1 V	rapid rotator (< 30 h) ¶ metal-rich	
γ	And A	2 05.1	+42 25	2.10	1.37	K3 IIb	9	−3.1	400	~0.065	~139	−12 SB	B: 5.4, B9 V, 9.8″; C: 6.2, A0 V; BC 0.2″ BC orbit: 63.7 y ¶ limb darkening observed interferometrically (disk 6.80 mas)	Almach
α	Ari +1P	2 08.3	+23 33	2.01	1.15	K2 IIIab	~49.6	0.5	66	0.240	128	−14 SB	calcium weak?	**Hamal**
β	Tri	2 10.7	+35 05	3.00	0.14	A5 IV	26	0.1	130	0.154	105	+10 SB2	SB orbit rather elongated (0.17 AU min, 0.42 AU max) ¶ IR excess (circumstellar matter? possible harbinger of planetesimals)	
o	Cet Aa	2 20.3	−2 53	6.47v	0.97	M5–10 IIIe	11	1.7	300	0.238	178	+64 V	LPV, 2–10.1; Ab (VZCet): WD, 10.4, 0.5″, ~400y on AGB; prototype of the Mira variables ¶ physical radius ~2 AU in visual, ~4 AU in IR ¶ nearest instance of (weak) symbiotic binarity, and the only symbiotic to be observed in all wavelength regimes from X-ray to (ALMA) radio: *Chandra* and HST have observed mass transfer, with HST directly imaging A-to-B plume, and there is additionally interferometry (in IR) from VLT; *GALEX* has found bow shock, tail (length 13 ly) in ISM; mass-loss rate ~1e-7 solar mass/y ¶ X-ray emission from Mira (not from the WD companion!) was reported in 2005 ¶ protoplanetary disk was detected around B in 2007 ¶ Fabricius noted variability in 1596; Hevelius proposed the name Mira in 1642 ¶ for briefing and bibliography, cf wwww.aavso.org/vsots_mira2, updating www.aavso.org/vsots_mira	Mira
γ	Cet AB	2 44.3	+3 19	3.47	0.09	A2 Va	41	1.5	80	0.207	225	−5 V	A: 3.57; B: 6.23, 2.0″, PA:283°→299°, 1825→2015 orbit ≥ 320 y	
α	UMi A	2 56.4	+89 21	1.97v	0.64	F5–8 Ib	7.5	−3.6	430	~0.046	~105?	−17 SB	low-amp. Cep., 4.0 d; B: 9.1, F3 V, 18.4″ (2016) the brightest of the Cepheid variables, and unusual in being	**Polaris**

												a Cepheid with mass measured through binary orbit; unfortunately for Cepheid period-luminosity calibrations, its distance is somewhat controverted (we here give *HIPPARCOS*-2007 distance; *Gaia* efforts are still in progress); amplitude has been decreasing in recent decades, and period has increased (possibly in transition from first-overtone pulsation to fundamental-mode pulsation); AAVSO(VSX) as at 2018-12-26 gives V-mag. range 1.97–2.00, period 3.9696 d ¶ strictly a three-star system, UMi Aa+ UMi Ab+Umi B; Aa+Ab has period 29.6 y, separation 6.7 AU min, 27 AU max, 17 AU average; B experiences Aa+Ab as essentially a point mass, with period ≥ 42,000 y, separation at least 2400 AU; Aa+Ab has been resolved by HST; B is mag. 9.1, at angular distance 18″ ¶ approaching NCP; closest approach will be 14′, in ~2105 ¶ B has E(B–V)=0.0	
θ Eri A	2 59.0	−40 14	3.28	0.17	A5 IV	30	0.5	100	0.057	293	+12 SB2	B: 4.35, A1 Va, 8.6″, PA:82°→91°, 1835→2013	**Acamar**
α Cet	3 03.3	+4 10	2.54	1.63	M2 III	13	−1.9	250	0.078	188	−26 V	mildly variable, in the “giant irregular” class ¶ radio source (due to stellar wind) ¶ notably deficient in carbon	**Menkar**
γ Per	3 06.2	+53 35	2.91	0.72	G8 III + A2 V	13	−1.5	240	0.006	175	+3 SB2	composite spectrum; orbit 14.6 y, next eclipse 2019 eclipse duration < 2 weeks, with AAVSO(VSX) ephemeris giving 2019-12-25 as midpoint date; eclipse variation ~ threshold of naked-eye detection, with AAVSO(VSX) giving V-mag. range 2.91–3.21 (and giving period 5346 d (14.64 y)) ¶ orbit is highly elliptical	
ρ Per	3 06.4	+38 55	3.32v	1.53	M4 II	11	−1.6	310	0.167	129	+28	semiregular var.: 3.3–4.0 period ~50 d, with possibly also a longer period	
β Per	3 09.4	+41 02	2.09v	0.00	B8 V + F:	36	−0.1	90	0.003	119	+4 SB	ecl.: 2.09–3.30, 2.9 d; composite hierarchical system, with β Per C experiencing the eclipsing, and tidally locked, pair AB as essentially a point mass (AB+C period ~680 d); we state here the AAVSO(VSX) V-magnitude range; as at 2012-12-26, AAVSO(VSX) gives period 2.86736 d; mass-transfer rate ~2e-8 $M_{\odot}$/y; putative AB period change (1975) was possibly associated with large mass-transfer event; secondary minimum of AB was first reported by electric-photometry innovator Stebbins in 1910ApJ....32..185S; B is X-ray and radio source, with large coronal loop believed pointing at all times to A; AB separation is 0.07 AU; approx.-55-frame orbit “movie” of AB has been compiled from the CHARA interferometry detailed at 2012ApJ...752...20B, and is displayed at https://en.wikipedia.org/wiki/Algol ¶ E(B–V) =+0.03	Algol
α Per	3 25.7	+49 56	1.79	0.48	F5 Ib	~6.4	−4.2	510	0.035	138	−2 V	in open cluster near edge of HR diagram Instability Strip (slightly too hot to be a straightforward Cepheid)	**Mirfak**
δ Eri	3 44.2	−9 42	3.52	0.92	K0 IV	111	3.7	29.5	0.749	353	−6	**[THIS STAR ONLY IN ONLINE VERSION OF TABLE]**	
δ Per	3 44.3	+47 51	3.01	−0.12	B5 IIIn	6	−3.0	500	0.050	149	+4 SB	¶ slightly variable (a few tens of millimags) ¶ cluster affiliation is controverted ¶ E(B–V) =+0.04	
γ Hyi	3 47.0	−74 11	3.26	1.59	M2 III	15.2	−0.8	~214	0.126	24	+16	evolutionary status is uncertain	
η Tau	3 48.6	+24 10	2.85	−0.09	B7 IIIn	8	−2.6	400	0.048	156	+10 V?	in Pleiades ¶ rapid rotator (BSC5: “rotationally unstable Be shell star”) ¶ significant dimming by ISM dust; E(B–V)=+0.03	Alcyone
ζ Per A	3 55.4	+31 56	2.84	0.27	B1 Ib	4	−4.0	800	0.011	150	+20 SB	B: 9.16, B8 V, 12.9″, PA:205°→209°,1824→2012 orbit ≥ 50,000 y ¶ significant dimming by ISM dust; E(B–V) =+0.33 (pronounced reddening)	
γ Eri	3 58.9	−13 27	2.97	1.59	M1 IIIb	16	−1.0	200	0.129	151	+62	Ca, Cr weak ¶ Kaler, at http://stars.astro.illinois.edu/, writes, “must be one of the least-studied of the cooler bright stars”	Zaurak
ε Per A	3 59.2	+40 04	2.90	−0.20	B0.5 IV	5	−3.6	600	0.028	149	+1 SB2	B: 7.39, B9.5 V, 8.7″, PA:10°→10°,1821→2012 orbit ≥ 16,000 y ¶ variable in the β Cep class; one of the most extreme spectroscopic variables (periods 2.27 h and 8.46 h) ¶ E(B–V) =+0.10	

λ	Tau A	4 01.8	+12 33	3.41v	−0.10	B3 V	7	−2.4	480	0.017	209	+18 SB2	ecl.: 3.37–3.91, 4.0 d; B: A4 IV AAVSO(VSX) as at 2018-12-26 gives period 3.9529478 d ¶ shape distortion (mutual tides), reflection effect, some evidence of mass transfer	
α	Ret A	4 14.7	−62 26	3.33	0.92	G8 II–III	20.2	−0.1	162	0.065	40	+36 SB?	a “clump giant” in HR diagram, fusing He	
ε	Tau +1P	4 29.8	+19 13	3.53	1.01	K0 III	22.2	0.3	150	0.113	110	+39 V?	in Hyades ¶ metal-rich ¶ first known instance of a planet-host in an open cluster; unusually massive among the currently known planet-hosts	Ain
θ^2	Tau	4 29.8	+15 55	3.40	0.18	A7 III	22	0.1	150	0.112	104	+40 SB	**[THIS STAR ONLY IN ONLINE VERSION OF TABLE]** in Hyades companion in elongated orbit (0.23 AU min, 1.3 AU max) ¶ variable in the δ Sct class; 12 periods known, 1.64 h to 2.22 h, ranges 0.5 millimag. to 30 millimag	Chamukuy
α	Dor AB	4 34.4	−55 00	3.30	−0.08	A0p V: (Si)	19	−0.3	169	~0.059	~79?	+26	A: 3.8; B: 4.3, B9 IV; 0.3″ (2016); orbit 12 y orbit very elongated: 1.9 AU min, 17.5 AU max	
α	Tau A	4 37.0	+16 33	0.87v	1.54	K5 III	49	−0.7	67	0.199	161	+54 SB	irregular var.: 0.75–0.95 ¶ foreground star, not true Hyades member ¶ BSC5 says “MgII emissions indicate a cooler shell surrounding the supergiant”, notes variable emission in Ca H and K lines ¶ disk diameter 19.96 mas, both from interferometry and from lunar occultation ¶ modest, irregular, variability (~0.2 mag); pronounced mass loss (wind)	Aldebaran
π^3	Ori	4 50.9	+7 00	3.19	0.48	F6 V	124	3.7	26.3	0.464	89	+24 SB2		Tabit
ι	Aur	4 58.3	+33 12	2.69v	1.49	K3 II	7	−3.2	500	0.016	155	+18V	var.: 2.63–2.78 ¶ X-ray “hybrid star” (unusual combination of (hot) corona, cool wind) ¶ dimming by ISM dust, ~0.6 mag.	Hassaleh
ε	Aur A	5 03.4	+43 51	3.03v	0.54	F0Iab? + ~B5V	<2?	−8.0:	~2000	~0.003	n.a.	−3 SB	ecl.: 2.92–3.83, 9892 d (dim ~700d) in place of lab, II-III is also suggested (Hoard et al, 2010); BSC5: “shell star”, “spectrum var. even outside eclipse”; low-amplitude pulsator (period varies, ~66 d) ¶ among the currently controverted points is mass, and so also luminosity class, of primary (orbital separation 35 AU on a high-mass model, 18 AU on a low-mass model); secondary is semi-opaque (550 K) ring (not disk, since mid-eclipse yields a brightening), diameter 3.8 AU, harbouring its own star, or even a star-pair: 18-paper archive, of NSF-supported ~2009-through~2011 AAVSO eclipse campaign, is at www.aavso.org/citizen-sky-epsilon-aurigae-papers	Almaaz
ε	Lep	5 06.3	−22 21	3.19	1.46	K4 III	15	−0.9	210	0.076	164	+1	evolutionary status is uncertain: in HR diagram first ascent, or second?	
η	Aur	5 07.9	+41 16	3.18	−0.15	B3 V	13	−1.2	240	0.075	155	+7 V?	weak magnetic field detected, ~2x strength of Earth’s dipole field ¶ spectral variations, 25 d, suggested (but not as yet confirmed?)	Haedus
β	Eri	5 08.8	−5 04	2.78	0.16	A3 IVn	36	0.6	89	0.112	228	−9	unexplained brightening episode, over 2 h, by ~3 mag, in 1985 (recalling the 1972 unexplained brightening of ε Peg)	Cursa
μ	Lep	5 13.8	−16 11	3.29v?	−0.11	B9p IV: (HgMn)	18	−0.5	190	0.050	109	+28	var?.: 2.97–3.41?, 2 d? variable in α CVn class? (variability so far unconfirmed, and no CVn-class-appropriate magnetic field detected yet?) ¶ among the brightest of the Hg-Mn stars ¶ X-ray emission noted from putative companion, at angular distance 0.93″	
β	Ori A	5 15.5	−8 11	0.18	−0.03	B8 Ia	4	−6.9	900	0.001	69	+21 SB	B: 6.8, B5 V, 9.5″ (2014); C: 7.6; BC: 0.1″ A-BC orbit ≥ 25,000 y, BC orbit ~400 y ¶ variable in the α Cyg class (non-radial pulsator) ¶ E(B–V) =+0.00	Rigel
α	Aur Aa+Ab	5 18.1	+46 01	0.08	0.80	G6:III + G2:III	76	−0.5	43	0.433	170	+30 SB2	composite; Aa: 0.7, Ab: 0.9 0.0–~0.1″ orbit 104.0 y; first binary with orbit studied interferometrically (Anderson-Pease, Mt Wilson, 1910); however, full system appears to be α Aur Aa+Ab+H+L, where H and L are red dwarfs sharing the proper motion of Aa+Ab and perhaps possessing further gravitationally bound companions (with α Aur B, C, D, E, F, G, I, J, K, however, being mere line-of-sight coincidences); more recent interferometry Mt Wilson “Mark III” 1994, Cambridge COAST 1995 ¶ α Aur Ab is in rapid evolutionary transition, currently crossing the Hertzsprung Gap	**Capella**

													¶ system is among the brightest of X-ray sources	
η	Ori AB	5 25.5	−2 23	3.35v	−0.24	B0.5 V + B	3	−4.0	1000	~0.004?	n.a.	+20 SB2	ecl.: 3.31–3.60, 8.0 d; A: 3.6; B: 5.0, 1.8″ (2017) PA: 87°→77°, 1848→2017, orbit ≥ 2000 y BSC5: "expanding circumstellar shell"	
γ	Ori	5 26.2	+6 22	1.64	−0.22	B2 III	13	−2.8	250	0.015	212	+18 SB?	BSC5: "expanding circumstellar shell"	**Bellatrix**
β	Tau	5 27.5	+28 37	1.65	−0.13	B7 III	24	−1.4	130	0.175	173	+9 V	BSC5: "expanding circumstellar shell" ¶ lunar occultations possible as far N as southern California ¶ often, but not invariably, classified as Hg-Mn star: Mn 25x solar (and Ca, Mg only ~0.12x solar: radiative lofting, gravitational settling) ¶ E(B–V)=0.00	**Elnath**
β	Lep A	5 29.1	−20 45	2.81	0.81	G5 II	~20.3	−0.6	160	0.086	183	−14 V?	B: 7.5, 2.7″, PA:268°→8°, 1875→2015 ¶ β Lep B is possibly variable ¶ duplicity now suspected also in β Lep A, through 2002 adaptive-optics observation at Haleakala: separation 2.58″	Nihal
δ	Ori A	5 33.0	−0 17	2.25v	−0.18	O9.5 II	5	−4.4	700	0.001	137	+16 SB	ecl.: 2.14–2.26, 5.7 d ¶ yielded first detection of ISM (Hartmann, 1904, through SB's non-moving Ca line) ¶ E(B–V)=+0.07	Mintaka
α	Lep	5 33.6	−17 49	2.58	0.21	F0 Ib	1.5	−6.6	2000	0.004	72	+24	evolutionary status unclear (has He fusion already started in core?); H-fusion past yields now abundances N 5x solar, Na 2x solar	Arneb
β	Dor	5 33.8	−62 29	3.76v	0.64	F7–G2 Ib	3.2	−3.7	1000	0.013	4	+7 V	Cepheid var.: 3.46–4.08, 9.8 d period not quite constant; evolutionary status uncertain ¶ observed by FUSE, XMM-Newton missions	
λ	Ori A	5 36.2	+9 57	3.39	−0.16	O8 IIIf	3	−4.2	~1100	0.004	216	+34	**[THIS STAR ONLY IN ONLINE VERSION OF TABLE]** B: 5.61, B0 V, 4.5″, PA:45°→45°, 1779→2017 ¶ the dominant member of Collinder 69 ¶ within gas ring 150 ly in diameter (possibly, but not certainly, remnant from a Type II supernova) ¶ E(B–V)=+0.12	Meissa
ι	Ori A	5 36.4	−5 54	2.75	−0.21	O9 III	~1.4	−6.5	2000	0.001	108	+22 SB2	B: 7.3, B7 IIIp (He wk), 11.6″, PA:134°→141°, 1779→2012, orbit ≥ 700,000 y; ι Ori A is itself a binary, 29 d, 0.11 AU min, 0.8 AU max; the elongated orbit, and the disparity in ages, suggest duplicity through many-body interaction-with-expulsion, rather than through cogenesis ¶ colliding winds make ι Ori A a strong X-ray source ¶ ι Ori B is variable ¶ brightest member of Sword asterism ¶ E(B–V)=+0.07	Hatysa
ε	Ori	5 37.2	−1 11	1.69	−0.18	B0 Ia	2	−7.2	2000	0.002	118	+26 SB	luminosity (etc) controverted: Crowther (2006) 275,000 $L_{\odot}$, Searle (2008) 537,00 $L_{\odot}$, Puebla (2015) 832,000 $L_{\odot}$: at any rate a useful point for public-outreach talks is the disparity in distances between powerful ε Ori and the closer, and feebler, ζ Ori and δ Ori, our subjective visual impressions notwithstanding ¶ E(B–V)=+0.08	**Alnilam**
ζ	Tau	5 38.8	+21 09	2.97v?	−0.15	B2 IIIpe (shell)	7	−2.7	400	0.020	175	+20 SB	rapid rotator, and one of the best-known Be stars; GCVS assertion of variability (in γ Cas class) is not universally accepted; BSC5: "expanding circumstellar shell"; "shell-line velocities do not correspond to orbital elements; possible gaseous ring"; "unstable shell star with pseudo-periodic phenomena"; also BSC5: "widths H-lines vary in about 10 min. polarization at H beta changes in tens of minutes, probably due to circumstellar matter" ¶ nature of SB companion ζ Tau B is unknown (could even be neutron star); period is 133 d, and separation (with orbit nearly circular) is ~1.17 AU	Tianguan
α	Col A	5 40.4	−34 04	2.65	−0.12	B7 IV	12	−1.9	260	0.025	176	+35 V?	rapid rotator, with mass loss to disk; variability, in γ Cas class, has been suspected: BSC5: "expanding circumstellar shell", and Hα is variable, and Hβ profile varies rapidly ¶ E(B–V) =0.00	Phact
ζ	Ori A	5 41.7	−1 56	1.74	−0.20	O9.5 Ib	4	−5.0	700	0.005	58	+18 SB	B: 4.2, B0 III, 2.4″, PA:152°→166°, 1822→2017 orbit ≥ 1500 y ¶ vigorous mass ejection	Alnitak

													¶ the brightest of the (rare) MK O-type stars ¶ E(B–V) =+0.09	
ζ	Lep	5 47.8	−14 49	3.55	0.10	A2 Vann	~46.3	1.9	~70.5	0.015	266	+20 SB?	rapid rotator (period ~0.2 d or ~0.3 d) ¶ has debris disk, has first known extrasolar asteroid belt ¶ approached to within ~4 ly or ~5 ly of Sun ~1 My ago **[THIS STAR ONLY IN ONLINE VERSION OF TABLE]**	
κ	Ori	5 48.7	−9 40	2.07	−0.17	B0.5 Ia	5	−4.4	600	0.002	131	+21 V?	evolutionary status unclear, high mass loss rate; slight variability (0.04 mag) ¶ carbon-deficient (with metallicity otherwise unremarkable) ¶ E(B–V) =+0.07	Saiph
β	Col	5 51.6	−35 46	3.12	1.15	K1.5 III	37.4	1.0	87	0.408	8	+89 V	high space velocity indicates that this is interloper from outside galactic thin disk, and yet it is richer than Sun in the elements beyond He	Wazn
α	Ori	5 56.2	+7 25	0.45v	1.50	M2 Iab	7	−5.5	500	0.030	68	+21 SB	semiregular var.: 0.0–1.3 AAVSO(SVX) as at 2018-12-26 classifies this as a semiregular late-type supergiant, assigning period 423 d, while giving secondary period ~2100 d; BSC5 discusses shells (gas, dust; UV and radio are cited) ¶ very slow rotator (8.4 y) ¶ bolometrically the brightest star in Earth's sky ¶ has the greatest angular diameter of the extrasolar stars in our table, with interferometry measures, at various wavelengths, ranging from 42 mas to 69 mas (and physical radius changes have also been asserted); additionally, severe mass loss has produced nested dusty rings, or part-rings, and a circumstellar envelope ~250x this star's own diameter; for the star itself, as opposed to its rings and envelope, Burnham's characterization as "red-hot vacuum" is apt ¶ *HIPPARCOS* parallax (which we give here) is controverted, with 4.5 mas obtained in radio, with *Gaia* update still awaited as of 2018 ¶ the first extrasolar star to be directly (as opposed to interferometrically) imaged (strictly, in imaging of chromosphere, in UV, by HST Faint Object Camera, in 1995); in 2009, VLT imaged a 30-AU plume; current highest-resolution imaging is from ALMA, in radio, from 2017 ¶ violently convective, probably now fusing core He, with Type-II supernova collapse expected within ~1 My ¶ 2016ApJ...819....7D discusses modelling ¶ AAVSO has backgrounder at www.aavso.org/vsots_alphaori	**Betelgeuse**
β	Aur	6 01.0	+44 57	1.90v	0.08	A1 IV	~40.2	−0.1	81	0.056	269	−18 SB2	ecl.: 1.89–1.98, 4.0 d (mags. equal) dimming at eclipse is ~0.1 mag.	Menkalinan
θ	Aur AB	6 01.1	+37 13	2.65	−0.08	A0p II: (Si)	~19.7	−0.9	166	~0.086	~149	+30 SB	B: 7.2, G2 V, 4.0″, PA:7°→304°, 1871→2014 orbit ≥ 1200 y, with separation ≥ 185 AU ¶ A is magnetic, and an oblique rotator; there are abundant anomalies in photospheric patches, with Si and Cr 10x and 100x solar, respectively	Mahasim
η	Gem	6 16.1	+22 30	3.31v	1.60	M3 III	8	−2.0	400	~0.064	~259	+19 SB	ecl., var.: 3.2–3.9, 233 d; B: 6.2, 1.8″ (2016) orbit ≥ 700 y ¶ variations in A have been variously ascribed either to binarity-eclipse or to Mira-like instability; A has finished core He burning, and is beginning its ascent up the HR diagram AGB ¶ liable to lunar, and also to very rare planetary, occultations	Propus
ζ	CMa	6 21.1	−30 04	3.02	−0.16	B2.5 V	9.0	−2.2	360	0.008	61	+32 SB	variability has been claimed (with membership claimed in the β Cep pulsator class) ¶ SB orbit 675 d	Furud
β	CMa	6 23.6	−17 58	1.98v	−0.24	B1 II–III	7	−3.9	~490	0.003	256	+34 SB	var.: 1.97–2.00, 0.25130 d (we give here the AAVSO(VSX) period and V-mag. range, as at 2018-12-27); the brightest of the β Cep pulsators; has multiple modes, with beat period 50 d; it is not known why ε CMa, while physically similar, is not a pulsator ¶ near the boundary of the "Local Bubble" ISM cavity ¶ E(B–V) =+0.01	Mirzam
μ	Gem	6 24.1	+22 30	2.87v	1.62	M3 IIIab	14	−1.4	230	0.124	153	+55 V?	irregular var.: 2.75–3.02, 27 d on HR diagram AGB ¶ subject to lunar occultations	Tejat
α	Car	6 24.4	−52 42	−0.62	0.16	A9 Ib	11	−5.5	~310	0.031	41	+21	visible both in X-ray (magnetically heated corona; also rapid rotator, strongly convective) and in radio ¶ evolutionary status not fully clear, and colour unusual in its luminosity class	**Canopus**

ν	Pup	6 38.4	−43 13	3.17	−0.10	B8 IIIn	9	−2.1	370	0.004	186	+28 SB	rapid rotator, with period < 1.7 d: shell has been suggested, with “central quasi-emission peak” (cf Rivinius et al., 1999) ¶ distance was ~27 ly 3.6 My ago	
γ	Gem	6 38.8	+16 23	1.93	0.00	A1 IVs	30	−0.7	110	0.057	166	−13 SB	SB in highly eccentric orbit, 12.6 y, average separation 8.5 AU ¶ the brightest star ever to be observed in an asteroid occultation (381 Myrrha, in 1991) ¶ E(B–V) =+0.03	Alhena
ε	Gem	6 45.1	+25 07	3.06	1.38	G8 Ib	4	−4.0	800	0.014	204	+10 SB	unusually yellow in the general population of supergiants ¶ among the few supergiants liable to lunar and planetary occultations	Mebsuta
α	CMa A	6 46.0	−16 45	−1.44	0.01	A0mA1 Va	~379	1.5	8.6	~1.339	~204	−8 SB	B: 8.5, WDA; 10.7″ (2016); orbit 50.1 y separation 8.2 AU min (3″), 31.5 AU max (11″, in 2019) ¶ IRAS detected IR excess, a signature of dust (rather unexpected in a binary) ¶ Fe abundance of α CMa is ~2x or ~3x solar ¶ α CMa B is unusually massive for a WD (1.02 $M_\odot$; Chandrasekhar Limit is, however, 1.4 $M_\odot$; spectral type of α CMa B is DA (= hydrogen-only)) ¶ E(B–V) =-0.03	**Sirius**
ξ	Gem	6 46.4	+12 52	3.35	0.44	F5 IV	56	2.1	58.7	0.223	211	+25 V?	possibly SB, with components of ~equal mass ¶ rapid rotator (but just barely over the internal-structure boundary that causes some stars to rotate rapidly, others to experience braking through magnetics and winds) ¶ X-ray source (suggesting significant corona)	Alzirr
α	Pic	6 48.4	−61 58	3.24	0.22	A6 Vn	~34	0.9	100	0.252	345	+21	rapid rotator; shell, with time-varying spectral absorption features ¶ X-ray emission suggests a companion, otherwise undetected	
τ	Pup	6 50.4	−50 38	2.94	1.21	K1 III	18	−0.8	180	0.077	154	+36 SB	SB period 1066.0 d, separation ~3 AU, orbit of low eccentricity	
ε	CMa A	6 59.4	−29 00	1.50	−0.21	B2 II	8.0	−4.0	410	0.004	68	+27	binary (7.5″; B is mag. ~8 or ~9) separation 900 AU, period at least 7500 y brightest known source of extreme UV (~75 nm) in Earth’s night sky; Lyman α (121.6 nm) observed by NASA OAO-3 ¶ E(B–V) =+0.02	**Adhara**
σ	CMa	7 02.5	−27 58	3.49v	1.73	K7 Ib	3	−4.2	1100	0.008	308	+22	irregular var.: 3.43–3.51 authorities are in some disagreement on MK type (possibly M, rather than K) **[THIS STAR ONLY IN ONLINE VERSION OF TABLE]**	Unurgunite
o^2	CMa	7 03.8v	−23 52	3.02	−0.08	B3 Ia	1	−6.6	3000	0.004	329	+48 SB	variable in α Cyg class of non-radial pulsators: mag. 2.93– 3.08, 24.44 d ¶ E(B–V) =+0.03	
δ	CMa	7 09.2	−26 26	1.83	0.67	F8 Ia	2	−6.6	2000	0.005	317	+34 SB	slow rotator (possibly ~1 y); N 2x solar, Na 6x solar **[THIS STAR ONLY IN ONLINE VERSION OF TABLE]**	Wezen
π	Pup	7 17.8	−37 08	2.71v	1.62	K3 Ib	4	−4.3	800	0.012	303	+16	semiregular var, mag. 2.70–2.85	
δ	Gem AB	7 21.3	+21 57	3.50	0.37	F0 IV	54	2.2	60	0.018	237	+4 SB	B: 8.2, K3 V, 5.5″, PA: 198°→230°, 1822→2016 orbit 1200 y ¶ lunar occultations possible; planetary occultations possible-yet-rare ¶ in evolutionary transition, having completed stable core-hydrogen fusion **[THIS STAR ONLY IN ONLINE VERSION OF TABLE]**	Wasat
η	CMa	7 24.9	−29 21	2.45	−0.08	B5 Ia	2	−6.5	2000	0.007	325	+41 V	variable in α Cyg class of non-radial pulsators; AAVSO(VSX) as at 2018-12-28 gives mag. range in *HIPPARCOS* passband 2.38–2.48, period 4.70433 d ¶ strong wind; ejected circumstellar mass inferred from IR excess ¶ E(B–V) =+0.02	Aludra
β	CMi	7 28.2	+8 15	2.89v	−0.10	B8 Ve	~20.2	−0.6	~162	0.064	234	+22 SB	rapid rotator, possibly ~1 d, with modest variability in the Balmer emission; disk of ejected matter has diameter ~4x diameter of β CMi itself (BSC5: “rotationally unstable”); although GCVS and AAVSO(VSX) assertion of γ Cas-type variability has not been corroborated, 2007ApJ...654..544S reports, using *MOST*, millimagnitude “slowly pulsating B-type” variability; AAVSO(VSX) as at 2012-12-27	Gomeisa

													gives V-mag. range 2.84–2.92	
σ	Pup A	7 29.8	−43 20	3.25	1.51	K5 III	17	−0.6	190	0.198	342	+88 SB	B: 8.6, G5: V, 21.5″, PA:90°→73°, 1826→2011 orbit ≥ 27,000 y, separation ≥ 1300 AU; SB is eclipsing, of β Lyr type, with orbit 257.8 d, with very modest alternating primary (0.04 mag) and secondary (0.03 mag) minima; the SB primary component shows slow irregular variability ¶ system has high space velocity	
α	Gem A	7 35.8	+31 51	1.93	0.03	A1mA2 Va	63	0.9	52	~0.254	~234	+6 SB	orbit 445 y; max = 6.5″, in 1880;	
α	Gem B	7 35.8	+31 51	2.97	0.03	A2mA5 V:	63	2.0	52	~0.254	~234	−1 SB	min = 1.8″, in 1965; 5.2″ (2017); separation 71 AU min, 138 AU max; C mag. 9.8; AC PA: 162°→163°, 1822→2017, 70″, orbit ≥ 14,000 y; C has variable-star YY Gem (an eclipsing binary, and additionally a variable of the BY Dra class, with flaring); not only C, but also each of A, B is itself SB, making ABC a hierarchical 6-star system (Kaler at http://stars.astro.illinois.edu/sow/castor.html writes, "certainly the sky's ranking sextuple"); https://en.wikipedia.org/wiki/Castor_(star) has a diagram summarizing this sextuple hierarchy, on the basis of 2012MNRAS.423..493H ¶ Castor-Pollux comparison is a helpful test of naked-eye night colour response	Castor
α	CMi A	7 40.3	+5 10	0.40	0.43	F5 IV–V	285	2.7	11.5	~1.259	~215	−3 SB	B: 10.3, WD; 3.8″ (2014); orbit 41 y separation 8.9 AU min, 21.0 AU max ¶ astroseismology of A is somewhat uncertain (*MOST* mission 2004 did not find pulsations, and yet WIRE mission 1999 and 2000 did) ¶ the WD Procyon B is physically unlike the WD Sirius B, attaining only ~0.2 of the Sirius B density, and being of rare spectral type DQZ	Procyon
β	Gem +1P	7 46.5	+27 59	1.16	0.99	K0 IIIb	97	1.1	33.8	0.628	266	+3 V	 the nearest of the giants; unusual in being a giant known to harbour an exoplanet (and the brightest known exoplanet host in Earth's sky); as of 2015, exoplanet is IAU-named "Thestias" ¶ subject to rare lunar occultations, for observers S of Earth's equator ¶ Castor-Pollux comparison is a helpful test of naked-eye night colour response	Pollux
ξ	Pup	7 50.1	−24 55	3.34	1.22	G6 Iab–Ib	3	−4.5	1200	0.005	260	+3 SB	 full system is Aa, Ab (SB) and B (mag. 13, ~5″, orbit ≥ 26,000 y ¶ Aa has high metallicity, with exact evolutionary status uncertain ¶ Aa is near, but is a little too cool to lie within, the HR diagram Instability Strip	Azmidi
χ	Car	7 57.3	−53 02	3.46	−0.18	B3 IV(p?)	7	−2.3	500	0.035	304	+19 V	Si II anomalous strength now discounted ¶ suggestion of variability now discounted, via *HIPPARCOS* ¶ the MK luminosity class "IV" (phenomenologically "giant") notwithstanding, χ Car is in astrophysical terms in the last part of its stable core-hydrogen-fusion phase	
ζ	Pup	8 04.3	−40 04	2.21	−0.27	O5 Iafn	3.0	−5.4	1080	0.034	299	−24 V?	blue supergiant ¶ rapid rotator (1.78 d), despite ~2300 km/s stellar wind (in which spiral structure was announced in 2017 by *BRITE* mission team), with mass loss rate > 1e-6 $M_\odot$ /y ¶ high space velocity (impelled by past nearby supernova? or, rather, impelled by multibody gravitational interactions in its stellar birth family?); possibly ejected from Trumpler 10 OB association ¶ distance has been controverted ¶ He, N overabundant ¶ has been suspected of being a variable in the α Cyg class ¶ E(B–V) =+0.04	Naos
ρ	Pup	8 08.4	−24 22	2.83v	0.46	F2mF5 II: (var)	51.3	1.4	64	0.095	299	+46 SB	var.: 2.68–2.87, 0.14 d prototype of the "ρ Pup stars" (these combine δ Sct variability with Am-like abundance anomalies); main period is ~3.3 h (0.15 mag); photosphere temperature is notably low in the overall population of stars presenting δ Sct variability ¶ IR excess (circumstellar ring, at separation 50 AU?)	Tureis
γ^2	Vel	8 10.1	−47 24	1.75v	−0.14	O9 I: + WC8	3	−5.9	1100	0.012	330	+35 SB2	var.: 1.81–1.87 ¶ the Wolf-Rayet component is the visually brightest of all WR stars, is an exceptionally massive WR; in the SB pair (orbit 78.5 d, separation 0.8 AU min? 1.6 AU max), the (carbon-rich) WR component,	

													now approaching supernova collapse, dominates spectrally, and yet it is the O component which is visually brighter; WR mass loss rate is 1e-5 $M_\odot$/y, about 25x the mass loss rate of the less dramatically evolved O component; “Spectral Gem of the Southern Skies”; the colliding winds make the SB pair an X-ray source ¶ distance to this SB is not well known ¶ BSC5: “symmetric shell” ¶ 41″ away from γ^1 Vel, which, like γ^2, is itself SB (orbit 1.48 d) ¶ neither the traditional Suhail al Muhlif nor the modern Regor (devised within NASA, to commemorate 1967y fire victim Roger Chaffee) is presently IAU-approved as a name for either member of the γ Vel pair	
β	Cnc +1P	8 17.6	+9 07	3.53	1.48	K4 III	11	−1.3	300	0.068	224	+22 V?	“barium star”, with Ba abundance ~6x solar, presumably as contamination from defunct companion (but no companion remnant has been found)	Tarf
ε	Car	8 22.9	−59 34	1.86v?	1.20	K3:III + B2:V	5	−4.5	600	0.034	311	+2	**[THIS STAR ONLY IN ONLINE VERSION OF TABLE]** ecl.?: 1.82–1.94? asserted to be variable 785 d, but not in AAVSO(VSX) database as of 2019-01-05 (if ecl., then separation ~4 AU, precluding mass transfer)	**Avior**
ο	UMa A+1P	8 31.9	+60 39	3.35v?	0.86	G5 III	~18.2	−0.3	~179	0.172	231	+20	var.?: 3.30? –3.36? ¶ currently in rapid evolutionary transition, crossing the Hertzsprung Gap ¶ despite high space velocity, a member of the galaxy thin disk	Muscida
δ	Vel AB	8 45.2	−54 47	1.93	0.04	A1 Va	40	0.0	81	~0.107	~164	+ 2 V?	B: 5.0, 0.5″, PA:177°→209°, 1894→2017 orbit 142 y (min angular separation was in 2000) ¶ Aa, Ab resolved both interferometrically and with VLT adaptive optics; orbit 45.15 d, average separation 90.61 AU, dimming ~0.4 mag: the brightest known eclipsing binary	Alsephina
ε	Hya ABC	8 47.8	+6 21	3.38	0.68	G5:III + A:	25	0.4	130	~0.232	259	+36 SB	composite A: 3.8; B: 4.7, 0.3″ (2014); C: 7.8, 2.8″ (2016) AB orbit 15.09 y, AB+C orbit 590 y ¶ C is SB, orbit 9.9 d	Ashlesha
ζ	Hya	8 56.4	+5 52	3.11	0.98	G9 II–III	~19.5	−0.4	~167	0.101	279	+23		
ι	UMa A	9 00.5	+47 58	3.12	0.22	A7 IVn	~68.9	2.3	47.3	~0.491	~244	+9 SB	A+BC 2.4″, PA: 349°→82°, 1831→2012 A+BC orbit 818 y; BC 0.7″, period ~39 y; A is itself SB, orbit 4028 d, making this a quadruple system; the system is not, as in many cases of multiplicity, hierarchical and stable, but kinematically unstable (disruption in ~0.1 My?) B mag. 9.9 M1 V, C mag. 10.1 M1 V	Talitha
λ	Vel	9 08.7	−43 31	2.23v	1.66	K4 Ib–IIa	6.0	−3.9	540	0.028	299	+18	slow irreg. var.: 2.14–2.30 ¶ probably on or approaching HR diagram AGB, but could still be on RGB ¶ has slow wind, whose origins are said to be poorly understood	**Suhail**
a	Car	9 11.5	−59 03	3.43v	−0.19	B2 IV–V	7	−2.3	500	0.022	312	+23 SB2	ecl.?: 3.41–3.44 ¶ orbit 6.74 d, with light curve indicating tidal distortion ¶ there is some uncertainty whether observable light is solely from primary, or whether primary and secondary make approximately equal contributions ¶ not to be confused with α Car	HR 3659
β	Car	9 13.4	−69 48	1.67	0.07	A1 III	28.8	−1.0	113	0.191	305	−5 V?	rapid rotator (< 2.1 d), despite having finished stable core hydrogen fusion ¶ quasi-periodic variation, ~0.5 h, in Balmer lines	**Miaplacidus**
ι	Car	9 17.6	−59 21	2.21v	0.19	A7 Ib	4.3	−4.6	800	0.022	302	+13	var.: 2.23–2.28 ¶ despite being slow rotator, has magnetic activity (as inferred from X-rays) ¶ not to be confused with l (letter el) Car	Aspidiske
α	Lyn	9 22.2	+34 19	3.14	1.55	K7 IIIab	16	−0.8	~203	0.224	274	+38	suspected var., mag. 3.12–3.17 (beginning to evolve into a Mira?)	
κ	Vel	9 22.7	−55 06	2.47	−0.14	B2 IV–V	6	−3.8	600	0.016	315	+22 SB	orbit 116.65 d, average separation possibly ~1.1 AU ¶ mass loss rate ~1e-9 $M_\odot$/y ¶ system is X-ray source ¶ ISM absorption has varied over the years (ISM cloud in transit?)	Markeb
α	Hya	9 28.5	−8 45	1.99	1.44	K3 II–III	18	−1.7	180	0.038	336	−4 V?	slow rotator (possibly 2.4 y), with Ba mildly overabundant ¶ astroseismology has been studied ¶ α Hya B (mag. 9.7; 282″, PA 154°, both measures almost unchanged since 1833) might be	Alphard

													a true binary companion (with orbit ≥ 870,000 y, separation ≥ 15,700 AU)	
N	Vel	9 31.8	−57 07	3.16	1.54	K5 III	13.6	−1.2	240	0.033	280	−14	irreg. var., low-amplitude (V mag. 3.12–3.18) classified by AAVSO(VSX), as at 2019-01-05, as “semi-regular variable” with period 82.0 d ¶ evolutionary status uncertain (He core fusion impending, or already ended?)	HR 3803
θ	UMa	9 34.2	+51 35	3.17	0.48	F6 IV	74.2	2.5	44.0	1.088	241	+15 SB	luminosity class, and also SB status, have been controverted, with postulated SB companion remaining undetected in speckle interferometry	
ο	Leo AB	9 42.2	+9 48	3.52v	0.52	F5 II + A5?	25	0.5	130	0.148	255	+27 SB	A: occ. bin. (mags equal) orbit 14.5 d, separation 0.165 AU (interferometrically resolvable) ¶ ο Leo A is a rare instance of a star that has ended core hydrogen fusion, and yet in which the convection typical of an evolved star has not yet removed the chemical peculiarities possible in a core-hydrogen fuser (where still-quiet atmosphere facilitates radiative lofting and gravitational settling)	Subra
l	Car	9 45.8	−62 36	3.69v	1.01	F9–G5 Ib	2	−4.7	2000	0.015	302	+3 V	**[THIS STAR ONLY IN ONLINE VERSION OF TABLE]** Cepheid var.: 3.28–4.18, 36 d AAVSO(VSX) as at 2018-12-27 gives period 35.551609 d; an exceptionally luminous, and consequently exceptionally slow, Cepheid (compare both the visual brightness and the intrinsic luminosity with less dramatic δ Cep, ζ Gem, η Aql: Kaler remarks that “if Carina had been in the northern hemisphere, the collection of these variables might well have been called the ‘Carinids’”; radius, in its pulsation cycle, has been measured as 160 $R_\odot$ min, 194 $R_\odot$ max ¶ circumstellar envelope of ejected matter, radius 10 AU–100 AU ¶ lower-case ell Car; not to be confused with i (lower-case i) Car (HR 3663), ι Car (HR 3699), L Car (HR 4089), I (upper-case i) Car (HR 4102) (and note additionally that Bayer nomenclature does not use the label “λ Car”)	HR 3884
ε	Leo	9 47.0	+23 41	2.97	0.81	G1 II	13.2	−1.4	250	0.047	259	+4 V?	**[THIS STAR ONLY IN ONLINE VERSION OF TABLE]** slow rotator, period possibly as long as 200 d ¶ currently crossing the Hertzsprung Gap? ¶ variability has been studied (cf Andrievsky 1998; pulsation as in Cepheids?) ¶ the Arabic or quasi-Arabic name Algenubi (more classically, al Ras al Asad al Janubiyyah et al.) is not presently IAU-official	
υ	Car AB	9 47.6	−65 10	2.92	0.29	A6 II	2.3	−5.3	~1400	0.028	307	+14	A: 3.01; B: 5.99, B7 III, 5.0″, PA:126°→126°, 1836→2010 orbit ≥ 19,500 y, separation ~2000 AU ¶ the duplicity causes parallax to be poorly known	
φ	Vel	9 57.6	−54 40	3.52	−0.07	B5 Ib	2.0	−4.9	1600	0.014	285	+14		
η	Leo	10 08.4	+16 40	3.48	−0.03	A0 Ib	3	−4.5	1300	~0.003	n.a.	+3 V	**[THIS STAR ONLY IN ONLINE VERSION OF TABLE]** B: 4.5, 0.1″, PA:84°→309°, 1937→1993 mass-loss rate ~5e-8 $M_\odot$/y (> 10,000x solar mass-loss rate); BSC5: “chromospheric shell” ¶ a lunar occultation has suggested duplicity, but this is unconfirmed	
α	Leo A	10 09.4	+11 52	1.36	−0.09	B7 Vn	41	−0.6	79	0.249	271	+6 SB	α Leo A is SB orbit 40.11 d, with the primary a rapid rotator (period 15.9 h, rendering the star *(i)* a significantly oblate spheroid (ratio of diameters 1.32, where sphere would have 1), which has attained 96.5% of its breakup speed, and *(ii)* the first rapid rotator found to exhibit Chandrasekhar rotation-induced polarization (2017NatAs…1..690C); the secondary is a WD of exceptionally low mass ¶ A+BC almost unchanged since 1779 (175.5″ in 2016); separation ≥ 4200 AU, orbit ≥ 125,000 y; BC combined light is mag. ~8.2; BC is under observed (PA: 89° →86°, 4.0″ →2.5″, 1867→1943, with separation ≥ 97AU, orbit ≥ 880 y ¶ α Leo is regularly occulted by Moon, and infrequently by Mercury, Venus, and asteroids: Venus most recently 1959-07-07, next 2044-10-01; Erigone cloud-defeated campaign of 2014-03-20 is documented at https://occultations.org/regulus2014 ¶ E(B–V) =+0.01	**Regulus**
ω	Car	10 14.2	−70 08	3.29	−0.07	B8 IIIn	9.5	−1.8	340	0.037	281	+7 V	or “IIIne”; shell star; rapid rotator (< 1.2 d, ~85% of breakup speed); photometric variation (cp γ Cas, δ Sco, …) might be expected, and yet seems undocumented;	

BSC5 does report variable Hα

q	Car	10 17.7	−61 26	3.39	1.54	K3 IIa	5.0	−3.1	660	0.026	286	+8	irregular var.: 3.36–3.44 classified “LC” by AAVSO(VSX) as at 2019-01-05 ¶ metallicity is uncertain ¶ evolutionary state is uncertain (has core already started He fusion?)	HR 4050
ζ	Leo	10 17.8	+23 19	3.43	0.31	F0 IIIa	12	−1.2	270	0.020	110	−16 SB	in rapid evolutionary transition, currently crossing Hertzsprung Gap	Adhafera
λ	UMa	10 18.3	+42 49	3.45	0.03	A1 IV	24	0.3	140	0.186	256	+18 V	despite MK luminosity class “IV”, has not yet finished core hydrogen fusion ¶ mildly metallic, being insufficient metallic to warrant MK “Am” ¶ seems mild IR excess (indicating circumstellar debris)	Tania Borealis
γ	Leo A +1P	10 21.0	+19 45	2.61	1.13	K1 IIIb Fe–0.5	26	−0.3	130	~0.333	~118	−37 SB	4.8″ (2017), PA:99° →126°, 1820→ 2017 (510.3 y);	
γ	Leo B	10 21.0	+19 45	3.16	1.42	G7 III Fe–1	26	0.2	130	~0.346	~118	−36 V	max = ~5″, around 2100 separation ≥ 170 AU, orbit > 500 y, orbital parameters not yet well known ¶ A, B are of mildly unequal masses, and therefore are of mildly disparate evolutionary stage (Kaler http://stars.astro.illinois.ed/: “best understood as being in different stages of gianthood”; cf this same source for further discussion of the uncertainties in various γ Leo parameters, including the respective mags of A and B) ¶ γ Leo A “+ 1P” is an exception to the tendency for exoplanets to be found around the more metallic stars (but the “+1 P” could be modelled as a brown dwarf); and indeed even “+2P” is now considered possible ¶ high space velocity of the γ Leo AB pair, plus their low metallicity, suggests system is interloper from remoter galactic region ¶ γ Leo AB, and indeed also the next “Sickle” star ζ Leo, serve to mark the radiant of the Leonids meteor shower	Algieba
μ	UMa	10 23.5	+41 24	3.06v?	1.60	M0 IIIp	14	−1.2	230	0.089	293	−21 SB	Ca II emission ¶ SB period 230 d ¶ variability suspected (suggested range 2.99–3.33; but AAVSO(VSX) database as of 2019-01-05 has no entry) ¶ Kaler (http://stars.astro.illinois.edu-sow-taniaas.html) terms this “a rare ‘hybrid star’” (in the sense of blowing both a fast-and-thin wind and a slower-and-dense wind), and additionally notes the puzzle posed by X-ray emission in the presence of cool photosphere	Tania Australis
p	Car	10 32.7	−61 47	3.30v	−0.09	B4 Vne	7	−2.6	500	0.021	304	+26	irregular var.: 3.27–3.37 ¶ fast rotator; BSC5: shell; variable Balmer-line profiles	HR 4140
θ	Car	10 43.7	−64 30	2.74	−0.22	B0.5 Vp	7	−3.0	460	0.022	303	+24 SB	chemically anomalous SB period 2.2 d is unusually short, suggesting that mass transfer could be the culprit in the anomalies ¶ the primary is the brightest of the “blue stragglers”; at http://stars.astro.illinois.edu/sow/thetacar.html, Kaler discusses difficulties in determination of the primary’s temperature and of its (short) rotation period ¶ E(B–V) =+0.06	
μ	Vel AB	10 47.6	−49 31	2.69	1.07	G5 III + F8:V	28	−0.1	~117	0.083	131	+6 SB	A: 2.72; B: 5.92, 2.3″, PA:55°→57°, 1880→2016 period variously given as 116.24 y (Hoffleit) and 138 y (Heintz); separation possibly 8 AU min, 93 AU max, 51 AU average ¶ A is in rapid evolutionary transition, having recently finished core hydrogen burning ¶ A is magnetic, and an X-ray emitter, with hot corona, and with violent 2-day X-ray flare detected in 1998 by IUE	
ν	Hya	10 50.6	−16 18	3.11	1.23	K2 III	23	−0.1	144	0.220	25	−1	slow rotator (but ≤ 619 d) ¶ low metallicity and high space velocity suggest interloper, born outside Sun’s neighbourhood	
β	UMa	11 03.0	+56 17	2.34	0.03	A0mA1 IV–V	~40.9	0.4	80	0.088	68	−12 SB	debris disk first detected via IR excess, now marginally resolved by *Herschel Space Observatory* (Matthews et al. 2010)	Merak
α	UMa AB	11 04.9	+61 39	1.81	1.06	K0 IIIa	27	−1.1	120	0.139	255	−9 SB	A: 1.86; B: 4.8, A8 V, 0.7″ (2014) orbit 44 y ¶ the first cool star found to have multimodal oscillations (WIRE camera; Buzasi, et al, 2000, suggest fundamental mode 6.35 d) ¶ the most distant of the seven Big Dipper stars (and, like η at the other extreme of the Big Zipper, not a member of the UMa Moving Group)	**Dubhe**
ψ	UMa	11 10.8	+44 24	3.00	1.14	K1 III	22.6	−0.2	145	0.068	246	−4 V?		

		RA	Dec	V	B–V	Sp	π	M	d	μ	PA	RV	Notes	Name
													slow rotator (but ≤ 2.6 y)	
δ	Leo	11 15.1	+20 25	2.56	0.13	A4 IV	56	1.3	58	0.193	132	−20 V		Zosma
													rapid rotator (< 0.5 d)	
													¶ suspected δ Sct variable	
θ	Leo	11 15.3	+15 19	3.33	0.00	A2 IV	~19.8	−0.2	165	0.099	217	+8 V	(K-line var.)	Chertan
													rotation rather slow for MK type A (but < 9 d); quiet	
													atmosphere renders Ca, Sc underabundant, and	
													Fe, Sr, Ba overabundant	
													¶ IR excess (debris disk?)	
ν	UMa	11 19.5	+32 59	3.49	1.40	K3 III Ba0.3	~8.2	−1.9	400	0.039	317	−9 SB	B: 9.5, 7.8″, PA:145°→145°, 1827→2015	Alula Borealis
													orbit ≥ 12,000 y; separation ≥ 950 AU	
													[THIS STAR ONLY IN ONLINE VERSION OF TABLE]	
ξ	Hya	11 34.0	−31 58	3.54	0.95	G7 III	~25.2	0.5	130	0.214	259	−5 V		
													La Silla CORALIE ~2001 detected multimodal	
													oscillations, not all radial, with periods ~3 h	
													[THIS STAR ONLY IN ONLINE VERSION OF TABLE]	
λ	Cen	11 36.7	−63 08	3.11	−0.04	B9.5 IIn	8	−2.4	400	0.034	258	−1 V		
													despite possible fast rotation (< 2.7 d?), Fe is	
													overabundant, with Si and C mildly underabundant	
													¶ at http://stars.astro.illinois.edu/sow/lambdacen.html,	
													Kaler discusses questions of visual binarity	
													(λ Cen Aa, Ab, B)	
β	Leo	11 50.1	+14 28	2.14	0.09	A3 Va	91	1.9	36	0.511	257	0 V		**Denebola**
													rapid rotator (< 0.65 d)	
													¶ debris disk resolved by *Herschel* Space Observatory	
													(Matthews et al. 2010), disk structures	
													differentiated with ground-based interferometry	
													(Stock et al. 2010)	
													¶ assertion of δ Sct variability now seems erroneous	
γ	UMa	11 54.8	+53 35	2.41	0.04	A0 Van	39	0.4	83	0.108	84	−13 SB		Phecda
													rapid rotator: MK type Ae has been asserted	
													(Ae is rare, Be common)	
													¶ E(B–V) =0.00	
δ	Cen	12 09.4	−50 50	2.58v	−0.13	B2 IVne	8	−2.9	400	0.050	262	+11 V	irregular var.: 2.51–2.65	
													¶ rapid rotator (< 1.3 d), with shell	
													2008A&A...488L..67M summarizes recent research,	
													and as part of a wider VLTI investigation into the	
													“Be phenomenon” not only discusses the	
													circumstellar envelope, but also reports discovery of	
													binarity (secondary at angular distance 68.7 mas)	
ε	Crv	12 11.1	−22 44	3.02	1.33	K2 III	~10.3	−1.9	320	0.072	278	+5		
													slow rotator (but ≤ 3.9 y)	
													¶ metals somewhat overabundant	
													¶ evolutionary status uncertain (core He fusion starting,	
													in progress, or finished?)	
													¶ the etymologically Arab name “Minkar” is of merely	
													modern origin, and is not currently IAU-official	
δ	Cru	12 16.2	−58 51	2.79v	−0.19	B2 IV	9.4	−2.3	350	0.037	254	+22 V?	var.: 2.78–2.84, 0.15 d	
													¶ rapid rotator (<1.3 d; BSC5: “expanding	
													circumstellar shell”)	
													¶ possibly in the β Cep variability class	
													¶ name Imai approved at IAU 2018, too late for	
													printed-edition Handbook	
δ	UMa	12 16.4	+56 55	3.32	0.08	A2 Van	40.5	1.4	81	0.104	86	−13 V		Megrez
													possesses debris disk, of unusually low radius	
													(Wyatt et al. 2007; Poynting-Robertson drag?)	
γ	Crv	12 16.8	−17 39	2.58	−0.11	B8 III	21	−0.8	154	0.160	278	−4 SB	sp. var.?	**Gienah**
													rather rapid rotation notwithstanding	
													(BSC5: “expanding circumstellar shell”), Hg and Mn	
													are overabundant, with some other elements	
													underabundant (but rotational line broadening	
													makes abundance determinations difficult)	
α	Cru A	12 27.7	−63 12	1.25	−0.20	B0.5 IV	10	−3.7	~320	0.037	251	−11 SB	5.4″ (1826); 4.2″ (2016)	**Acrux**
α	Cru B	12 27.7	−63 12	1.64	−0.18	B1 Vn	10	−3.3	~320	0.037?	251?	−1	PA: 114°→112°, 1826→2016	
													orbit ≥ 1300 y, separation ~430 AU;	
													A is SB pair Aa, Ab (75.78 d, separation ~0.5 AU min,	
													~1.5 AU max);	
													C (itself an SB pair) at ~90″ from AB, imperfectly	
													sharing the AB proper motion, is possibly (not assuredly)	
													gravitationally bound with AB (if bound, then	
													> 130,000 y, with separation ≥ 9,000 AU);	
													WDS additionally documents D, E, F, G, H, I, J, K	
													¶ duplicity makes individual magnitude determinations	
													for A, B somewhat controverted	
δ	Crv A	12 30.9	−16 37	2.94	−0.01	B9.5 IVn	~37.6	0.8	87	0.252	237	+9 V	B:8.26, K2 V, 24.6″, PA: 216°→213°, 1782→2012	Algorab
													orbit ≥ 9400 y; although A, B have common proper	
													motion, disparity in age estimates has caused	
													binarity to be questioned	
													¶ Kaler suggests B is young post-T-Tauri star,	
													with surrounding dust as yet uncleared	
γ	Cru	12 32.3	−57 13	1.59v	1.60	M3.5 III	37	−0.6	89	0.267	174	+21	var.: 1.60–1.67	**Gacrux**
													although has been classified as semiregular var.,	
													at least 6 pulsation periods have been documented	
													¶ the nearest of the M giants, radius > 0.5 AU; evolutionary	

												status uncertain (is core He fusion now finished?) ¶ cause of the observed Ba overabundance is unknown (undetected evolved companion?)	
β Crv	12 35.4	−23 30	2.65	0.89	G5 II	22	−0.6	146	0.057	179	−8 V	slight variability has been reported (2.60–2.66) ¶ slow rotator (but ≤ 180 d) ¶ possibly in evolutionary transition (He core about to ignite?) ¶ assertion of weak Ba-star status is perhaps erroneous	Kraz
α Mus	12 38.4	−69 15	2.69	−0.18	B2 IV–V	10.3	−2.2	320	0.042	252	+13 V	var.: 2.68–2.73, 0.090 d classification of the low-amplitude variability as β Cep has been questioned ¶ rapid rotator (< 2 d)	
γ Cen A	12 42.6	−49 04	2.95	−0.02	A1 IV	25	−0.1	130	~0.194	~267	−6	orbit 84 y; 0.4″ (2010),	
γ Cen B	12 42.6	−49 04	2.85	−0.02	A0 IV	25	−0.2	130	~0.194	~267	−6	0.1″ (2017); max = 1.7″; separation 8 AU min, 67 AU max, 37 AU average ¶ Arabic name Muhlifain is not currently IAU-official	
γ Vir AB	12 42.6	−1 33	2.74	0.37	F1 V + F0mF2 V	85	2.4	39	~0.619	~276	−20	A: 3.48; B: 3.50; 0.8″ (2007); 2.5″ (2016) orbit 169 y; separation 5 AU min (most recently 1836 and 2005), 81 AU max, 43 AU average, with plane of orbit inclined 31° to plane of sky; for discussion of orbit, with observations plot showing error bars (binary astrometry being now old enough to archive data for one full orbit), cf Kaler at http://stars.astro.illinois.edu/sow/porrima.html ¶ lunar occultations possible, planetary occultations possible-yet-rare	Porrima
β Mus AB	12 47.5	−68 13	3.04	−0.18	B2 V + B2.5 V	~9.6	−2.1	340	~0.043	~258	+42 V	A: 3.51; B: 4.00, 1.1″, PA:317°→53°, 1880→2016 orbit 194 y; average separation uncertain (101 AU, or only ~80 AU?); orbit map, showing error bars, given by Kaler at http://stars.astro.illinois.edu/sow/betamus.html, with Kaler's accompanying discussion of orbit-modelling problems, underscores limitations in current β Mus AB knowledge ¶ β Mus A is rapid rotator (< 1 d) ¶ a runaway system, in the sense of presenting a high velocity relative to the general galactic rotation	
β Cru	12 48.9	−59 48	1.25v	−0.24	B0.5 III	12	−3.4	300	0.046	249	+16 SB	var.: 1.23–1.31, 0.24 d SB period 5 y, separation 5.4 AU min, 12.0 AU max; Kaler at http://stars.astro.illinois.edu/sow/mimosa.html discusses other possible companions, including an X-ray visible, and yet optically invisible, object interpreted as a pre-Main-Sequence star ¶ β Cru A is believed to be a rapid rotator (possible ~3.6 d) ¶ β Cru A is a multiperiodic β Cep variable ¶ β Cru A, its MK luminosity class "III" notwithstanding, is only about halfway through its career of stable core-hydrogen fusing	Mimosa
ε UMa	12 54.9	+55 51	1.76v	−0.02	A0p IV: (CrEu)	~39.5	−0.3	83	0.112	94	−9 SB?	var.: 1.76–1.78, 5.1 d the brightest of the Ap stars, and a variable in the α^2 CVn class (in the specific case of ε Uma, the magnetic-dipole axis is believed to be nearly perpendicular to rotation axis, yielding Cr bands nearly perpendicular to equator; dipole strength is unusually low) (but it has also been suggested that a substellar companion of mass ~14.7x Jupiter, at average separation 0.055 AU, orbit 5.1 d, rather than a 5.1-d stellar rotation, is the source of the observed variability period)	**Alioth**
δ Vir	12 56.6	+3 18	3.39	1.57	M3 III	16	−0.5	~198	0.473	264	−18 V?	semireg. var. (multi-period pulsator), mag. 3.32–3.40 ¶ high space velocity relative to galactic neighbours ¶ evolutionary status uncertain (He fusion recently started, or already finished?)	Minelauva
α^2 CVn	12 56.9	+38 13	2.85	−0.06	A0p (SiEu)	28	0.1	110	0.241	283	−3 V	B:5.6, F0 V, 19.3″, PA:234°→230°, 1777→2017 orbit ≥ 8300 y (common proper motion indicates true binarity); separation ≥ 675 AU; prototype for the α^2 CVn variables (chemically anomalous photospheric regions yielding spectroscopic variability, and with magnetism yielding large spots; in the particular case of α^2 CVn, rotation period is 5.46939 d, with consequent spot-driven magnitude range 2.84–2.98) ¶ two correct, potentially confusing, designations are α CVn A (signalling that this is the brighter of the binary pair) and α^2 CVn (signalling that α^1 crosses the local meridian before α^2, lying further W); the Latin "heart-of-Charles" designation, official at IAU as of 2016, honours the "martyr king" Charles I (although Charles II is sometimes cited in error)	Cor Caroli

ε	Vir	13 03.1	+10 51	2.85	0.93	G9 IIIab	29.8	0.2	110	0.275	274	−14 V?	one of the most notable X-ray sources in our table (X-ray luminosity, although far below α Aur, is nevertheless almost 300x solar)	Vindemiatrix
γ	Hya	13 20.0	−23 16	2.99	0.92	G8 IIIa	~24.4	−0.1	134	0.081	121	−5 V?	slow rotator (but ≤ 240 d) evolutionary state uncertain (core He fusion impending, or already in progress?)	
ι	Cen	13 21.7	−36 49	2.75	0.07	A2 Va	55	1.5	59	0.352	256	0	rapid rotator (< 2d) ¶ low metallicity ¶ debris disk (unusually luminous, given evolutionary state of ι Cen)	
ζ	UMa A	13 24.7	+54 49	2.23	0.06	A1 Va	40	0.1	90	0.123	100	−6 SB2	B:3.94, A1mA7 IV–V, 14.4″; period >5000 y? not only are A+B a true binary; it is now additionally argued (controversy possibly continues) that Alcor is gravitationally bound to A+B (Bob King, *Sky & Tel* .2015-03-25); although ζ Uma A and ζ Uma B (both chemically anomalous) are universally accepted as themselves individually SB (yielding quartet ζ UMa Aa, Ab, 20.538 d (cf NPOI trial, 1997AJ….114.1221B), ζ UMa Ba, Bb, 175.6 d; both SB orbits are highly elliptical), the old, widely repeated claim that Alcor is itself SB requires scrutiny (pro, F.Heard ApJ 1949; contra, www.leosondra.cz/en/mizar, specifically rebutting Heard; once again pro, but now on new basis (discovering elusive red-dwarf companion), 2010ApJ…709..733Z; this Leos Ondra web source should be consulted also *(a)* for details on Mizar-Alcor multiplicity-studies history, including Galileo and Michelson (Ondra, citing inter alia Fedele 1949, seems to establish that it was Galileo pupil Castelli, rather than (as widely asserted) Riccioli, who discovered Mizar's visual duplicity) and *(b)* for a 15′ map documenting around 20 of the field stars, including mag. 7.58 "Stella Luoviciana" ("Sidus Ludovicianum"))	Mizar
α	Vir	13 26.2	−11 16	0.98v	−0.24	B1 V	13	−3.4	250	0.052	234	+1 SB2	var.: 0.95–1.05, 4.0 d; mult. 3.1, 4.5, 7.5 ¶ this SB (separation 0.12 AU; 4.0145 d) is the brightest of the ellipsoidal rotating variables (no eclipse, but the SB's presented luminous area varies with orbital periodicity, through geometrical asymmetry); the brighter SB component (a rapid rotator) is itself a pulsating variable of the β Cep type (0.1738 d); SB orbit is highly elliptical; the two stars are not tidally locked (young system?); further, the pair is a polarimetric variable (ISM material entrained?); the secondary is one of the few stars known to exhibit Struve-Sahade variation in its spectral line strengths ¶ strong X-ray source (colliding winds from the two SB stars?) ¶ duplicity has made the assignment of MK types to the two SB stars difficult ¶ first interferometer to resolve the SB was Narrabri (ca 1966–1970) ¶ lunar occultations indicate a further three components; planetary occultations are possible-yet-rare ¶ E(B–V)=+0.03	**Spica**
ζ	Vir	13 35.7	−0 42	3.38	0.11	A2 IV	44	1.6	74	0.285	280	−13	rapid rotator (< 0.5 d; this renders puzzling the possible evidence for chemical anomalies, which would presuppose a quiet atmosphere) ¶ now strictly ζ Vir A; elusive red-dwarf companion B is reported in 2010ApJ…712..421H (0.168 M☉, possibly accounting for the X-ray emission observed by ROSAT: as a star of a spectral type lacking strong winds and lacking convection at photosphere, ζ Vir A would not itself be expected to emit X-rays) ¶ a good marker of celestial equator (precession placed ζ Vir exactly onto equator in February 1883)	Heze
ε	Cen	13 41.1	−53 34	2.29	−0.17	B1 III	8	−3.3	400	0.019	233	+3	slight variability (mag. 2.29–2.31; multiperiodic; β Cep type) ¶ rapid rotator (< 2.7 d) ¶ metals underabundant ¶ although we here assign MK luminosity class "III", Kaler at http://stars.astro.illinois.edu/sow/epscen.html discusses uncertainty	
η	UMa	13 48.3	+49 13	1.85	−0.10	B3 V	31	−0.7	104	0.122	263	−11 SB?	resembles α Uma, at the other extreme of the Big Dipper, in not belonging to UMa Moving Group; 1921LicOB..10..110T asserts Pleiades Group ¶ rapid rotator (< 21 h), with some line variability	**Alkaid**

												(circumstellar ejecta disk?) ¶ X-ray source ¶ colour and mean temperature are anomalous for the MK type ¶ unusually young in our Sample S (< 15 My) ¶ E(B–V)=+0.02	
ν Cen	13 50.7	−41 47	3.41	−0.22	B2 IV	~7.5	−2.2	440	0.034	233	+9 SB	SB period is 2.622 d; system is rotating ellipsoidal variable (not eclipsing, but varying in light as the presented surface area changes); additionally, the primary is a pulsator in the β Cep class (mag. 3.38–3.41) ¶ MK luminosity class “IV” notwithstanding, primary is still a stable fuser of core hydrogen ¶ possible weak Be, the (possible) emission coming (possible; and possibly intermittent?) circumstellar disk	
μ Cen	13 50.8	−42 34	3.47v	−0.17	B2 IV–V pne	~6.4	−2.5	510	0.031	232	+9 SB	variable shell: 2.92–3.47; rapid rotator, and consistently with this a variable in the γ Cas class; additionally said to be a multiperiodic non-radial pulsator; BSC5: “line profiles of MgII 4481 change in period 0.505 d, about five times the period of weaker absorption”; variable Hα; “variable line profiles”	
η Boo	13 55.6	+18 18	2.68	0.58	G0 IV	88	2.4	37	0.361	190	0 SB	unusually metal-rich ¶ an X-ray source (hot corona) ¶ 2007ApJ…657.1058V discusses recent work (*MOST* helioseismology, PTI interferometry)	Muphrid
ζ Cen	13 56.8	−47 23	2.55	−0.18	B2.5 IV	8.5	−2.8	380	0.073	232	+7 SB2	SB period 8.02 d ¶ primary is a rapid rotator (<1.5 d) (BSC5: “expanding circumstellar disk”) ¶ MK luminosity class “IV” notwithstanding, primary is possibly only halfway through its core hydrogen fusing ¶ E(B–V) =–0.02	
β Cen AB	14 05.2	−60 28	0.58v	−0.23	B1 III	8	−4.8	400	0.041	235	+6 SB	B:3.94, A1mA7 IV–V, 0.3″ (2017) entire (triple) system comprises SB Aa+Ab (357 d, separation 0.53 AU min, 5.5 AU max, 4 AU average) with B; at least one, and perhaps both, of Aa, Ab multiperiod variables in the β Cep class; Kaler discusses uncertainty in distance (etc) of the triple at http://stars.astro.illinois.edu/sow/hadar.html ¶ E(B–V) =+0.02	**Hadar**
π Hya	14 07.5	−26 47	3.25	1.09	K2 IIIb	~32.3	0.8	101	0.148	163	+27 V	negative cyanide ion lines are anomalously weak relative to metal lines, consistent with this star’s anomalously high velocity relative to Sun (suggesting interloper in our own galactic region; however, π Hya is more metal rich than the celebrated interloper α Boo) ¶ in the HR-diagram “clump” of core-He fusers (but uncertain whether recent arrival in clump or longtime denizen)	
θ Cen	14 07.8	−36 28	2.06	1.01	K0 IIIb	55	0.8	59	0.734	225	+1	high velocity with respect to Sun suggests interloper status (and yet metallicity is approximately solar)	**Menkent**
α Boo	14 16.6	+19 05	−0.05	1.24	K1.5 III Fe–0.5	89	−0.3	37	2.279	209	−5 V	high space velocity a metal-poor interloper (from galactic thick disk? but galaxy-merger scenario has also been suggested), and member of Arcturus Moving Group (2009IAUS..254..139W) ¶ a magnetic cycle (< 14 y?) has been detected ¶ still ascending HR diagram RGB, with He flash impending? (but a later evolutionary stage has also been suggested) ¶ publication of α Boo line atlas 1968pmas.book…..G (R.Griffin) was a major event in postwar spectroscopy ¶ α Boo has been studied in recent astroseismology ¶ there may be a companion, at margin of *HIPPARCOS* detectability	**Arcturus**
ι Lup	14 20.7	−46 09	3.55	−0.18	B2.5 IVn	~9.6	−1.5	340	0.013	249	+22	rapid rotator (possibly ~0.9 d), and yet no evidence of circumstellar disk, and in particular no Be spectral features ¶ the MK luminosity class “IV” notwithstanding, still performing stable core-hydrogen fusion **[THIS STAR ONLY IN ONLINE VERSION OF TABLE]**	
γ Boo	14 32.9	+38 13	3.04	0.19	A7 IV+	37.6	0.9	87	0.190	323	−37 V	variable in the δ Sct class ¶ IR excess (from circumstellar debris, so far unexplained) ¶ strictly at least Aa+Ab (resolved in speckle interferometry as 70 mas)	Seginus

η Cen	14 36.8	−42 15	2.33v	−0.16	B1.5 IV pne	11	−2.5	310	0.048	227	0 SB	variable shell: 2.29–2.47 variable (multiperiodic) both in γ Cas class and in λ Eri class; BSC5: Hα variable, Hβ “sometimes bright, sometimes dark and double or multiple”; consistently with γ Cas variability, a rapid rotator (< 1 d)	
α Cen B	14 40.9	−60 55	1.35	0.9	K1 V	750	5.7	4.3	~3.703	~283	−21 V?	AB 4.1″ (2016); orbit 79.9 y; min = 2″ (1955); max 22″ separation 11.2 AU min, 35.6 AU max; Kaler at http://stars.astro.illinois.edu/sow/rigil-kent.html has map of AB orbit (note further here that green, violet, blue denote micrometry, photography, interferometry, respectively: as the error bars suggest, the AB orbit is one of the most precisely known in visual-binary astrometry; Kaler also discusses some uncertainties in the ABC physical properties) ¶ magnetic activity of α Cen A is in deep decline since 2005 ¶ 2005A&A...442…315R reports a flare on magnetically active α Cen B ¶ 2012 B-exoplanet claim now discounted, and yet an exoplanet Bc now considered possible in 2015MNRAS.450.2043D ¶ Einstein-ring event expected with 45% probability in 2028, early in May	
α Cen A	14 40.9	−60 55	−0.01	0.71	G2 V	750	4.4	4.3	~3.710	~277	−22 SB	C: Proxima, 12.4, M5e, 212° gravitational binding of AB+C was finally established with high probability in 2017A&A…598L…7K (~550,000 y: min > 4300 AU, max 13,000 AU) ¶ 2016Natur.536..437A announces an approx. Earth-mass exoplanet (mass < ~3x Earth?) around α Cen C (unfortunately, however, for exobiology, α Cen C suffers superflares); https://en.wikipedia.org/wiki/Proxima_Centauri_b discusses astrobiology pros and cons; http://breakthroughinitiatives.org/initiative/3 advocates nanocraft exploration ¶ all of A, B, C are metals-rich ¶ Toliman, as name for α Cen B, was adopted at IAU on 2018-08-10, too late for inclusion in printed-edition Handbook	Rigil Kentaurus
α Lup	14 43.2	−47 28	2.30	−0.15	B1.5 III	7	−3.5	460	0.032	221	+5 SB	low-amplitude var.: 2.29–2.34, 0.26 d in β Cep class; actually multiperiodic, with primary period (unusually long) 0.2598466 d given by AAVSO(VSX) as at 2019-01-02	
α Cir	14 44.1	−65 04	3.18	0.26	A7p (Sr)	60.4	2.1	54.1	0.303	220	+7 SB?	B: 8.6, K5 V, 15.7″, PA:263°→224°, 1826→2017 AB probably true binary, with orbit ≥ 2600 y ¶ the brightest variable of the AAVSO “rapidly oscillating Ap” type (features of the type include rapid non-radial pulsation with a stellar-rotation signal), with V mag range 3.17–3.19; magnetically an oblique rotator (4.4790 d, with field strength ~500x solar); 2009MNRAS.396.1189B discusses the rotation, two notably stable putative equatorial chemical-anomaly regions, and astroseismology, with history and fresh WIRE+SAAO observations	
ε Boo AB	14 45.8	+27 00	2.35	1.34	K0 II–III+A0 V	16	−1.6	200	0.044	288	−17 V	A:2.50; B:4.66, 2.9″, PA:318°→345°,1822→2015 orbit well over 1000 y ¶ ε Boo B is a rapid rotator ¶ http://stars.astro.illinois.edu/sow/izar.html discusses difficulties in determination of the individual magnitudes and of the binary system’s distance ¶ F.G.W. von Struve: “pulcherrima” (“the loveliest”)	Izar
β UMi +1P	14 50.7	+74 05	2.07	1.46	K4 III	24.9	−0.9	131	0.035	289	+17 V	a guide for the aligning of a small telescope with equatorial mount (since NCP, although not quite coincident with α UMi, does lie near the great-circle arc linking β UMi with α UMi: http://arksky.org/Kochab.htm) ¶ Fe underabundant, Ba possibly slightly overabundant ¶ 2008A&A...483L..43T suggests (via *Coriolis*-SMEI) two short-lived radial-pulsation mods ¶ 2014A&A...566A..67L announces exoplanet	**Kochab**
α^2 Lib	14 52.0	−16 07	2.75	0.15	A3 III–IV	43	0.9	76	0.126	237	−10 SB	angular distance from α^1 Lib, which shares the proper motion of α^2 Lib, is 231″, with separation ≥ 5500 AU; if α^1 and α^2 are gravitationally bound, then their period is ≥ 200,000 y; “1” signals the fact that α^1 Lib, lying to W of α^2 Lib, although fainter than “2”, is the earlier of the two in its crossing of the local meridian ¶ α^2 Lib is overabundant in some metals, perhaps due to influence of its very close SB companion (angular distance ~10 mas, separation a few tenths of 1 AU)	**Zubenelgenubi**

													¶ lunar occultations are possible, planetary occultations possible-yet-rare	
β	Lup	14 59.8	−43 13	2.68	−0.18	B2 IV	9	−2.7	380	0.054	222	0 SB	low-amplitude (β Cep) variable, with dominant period 0.232 d ¶ fast rotator (< 3.4 d) ¶ low metallicity	
κ	Cen	15 00.4	−42 11	3.13	−0.21	B2 V	9	−2.2	400	0.029	218	+8 SB	strictly a triple system, Aa+Ab+B; B mag. 11.5; AB 4″, PA: 84°→83°, 1926→2000, separation ≥ 470 AU; ≥ 3000 y; Aa+Ab separation possibly ~10 AU, period possibly ~10 y (http://stars.astro.illinois.edu/sow/kappacen.html discusses various physical uncertainties) ¶ line profiles vary; although the Aa+Ab binarity has made variability classification difficult, κ Cen Aa is classified by AAVSO(VSX) as a variable of the β Cep type (with V mag. range 3.13−3.14, and with period 0.095325 d)	
β	Boo	15 02.7	+40 19	3.49	0.96	G8 IIIa	14.5	−0.7	230	0.049	234	−20 V?	Ba 0.4, Fe −0.5 1995A&A...296..509H discusses the puzzling flare seen by *ROSAT* 1993-08-08 (unusual for a lone M giant; it is possible, but seems unlikely, that flare came instead from an undetected M-dwarf companion; the mild Ba enhancement is, admittedly, consistent with presence of such a companion); slow rotator (~200 d)	Nekkar
σ	Lib	15 05.2	−25 21	3.25v	1.67	M2.5 III	11	−1.5	290	0.083	239	−4	**[THIS STAR ONLY IN ONLINE VERSION OF TABLE]** semiregular var.: 3.20–3.46 classified by AAVSO(VSX) as semiregular variable, with mean period 20 d; there is also rapid microvariability ¶ highly evolved (on HR diagram AGB, with dead carbon-oxygen core)	Brachium
ζ	Lup	15 13.7	−52 10	3.41	0.92	G8 III	~27.8	0.6	117	0.133	238	−10	strictly ζ Lup AB: A is mag. 3.50, B is mag. 6.74; 71.60″, with at most scant change over the period 1826–2016; separation ≥ 2600 AU; shared proper motion suggests true binary (period possibly ≥ 68,000 y) ¶ A is an HR diagram "red clump" star (originally Sun-like, but He flash now finished, core He fusion now underway)	
δ	Boo	15 16.3	+33 15	3.46	0.96	G8 III Fe–1	~26.8	0.6	122	0.140	143	−12 SB	strictly a very wide double: B is mag. 7.89, 105″, PA: 84°→78°, 1780→2017, separation ≥ 3800 AU, period 120,000 y (with shared proper motion indicating true binarity) ¶ δ Boo A is CN weak; δ Boo B could be a subdwarf, consistently with the observed low metallicity of δ Boo A ¶ δ Boo A is an HR diagram "clump" star (core He fusion now underway)	
β	Lib	15 18.1	−9 27	2.61	−0.07	B8 IIIn	~17.6	−1.2	190	0.100	259	−35 SB	flagged by AAVSO(VSX) as "suspected variable lacking deeper studies," with V mag. 2.60–2.62 (and yet Eratosthenes, resp. Ptolemy, asserted β Lib to be brighter than, resp. equal to, α Sco) ¶ rapid rotator ¶ E(B–V) =–0.02	Zubeneschamali
γ	UMi	15 20.7	+71 46	3.00	0.06	A3 III	6.7	−2.9	490	0.025	315	−4 V	a rapid rotator, and (despite being in MK type A, not B) said to be a variable shell star (cf 2000A&A...354..157H; BSC5: "shell possibly variable", H and CaII variable); AAVSO(VSX), however, classified this as a variable of the δ Sct type	Pherkad
γ	TrA	15 20.8	−68 45	2.87	0.01	A1 IIIn	17.7	−0.9	184	0.074	244	−3 V	has been asserted to be chemically anomalous (Eu overabundance), and also, not quite consistently, has been classed as a rapid rotator (< 1.2 d) ¶ although we here give MK luminosity class III, class V has also been asserted ¶ IR excess has been asserted (circumstellar disk?)	
δ	Lup	15 22.7	−40 43	3.22	−0.23	B1.5 IVn	4	−3.9	900	0.032	218	0 V?	rapid rotator (< 2.4 d) ¶ a (low-amplitude) variable of the β Cep type, with a single period known, 0.1655 d (cf 2007MNRAS.377..645S)	
ε	Lup AB	15 24.0	−44 46	3.37	−0.19	B2 IV–V	6	−2.6	500	~0.030	~230	+8 SB2	A: 3.56; B: 5.04, 0.2″, PA:285°→70°, 1883→2017 orbit 737 y: in more detail, a (probable) hierarchical quadruple; although B experiences A as essentially a point mass, in fact A is SB, for which 2005A&A...440..249U gives SB period 4.55970 d (classifying primary as a suspect β Cep variable and secondary as a new β Cep variable), experiencing AB, on the other hand, as essentially a point mass is the (probably) gravitationally bound C (lying at angular distance 26.1″ in 2016; separation ≥ 4100 AU; if gravitationally bound, then period ≥ 60,000 y);	

													in its stable kinematics, this putative hierarchical quadruple may be contrasted with the unstable, nonhierarchical θ Ori system, and in its detailed organization with the stable, hierarchical, but mere “double-double” ε Lyr system	
ι	Dra +1P	15 25.4	+58 54	3.29	1.17	K2 III	32.2	0.8	101	0.019	334	−11	2002ApJ...576..478F announces substellar-mass companion and discusses possibility of transits; this is the first discovery of a planet or brown dwarf (IAU name: Hypatia) orbiting a star which has finished stable core-hydrogen fusion; http://exoplanet.eu/catalog/HIP%2075458_b/ may from time to time have updates; its substellar companion notwithstanding, ι Dra has metallicity only slightly greater than solar	Edasich
α	CrB	15 35.5	+26 39	2.22v	0.03	A0 IV (composite)	43	0.4	75	0.150	127	+2 SB	ecl.: 2.21–2.32, 17 d (more precisely, from AVSO(VSX) as at 2019-01-02, 3.59907 d): a detached binary, with neither component filling its Roche lobe; separation 0.13 AU min; as with β Per, so also with α CrB, instrumental photometry reveals both the primary and the secondary eclipse ¶ individual MK types are difficult: primary possibly A0 V, secondary possibly G5 ¶ primary has IR excess (debris disk?) ¶ secondary is X-ray visible and is a rather rapid rotator (~9 d or ~7 d or less, so not tidally locked) ¶ non-IAU name Gemma denotes α CrB as “gem of the Northern Crown”	**Alphecca**
γ	Lup AB	15 36.4	−41 14	2.80	−0.22	B2 IVn	8	−2.8	400	~0.030	~212	+2 V	A: 3.5; B: 3.6; similar spectra 0.8″ (2017) PA: 94°→275°, 1835→2017; max angular separation 1980, min ang. dist. 2075; orbit 190 y: γ Lup AB orbit is seen nearly edge-on; separation 41 AU min, 128 AU max, 84.5 AU average; http://stars.astro.illinois.edu/sow/gammalup.html has an orbit map, showing that observational coverage is imperfect (green for micrometry (with large error bars), violet for photography, blue for interferometry); γ Lup A is itself SB (2.8081 d), making this a hierarchical triple system, with the primary in the γ Lup A pairing a fast rotator (< 1 d, so not tidally locked) ¶ BSC5 asserts expanding circumstellar shell, and (citing 1987 Vainu Bappu spectra) notes emission peaks in Hα profiles, says possibly in transition from B to Be	
α	Ser	15 45.2	+6 22	2.63v?	1.17	K2 IIIb CN1	44	0.9	74	0.141	71	+3 V?	var.? not in AAVSO(VSX) variability database as at 2019-01-02 ¶ a “strong-lined giant” (although [Fe/H] metallicity is not very much above solar) ¶ a modest X-ray source ¶ has borne also the (not IAU-official) name Cor Serpentis (“Heart of the Serpent”), despite being the principal luminary of Serpens Caput (“Serpent Head”)	Unukalhai
μ	Ser	15 50.6	−3 29	3.54	−0.04	A0 III	19	0.0	170	0.104	255	−9 SB	announced in 2010NewA...15..324G as astrometric binary, 36 y **[THIS STAR ONLY IN ONLINE VERSION OF TABLE]**	
β	TrA	15 56.9	−63 29	2.83	0.32	F0 IV	~80.8	2.4	40.4	0.444	205	0	*Spitzer Infrared Telescope* finds IR excess (debris disk?) ¶ rapid rotator (slightly < 1 d), with detectable magnetic field ¶ metals vary widely (some overabundant, some underabundant)	
π	Sco A	16 00.0	−26 10	2.89	−0.18	B1 V + B2 V	6	−3.4	600	0.029	203	−3 SB2	A: occ. bin.: 3.4 + 4.5, 1.57 d (more precisely, from AAVSO(VSX) as at 2019-01-02, 1.570103 d), circular orbit, possibly tidally locked, separation possibly ~0.07 AU; although system has been said to be of β Lyr type, the AAVSO(VSX) classification is, rather, “rotating ellipsoidal variable” (the stars so close as to gravitationally distorted into ellipsoids, but neither star deformed into the teardrop shape possible in one β Lyr scenario (the β-Lyr variability-type scenario, namely, in which a component becomes so grossly distended as to fill its Roche lobe; in any β Lyr variable, the shape distortion is by definition so severe as to leave no constant-light segments in the light curve)); V-mag range 2.88–2.91; inspection of AAVSO(VSX)	Fang

													suggests a present paucity in photometry (and Kaler at http://stars.astro.illinois.edu/sow/pisco.html additionally discusses some difficulties in astrophysical modelling) ¶ companion π pi Sco B, mag. 11.9 at angular distance 50″, shows only scant change over the WDS record (which starts in 1878, and currently ends in 1999); Kaler suggests separation > 8000 AU, period > 160,000 y ¶ E(B–V) =+0.08	
T	CrB	16 00.3	+25 52	10.08v	1.34	gM3: + Bep	—	0.6	2500?	0.011	329	−29 SB	recurrent nova 1866 (mag. 3), 1946 (mag. 2) only ten galactic recurrent novae are currently known (2010ApJS..187..275S; these are by definition novae known to recur, and yet lacking the short periods of dwarf novae) ¶ although documented here with its historically usual magnitude of 10.08, T CrB brightened from February 2015, attaining ~9.2 in April 2015 (with mag. 9.8, on the other hand, reported on 2018-11-15); Bob King in *Sky and Tel.* 2016-04-20 gives recent history, and AAVSO has a backgrounder at https://www.aavso.org/t-crb; next eruption 2026, or earlier? ¶ nova phenomenon is due to WD companion, orbit 227 d	
η	Lup A	16 01.4	−38 27	3.42	−0.21	B2.5 IVn	7	−2.2	440	0.033	211	+8 V	A: 3.47; B: 7.70, 15.0″, PA:22°→19°, 1834→2016 orbit ≥ 26,000 y: a hierarchical system, with remote outlier D at angular distance 135″ (separation ≥ 18,000 AU, period ≥ 750,000 y), with D experiencing the AB pair as essentially a point mass; η Lup C is not part of this (triple) system, C's angular proximity to AB being a mere line-of-sight coincidence ¶ although η Lup A is a rapid rotator (< 1.1 d), there is no evidence of a circumstellar disk, and in particular there seems to be no documentation of Be phenomenology ¶ η Lup B is chemically peculiar	
δ	Sco AB	16 01.5	−22 41	2.29	−0.12	B0.3 IVe + B3V	7	−3.6	500	~0.037	~196	−7 SB	periastron outbursts 2000, 2011 https://www.aavso.org/delta-scorpi has recent forum discussion, notably on choice of comparison stars for the visual observer; a typical recent AAVSO V-filter photometry report is 2018-07-19, mag. 1.713: classified at AAVSO(VSX) as a variable of the γ Cas type; consistently with this classification, the primary is a rapid rotator; www.aavso.org/vsots_delsco covers 2000–2011 ¶ AB: 10.8 y, 0.2″ (2016); http://stars.astro.illinois.edu/sow/dschubba.html discusses multiplicity (in all, possibly quadruple, with hierarchical organization; AB period is 20 d, separation ~0.4 AU) ¶ E(B–V)=+0.16	Dschubba
β	Sco AB	16 06.6	−19 51	2.56	−0.06	B0.5 V	8	−2.9	400	0.025	192	−1 SB	A: 2.78; B: 5.04, 0.3″ (2017); C: 4.93, 14″ in gross terms a visual binary, with separation ≥ 2200 AU, period > 16,000 y; but in fact putatively a sextuplet; https://en.wikipedia.org/wiki/Beta_Scorpii summarizes the sextuplet's hierarchy in a diagram (Aa with Ab (6.82 d), and B experiencing Aa+Ab as essentially a point mass (610 y); Ea with Eb (10.7 d), and C experiencing Ea+Eb as essentially a point mass (39 y); the B+AaAb triple is in a wide, > 16,000-y, orbit with the C+EaEb triple, around the centre of mass shared by this pair of triples, thereby delivering the gross visual-binary phenomenology) ¶ lunar occultations possible, planetary occultations possible-yet-rare (1971-05-14 occultation by Jovian satellite Io) ¶ the name Graffias is not IAU-official	Acrab
δ	Oph	16 15.4	−3 45	2.73	1.58	M1 III	~19.1	−0.9	171	0.150	198	−20 V	slow rotator ¶ high metallicity ¶ although δ Oph has finished core hydrogen fusion, its exact evolutionary state is uncertain (cf http://stars.astro.illinois.edu/sow/yedprior.html) ¶ naked-eye neighbor Yed Posterior is a mere line-of-sight coincidence, too greatly separated in space for true binarity; the "prior" and "posterior" in the traditional, and as of 2016 IAU-official, names denote the order in which these two (physically unrelated) stars cross the local meridian ¶ listed in NSV as a suspected variable;	Yed Prior

												1992IBVS.3792....1P finds no variability, but says that since NSV V-amplitude is just 0.03 mag, variability cannot be excluded	
ε Oph	16 19.4	−4 44	3.23	0.97	G9.5 IIIb	31	0.7	106	0.093	64	−10 V	CN and C notably underabundant, suggesting that ε Oph is an interloper from outside the galactic thin disk	Yed Posterior
σ Sco A	16 22.4	−25 38	2.91v	0.13	B1 III	5	−3.7	700	0.019	213	+3 SB	var.: 2.86–2.94, 0.25 d; B: 8.3, B9 V, 20.3″ (2016) recent studies, including lunar occultation measures, show σ Sco to be a quadruple system, with σ Sco A in fact a spectroscopic binary (33.0 d) in orbit with a B7 star at angular distance 9.4″ (period > 100 y); 2007MNRAS.380.1276N announces interferometric solution for the SB orbit, proposing for primary and secondary the respective MK types B1 III, B1 V; in the SB pair, the primary is a variable of the β Cep type (in 2018 November, AAVSO(VSX) gives V-mag. range 2.86–2.94, period 0.246839 d; 1992A&A...261..203P discusses period changes) ¶ photography shows σ Sco to be embedded in diffuse nebula ¶ E(B–V) =+0.4 (pronounced reddening)	Alniyat
η Dra A	16 24.3	+61 28	2.73	0.91	G8 IIIab	35.4	0.5	92	0.059	343	-14 SB?	B: 8.7, 4.4″, PA: 150°→143°, 1843→2015 orbit ≥ 1000 y, separation ≥ 140 AU ¶ η Dra A is a “clump star” in HR diagram (evolved, now stable, performing core He fusion) ¶ η Dra A is believed to be a slow rotator (~400 d) ¶ η Dra A is a modest X-ray source ¶ η Dra A is listed by NSV (Kukarkin et al.) as a suspected variable ¶ near the radiant of the η Draconids meteor shower	Athebyne
α Sco A	16 30.6	-26 28	1.06v	1.86	M1.5 Iab	6	-5.1	600	0.026	207	-26 SB	var.: 0.88–1.16; B: 5.37, 3.2″ (2016) PA: 273°→276°, 1847→2016; orbit 2500 y? AAVSO(VSX): semireg (with some discussion of period; cf also 2013AJ....145...38P, where a true period is found for radial-velocity variations, and the detected variation is judged to be more likely of pulsational than of orbital origin), V mag. 0.75–1.21 (but the variability has also been called irregular); 2018AuJAn..29...89H reports that variability was observed by, and incorporated into the oral tradition of, aboriginals in southern Australia; asserted by Eratosthenes to be fainter than β Lib, and by Ptolemy to equal β Lib ¶ radius has been studied interferometrically and via lunar occultations (up to 3.4 AU; however, even apart from the problem of pulsation, radius determination of highly evolved red stars is wavelength-dependent); one of the two first-magnitude supergiants (the other being α Ori) ¶ significant stellar wind, with mass loss almost 1e-6 $M_\odot$/y, within which α Sco B has created a locally ionized region ¶ the most massive member of the Sco-Cen Association (the nearest OB association) ¶ B shares in the proper motion of A, indicating true binarity: AB separation is ≥ 530 AU, period possibly ~1200 y ¶ location (within zodiac) makes the classical Greek name, for “rival of Mars”, appropriate not only as regards apparent colour but also as regards sky geometry	**Antares**
β Her	16 31.1	+21 27	2.78	0.95	G7 IIIa	23	-0.4	140	0.100	261	-26 SB	SB period computed 1908, and again 2008, in both cases ~410 d; 1977ApJ...214L..79B announces speckle-interferometry resolution of the SB, with angular distance 43 mas ¶ suspected variable (NSV (Kukarkin, et al., online) suggests V mag. range 2.76–2.81) ¶ X-ray emission from the SB primary indicates magnetic activity ¶ Kaler, noting that primary has N enhanced relative to C, says in his overall summation “a very normal star for its state of age” ¶ “Kornephoros” = Gk “club-bearer”, in reference to the weapon of Hercules (compare α Her, which in the pictorial-atlas tradition marks the hero’s head)	Kornephoros
τ Sco	16 37.1	-28 15	2.82	-0.21	B0 V	7	-3.0	500	0.025	203	+2 V	intrinsically more luminous than σ Sco, but more	

											heavily obscured by ISM ¶ anomalous in its UV lines (P Cyg profile) ¶ O and Fe are underabundant ¶ 2006MNRAS.370..629D discusses τ Sco magnetic topology (poloidal, with also a warped toroidal component of modest strength), including both its origin (more likely a fossil field from the star's (recent) birth than a dynamo effect) and its connection with winds and with the observed hard X-ray emission; the authors note that the topology is stable over the 1.5-y period of their observations (in contrast with a strongly differential-rotation star, such as Sun); in additionally announcing a (refined) rotation period of 41.033 d, the authors comment, "the second-slowest rotator so far known among high-mass stars" ¶ Kaler: "among the most-observed stars in the sky" ¶ E(B-V)=+0.06 ¶ the name Paikauhale was IAU-approved in 2018-08-10 (too late for inclusion in our printed-edition Handbook); the not-IAU-official "Al Niyat", or "the arteries of the Heart", denotes σ Sco and τ Sco jointly, as flanking α Sco
ζ Oph	16 38.2 -10 36	2.54	0.04	O9.5 Vn	9	-2.7	370	0.029	32	-15 V	¶ a rapid rotator, period possibly ~1 d (possibly close to breakup speed) ¶ a runaway star, with high-mass loss rate (bow shock detected), perhaps formerly the secondary in a binary pair whose primary perished in a supernova; 2011AN....332..147H confirms magnetic field, discusses X-ray properties, suggests PSR B1919+10 as remnant of the hypothesized defunct companion ¶ AAVSO(VSX), assigning V-magnitude range 2.56–2.58, follows GCVS in treating ζ Oph as a variable which is of MK spectral type Be, and yet which lacks the history of outbursts found in the γ Cas class; ζ Oph is, on the other hand, classified as γ Cas-variable (and is termed a shell star) in BSC5 (presenting some history of Hα absorption, Hα emission); still elsewhere, ζ Oph has been treated as a prototype for the "ζ Oph variables" ¶ 2011AN....332..147H confirms magnetic field, discusses X-ray properties ¶ E(B–V) =+0.32 (pronounced reddening; if ISM were not present, ζ Oph wold attain nearly first magnitude)
ζ Her AB	16 42.0 +31 34	2.81	0.65	G1 IV	93	2.7	35	~0.575	~307	−70 SB	A: 2.90; B: 5.53, G7 V, 1.3″ (2016), orbit 34.45 y orbit well studied since F.G.W.von Struve 1826 micrometry (however, it was Herschel, not von Struve, who discovered the binarity); separation 8 AU min, 21 AU max, 15 AU average, 34.45 y; one of the few binaries in which ratio of B mass to sum of A and B masses can be studied both astrometrically and spectroscopically ¶ ζ Her A is unusual in its evolutionary phase, being in the Hertzsprung Gap (and so in rapid evolutionary transition) ¶ 2001A&A...379..245M summarizes previous work, presents detailed physical modelling for A and B, and discusses astroseismology of A, remarking in conclusion that "among the binaries to be calibrated with some confidence, ζ Herculis is one of the most interesting owing to the difference of evolutionary state of components" ¶ high velocity relative to Sun
η Her	16 43.6 +38 53	3.48	0.92	G7.5 IIIb Fe–1	30.0	0.9	109	0.092	157	+8 V?	on HR diagram a "clump star" ¶ Fe is notably underabundant
α TrA	16 50.7 −69 04	1.91	1.45	K2 IIb–IIIa	~8.4	−3.5	390	0.036	150	−3	**Atria** anomalous for its MK type, with flares and X-ray emission, perhaps from as-yet-undetected magnetically active companion (a companion would indeed be indicated by the claimed "barium star" status of α TrA; http://stars.astro.illinois.edu/sow/atria.html, in discussing the possibility of a companion, also remarks, however, "the classic 'hybrid star', a giant that shows evidence for blowing a cool wind from its surface, yet having a hot surrounding magnetic corona at the same time";

													https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20040086627.pdf further discusses both α TrA and β Dra, as (solitary) stars which are in this particular posited sense “hybrid”	
ε	Sco	16 51.4	−34 20	2.29	1.14	K2 III	51	0.8	64	0.666	247	−3	slow rotator (possibly even 1.3 y) ¶ evolved, and yet not a clump star; http://stars.astro.illinois.edu/sow/epssco.html discusses the uncertainty in evolutionary stage (brightening, with He core as yet awaiting ignition? dimming, with He core fusion in progress? or brightening, with dead C-and-O core, He-core fusion now over?) ¶ high velocity relative to Sun indicates origin outside the galactic thin disk (and metal underabundances are consistent with such an origin)	Larawag
μ^1	Sco	16 53.2	−38 05	3.00v	−0.20	B1.5 IVn	7	−2.9	500	0.024	206	−25 SB2	ecl.: 2.94–3.22, 1.4 d (more precisely, in AAVSO(VSX) as at 2019-01-02, 1.44626907 d); semidetached, partially eclipsing, binary system, with mass transfer, resembling β Lyr in its never-constant light and in exhibiting both primary and secondary minima; 1948MNRAS.108..398S gives the light curve, and also discusses early observational history (this is the third SB discovery in astronomy (made by Bailey, 1896)); separation is ~0.07 AU ¶ μ^1 Sco and μ^2 Sco are not gravitationally bound, although both belong to the (gravitationally unbound) “Upper Sco” subgroup of the Sco-Cen Association	Xamidimura
κ	Oph	16 58.6	+9 21	3.19	1.16	K2 III	36	1.0	91	0.292	268	−56 V	slow rotator (possibly as slow as 1.6 y) ¶ historical assertion of variability may be due to a confusion between κ Oph and χ Oph; completely apart from this historical problem, however, 2001BaltA..10..593A discusses the possible variability both of κ Oph and of other HR diagram red-clump giants ¶ high velocity relative to Sun suggests origin outside the galactic thin disk	
ζ	Ara	17 00.2	−56 01	3.12	1.55	K4 III	7	−2.7	490	0.041	206	−6	one of the rather rare instances of a giant excessively bright in far IR (1997A&A...323..513P suggests that such giants are more likely to be radiating their IR excess from circumstellar debris disks than from winds, and so are to be considered evolved-star analogues of the unevolved (and IR-bright) α Lyr)	
ζ	Dra	17 08.8	+65 41	3.17	−0.12	B6 III	10	−1.8	330	0.028	314	−17 V	given the recent formation of ζ Dra, its Fe is anomalously underabundant ¶ E(B–V) =+0.03	Aldhibah
η	Oph AB	17 11.5	−15 45	2.43	0.06	A2.5 Va	37	0.3	90	~0.107	~22	−1 SB	A: 3.0; B: 3.5, A3 V, 0.5″ (2017), orbit 87.6 y highly eccentric orbit: separation 2 AU min, 65 AU max ¶ it is possible that A, or B, or both A and B, are superabundant in metals	**Sabik**
η	Sco	17 13.6	−43 16	3.32	0.44	F2 V:p (Cr)	~44.4	1.6	73	0.290	175	−28	although we are constrained by 2019 Handbook printed-edition workflow to display the Garrison legacy dwarf MK type “F2 V:p(Cr)” here (complexity of the legacy type hints at difficulties in classification; even “dwarf barium star” has been asserted elsewhere), it is also the case that NASA NStars assigns, in work summarized at 2006AJ....132..161G (with Garrison the third author) subgiant MK type F5 IV ¶ rapid rotator (< 1 d); the observed X-ray emission is consistent with magnetic effects (including coronal heating?) stemming from rapid rotation	
α	Her AB	17 15.5	+14 22	2.78v	1.16	M5 Ib–II	9	−2.4	400	0.032	347	−33 V	semiregular var.: 2.7–4.0; B: 5.4, 4.8″ (2017) PA: 117°→104°, 1777→2017; orbit > 3000 y; α Her A is strictly SB Aa+Ab (~10 y), and α Her B also strictly SB Ba+Bb (51.578 d, separation 0.4 AU), making α Her at least a (kinematically stable, hierarchically organized) quadruplet; more distant α Her C and α Her D are not necessarily gravitationally bound to the quadruplet; separation of Aa+Ab and Ba+Bb (each of these binaries experiencing its distant companion binary as essentially a point mass) is > 500 AU ¶ 1956ApJ...123..210D discusses mass	Rasalgethi

											loss from (in 21st-century nomenclature) α Her Aa, and the consequent circumstellar material (so copious as to encompass even Ba+Bb) ¶ https://en.wikipedia.org/wiki/List_of_largest_stars shows ranking of α Her Aa (radius ~1.5 AU, or more) in the overall known cosmic population of giants, supergiants, and hypergiants ¶ in classification of AAVSO(VSX), α Her Aa is a "semi-regular late-type giant", with V-magnitude range 2.73–3.60; 2001PASP..113..983P reports timescales both of 80–140 d and of 1000–3000 d, while underscoring the complexity of the variation (in their Figure 5, authors show light curve) ¶ in the pictorial-atlas tradition, α Her marks the head of hero Hercules (with β Her marking his club; for summer-evening observers in the Northern Hemisphere, the hero is to be visualized inverted, with feet high in the sky, club and head lower)	
π Her	17 15.7 +36 47	3.16	1.44	K3 IIab	8.7	−2.2	380	0.027	276	−26 V?	MK classification K3 has also been asserted ¶ low-amplitude photometric variations with low-amplitude radial-velocity variations, 613 d, perhaps favour the hypothesis of non-radial pulsation over the competing hypotheses of an undetected low-mass companion and of rotation-with-star spots	
δ Her	17 15.8 +24 49	3.12	0.08	A1 Vann	43.4	1.3	75	~0.158	~188	−40 SB	B: 8.8, 12.7″ (2013) is optical companion δ Her A, being SB (and also resolved as a binary in interferometry, with angular distance 60 mas; separation ≥ 1.45 AU, period ≥ 335 d), is strictly δ Her Aa+Ab ¶ δ Her Aa is a fast rotator (< 9 h) ¶ as with δ Her B, so also δ Her C and δ Her D, at respective angular distances 174″ (2013) and 192″ (2009), are most likely mere line-of-sight coincidences	Sarin
θ Oph	17 23.2 −25 01	3.27v	−0.19	B2 IV	~7.5	−2.4	440	0.025	197	−2 SB	var.: 3.25–3.31, 0.14 d http://stars.astro.illinois.edu/sow/thetaoph.html discusses uncertainties in multiplicity: perhaps SB with outlying, gravitationally bound, companion at angular distance 0.15″; the primary in the putative SB is a β Cep variable, 0.140531 d ¶ occasional lunar occultations	
β Ara	17 26.9 −55 33	2.84	1.48	K3 Ib–IIa	5	−3.6	600	0.027	199	0	slow rotator (possibly as much as 2.33 y) ¶ high metallicity ¶ not gravitationally bound to γ Ara AB	
γ Ara A	17 27.0 −56 24	3.31	−0.15	B1 Ib	~2.9	−4.4	1100	0.016	182	−3 V	broad lines for Ib; B:10.0,18.4″, PA:324°→326°, 1835→2016 orbit ≥ 135,000 y, separation ≥ 6200 AU ¶ γ Ara A is rapid rotator (both "~4.8 d" and "< 2.5 d" have been asserted, and yet rapid rotation is unusual for the (evolved) γ Ara A luminosity class ¶ 1997A&A...318..157P finds via IUE spectroscopy that, consistently with this rapid rotation, the stellar wind of γ Ara A may be equatorially enhanced (and more generally, that the wind is variable, and is structured with two components, its structure being not typical of stars in this portion of the HR diagram) ¶ γ Ara AB is not gravitationally bound to β Ara ¶ E(B–V) =+0.08	
β Dra A	17 30.9 +52 17	2.79	0.95	G2 Ib–IIa	8.6	−2.5	380	0.020	308	−20 V	B: 11.5, 4.4″, PA:13°→12°, 1889→1934 orbit ≥ 4000 y ¶ in evolutionary terms, β Dra A is somewhat unusual, as a yellow more-than-giant (having been a stable core-hydrogen fuser just 0.5 My ago, the star is in transition to being redder, and of still larger radius ¶ it is also odd that β Dra A, while lying in the HR diagram Instability Strip, has not been observed to pulsate ¶ the paucity of astrometric data for β Dra AB, as a visual binary system, is something of a further oddity	Rastaban
υ Sco	17 32.1 −37 19	2.70	−0.18	B2 IV	6	−3.5	600	0.030	185	+8 SB	although we here give spectral type B, type Be has also been asserted ¶ υ Sco and λ Sco are not gravitationally bound (although both belong to the (gravitationally unbound) Sco–Cen OB association, and have as an optical double been called the "Cat's Eyes")	Lesath

¶ E(B–V) =+0.02

α	Ara	17 33.4	−49 53	2.84	−0.14	B2 Vne	12	−1.7	300	0.075	206	0	SB

of spectral type Be (i.e., in emission (from equatorial ejecta)), and a shell star (i.e. ejecta are of high density, and are seen nearly edge-on, thereby yielding also spectral absorption); consistently with shell-star status, α Ara has possible photometric history of eruptions; physical-model paper 2007A&A...464...59M says, “For the first time, we obtain the clear evidence that the [equatorial ejecta] disk is in Keplerian rotation, closing a debate that has continued since the discovery of the first Be star γ Cas by Father Secchi”; on the authors’ modelling, α Ara is rotating near breakup speed (and consequently is oblate), with an enhanced wind from its poles; the authors assert the possibility that equatorial ejecta disk is truncated by an unseen companion at 32 stellar radii
¶ IR excess is unusually high for a Be star
¶ for problem of distance (the *HIPPARCOS* distance which we give here may be too high) cf 2005A&A...435..275C and 2007A&A...464...59M

λ	Sco **Shaula**	17 34.9	−37 07	1.62v	−0.23	B1.5 IV	6	−4.6	600	0.032	195	−3	SB2

ecl.?, var: 1.62−1.68, 0.21 d

strictly a hierarchical triple system, with orbits studied interferometrically in 2006MNRAS.370..884T: the narrow λ Sco A pair has period 5.9525 d, with eclipsing, and the wider λ Sco AB pairing has period ~1000 d
¶ although 2018 workflow constraints have obliged us to cite the *HIPPARCOS* distance in the printed-edition Handbook, a corrected, 50% smaller, distance became known to us after press time via 2006MNRAS.370..884T: generally speaking, *HIPPARCOS*, like other fine-grained-parallax measures of distance, risks degradation if a star has a stellar-mass gravitationally bound companion
¶ the primary in the λ Sco A pair is a β Cep variable; since full orbital coverage is available in this case (as also with β Cep itself; in most or all other β Cep-class cases, full orbital coverage is presently unavailable), mass determination becomes feasible, making the λ Sco A pair important in β Cep-variable research; the secondary in the λ Sco A pair is itself of interest, as a possible pre-Main Sequence star (this would be consistent with the observed X-ray emission)
¶ 1975MNRAS.173..709L gives some photometry
¶ a flare was observed in vicinity of λ Sco on 1975-06-01
¶ 2004A&A...427..581U summarizes previous work on λ Sco, discusses masses, discusses tidal effect on β Cep pulsation
¶ λ Sco and υ Sco are not gravitationally bound (although both belong to the (gravitationally unbound) Sco-Cen OB association, and have as an optical double been jointly called the “Cat’s Eyes”)
¶ E(B–V) =+0.03

α	Oph	17 35.8	+12 33	2.08	0.16	A5 Vnn	67	1.2	49	0.247	154	+13	SB?

Rasalhague

strictly α Oph AB, with α Oph A a fast rotator (oblateness has been imaged interferometrically); the binary system has become better understood with the recent, 2011ApJ...726..104H, determination of masses and orbit geometry, through coronagraph and adoptive optics (period 3148.4 d, angular distance at periastron passage ~50 mas; the now-achieved determination of masses in this particular system has implications for astrophysics generally, since it potentially facilitates the refining of numerical models for rapidly rotating hot stars)
¶ astroseismology mission *MOST* has identified ~50 pulsational modes in α Oph A

ξ	Ser	17 38.7	−15 25	3.54	0.26	F0 IIIb	31	1.0	105	0.073	215	−43	SB

hierarchically organized triple system, comprising ξ Ser Aa and ξ Ser Ab, experienced as essentially a point mass by the outlying ξ Ser B; period of single-lined SB Aa+Ab is 2.29 d, with angular distance (in 1987) 0.30″;

													B is mag. 13.0, at angular distance 24.9″ (2012), with PA: 81°→78°, 1943→2012, and period possibly ~15,000 y ¶ although in our printed Handbook edition we give a Garrison-determined MK type without discussion of multiplicity, ξ Ser Aa has been asserted to be very slightly hotter than Garrison's "F0 IIIb", and moreover to be chemically peculiar, being on this (more recent?) determination of MK type A9 IIIp Sr; additionally, somewhere in the literature, δ Sct variability has been asserted or conjectured (Kaler comments at http://stars.astro.illinois.edu/sow/xiser.html: "the star /…/ remains cryptic") **[THIS STAR ONLY IN ONLINE VERSION OF TABLE]**	
θ	Sco	17 38.7	−43 00	1.86	0.41	F1 III	~11	−3.0	300	0.006	119	+1	rapid rotator, in the sense that *v* sin *i* is (according to 2005yCat.3244....0G) 125.0 km/s; since, however, θ Sco is a (rapidly evolving) giant, its high *v* sin *i* may correspond to a not-spectacularly short rotation period, of up to 10 d ¶ optical companion, mag. 5.36, 6.50″; PA: 322°→315°, 1896→1991 ¶ although it is the Sumerian name Sargas that is IAU-official as of 2016-08-21, θ Sco, like κ Sco, has also been known under the different, not IAU-official, name Girtab (originally applied by the Sumerians to an entire asterism)	Sargas
κ	Sco	17 43.8	−39 02	2.39	−0.17	B1.5 III	7	−3.5	480	0.026	193	−14 SB	κ Sco AB has orbital period 195.65 d, with separation 1.7 AU ¶ κ Sco A is a rapid rotator (1.9 d), and additionally is a variable of β Cep type (0.1998303 d, V mag. 2.41-2.42; 1975MNRAS.173..709L gives some photometry, confirming a beat period) ¶ κ Sco, as a single naked-eye object, has (like θ Sco) been known under the different, not IAU-official, name Girtab (originally applied by the Sumerians to an entire asterism)	
β	Oph	17 44.4	+4 34	2.76	1.17	K2 III	~39.8	0.8	82	0.165	345	−12 V	1996ApJ...468..391H finds multiple pulsation periods, in behavior paralleling α Boo ("it may well be that these [two] stars represent a new class of radially and un-radially pulsating stars"), and also a possible long period of 142.3 d; the authors suggest that if the latter is real, then although the more likely explanation is a 142.3-d rotation, nevertheless gravitational pull from an unknown exoplanet is conceivable	Cebalrai
μ	Her A	17 47.2	+27 43	3.42	0.75	G5 IV	~120.3	3.8	27.1	0.804	201	−16 V	BC: 9.78, 35.5″, PA:240°→249°, 1781→2015 orbit ≥ 3700 y: stable quadruple system, in fact the third-closest quadruple star system to Sun; system is organized as a "double double," being one of the best-studied such systems (2016AJ....151..169R consequently says μ Her "serves as an archetype for understanding stellar system formation"): μ Her Aa+Ab is in tight orbit, and μ Her B+C is in tight orbit, with each of these two pairs experiencing the other as essentially a point mass; 2016AJ....151..169R gives Aa+Ab a period of ~100 y, with wide uncertainties, concluding also that Ab is an M-dwarf (as opposed to a mere substellar object); B+C has period 43.127 y, separation 1.5 AU min, 3.6 AU max, 2.2 AU average; the separation of the Aa+Ab centre of mass from the B+C centre of mass is ≥ 300 AU, with orbital period ≥ 3700 y ¶ despite having finished core-hydrogen fusion, μ Her Aa is a fast rotator, and is consequently magnetically active and an X-ray source	
ι^1	Sco	17 49.0	−40 08	2.99	0.51	F2 Ia	2	−5.9	2000	0.006	180	−28 SB	a rare instance of a yellow supergiant (dead He core; the star is now cooling, and is so now in transition to the less exotic status of red supergiant) ¶ radius estimates vary; CADARS	

													(2001A&A...367..521P) value is ~1.9 AU ¶ mass loss ~1e-7 $M_\odot$/y ¶ slow rotator (≥ 0.5 y) ¶ distance and mass are rather uncertain ¶ the modest angular distance of ι^1 Sco from ι^2 Sco is the result of a mere line-of-sight coincidence (with ι^2 ~2 times as distant as ι^1; again by coincidence, not ι^1 alone, but also ι^2, is a supergiant)
	G Sco	17 51.2	−37 03	3.19	1.19	K2 III	25.9	0.3	126	0.049	56	+25	HR6630, Fuyue although masses of K giants are in general uncertain, in this particular case the mass is known via WIRE salvage-mission astroseismology (being determined in 2008ApJ...674L..53S as 1.44 $M_\odot$, with just a 15% uncertainty)
γ	Dra	17 57.1	+51 29	2.24	1.52	K5 III	21.1	−1.1	154	0.024	200	−28	**Eltanin** in 1728, James Bradley used γ Dra to demonstrate aberration of light (“velocity aberration”); his demonstration strongly confirmed the heliocentric (and thus non-Ptolemaic) kinematics of Solar System ¶ Fe is slightly underabundant
ν	Oph +2P	18 00.1	−9 46	3.32	0.99	G9.5 IIIa	22	0.0	150	0.117	185	+13	brown-dwarf companions, with masses ≤ 24x Jupiter and ≤ 27x Jupiter (deuterium fusion begins at a lower mass, 13x Jupiter), periods 530.3 d and 3190 d (Quirrenbach et al. 2011, and additionally 2012PASJ...64..135S; the latter paper suggests formation in circumstellar disk, with subsequent migration, in a scenario reminiscent of planet and exoplanet formation): this is the third star found to be hosting two brown dwarfs ¶ slow rotator (≤ 234 d) ¶ far-IR variability has been suspected ¶ CN underabundant, Fe overabundant
γ^2	Sgr	18 07.1	−30 25	2.98	0.98	K0 III	34	0.6	97	0.189	197	+22 SB	Alnasl metals underabundant ¶ ε Sgr and the γ^2–γ^1 Sgr pair serve as pointers to Baade’s Window ¶ angular proximity of γ^1 Sgr (= W Sgr; ~50 arcmin, to ~N of γ^2 Sgr) is a mere line-of-sight coincidence
η	Sgr A	18 18.9	−36 45	3.10v	1.5	M3.5 IIIab	22	−0.2	~146	0.211	218	+1 V?	irreg. var.: 3.05–3.12; B: 8.33, G8: IV:, 3.5″ (2016) PA:100°→110°, 1879→2016; orbit ≥ 1270 y, separation ≥ 165 AU ¶ η Sgr A is variously asserted to be on the (very highly evolved) HR diagram AGB or at the tip of the RGB ¶ η Sgr A is in the AAVSO(VSX) classification an “LB”, i.e. a slow irregular variable ¶ temperature of η Sgr A not yet well determined?
δ	Sgr	18 22.2	−29 49	2.72	1.38	K2.5 IIIa	9	−2.4	350	0.041	128	−20 V?	Kaus Media possibly a weak barium (Ba) star, δ Sgr A possesses (as expected for a Ba star) a WD companion ¶ temperature of δ Sgr A not yet well determined? ¶ “Kaus” is Arabic “bow”, with Kaus Borealis (λ Sgr), Kaus Media (δ Sgr), and Kaus Australis (ε Sgr) the three delineating stars of the archer’s bow; by coincidence, the archer turns out to be aiming rather close both to Baade’s Window and (prolonging the line of firing) to the Sgr A black hole at the galaxy’s centre
η	Ser	18 22.3	−2 54	3.23	0.94	K0 III–IV	54	1.9	~60.5	0.890	218	+9 V?	slow rotator (but ≤ 1.9 y) ¶ high velocity relative to Sun suggests that η Ser is an interloper (born outside the galactic thin disk? consistently with this conjecture, Fe is underabundant)
ε	Sgr	18 25.5	−34 22	1.79	−0.03	A0 IIn (shell?)	23	−1.4	~143	0.130	198	−15	**Kaus Australis** fast rotator (consistent with shell-star classification); as might be predicted for a fast rotator, a magnetic field, and also X-ray emission, have been detected ¶ has been classified as a λ Boo star, apparently in error ¶ IR excess indicates debris disk (possibly also detected in polarimetry), at average separation 155 AU; and yet a companion is also asserted, surprisingly present within this radius
α	Tel	18 28.4	−45 57	3.49	−0.18	B3 IV	12	−1.2	280	0.056	198	0 V?	http://stars.astro.illinois.edu/sow/alphatel.html remarks that MK luminosity class IV notwithstanding, α Tel is still on the astrophysical (as opposed to the MK-phenomenological) Main Sequence (in other words, is still fusing core hydrogen)

													¶ said in 2005ApJS..158..193S to be among the (rare) He-rich stars; these authors list α Tel as a candidate-and-unconfirmed β Cep variable, and say they suspect it is a variable in the slowly pulsating B-star class; although α Tel has *HIPPARCOS* microvariability (0.909 d), it is absent from the AAVSO(VSX) database **[THIS STAR ONLY IN ONLINE VERSION OF TABLE]**	
λ	Sgr	18 29.2	−25 25	2.82	1.02	K1 IIIb	~41.7	0.9	78	0.191	194	−43 V?	modest X-ray emission indicates some magnetic activity (not usual in a duly evolved, stable core-He-fusing, HR diagram “clump star” ¶ lunar occultations are possible, planetary occultations possible—yet-rare; most recent planetary occultation was by Venus, on 1984-11-19 ¶ unusual in occupying fully three roles in the Western pictorial traditions: as northernmost star of the Archer’s Bow, as westernmost (handle-tip) star of the Little Milk Dipper, and as uppermost (lid-knob) star in the Teapot	Kaus Borealis
α	Lyr	18 37.6	+38 48	0.03	0.00	A0 Va	130	0.6	25.0	0.350	35	−14 V	pole-on rapid rotator with circumstellar disk 2007ASPC..364..305G reviews the history of, and the persisting difficulties in, modelling: spectroscopy, and above all interferometry (cf 2006ApJ...645..664A) suggest α Lyr is a rapid rotator (attaining > 90% of breakup speed, with 2015A&A...577A..64B taking period as 0.678 d), and is seen nearly pole-on; it is the star’s oblate spheroid shape, with its consequent latitude-varying photosphere (severe temperature and luminosity gradients along the arcs of photospheric longitude, with equator coolest and darkest), rather than any evolution beyond core-hydrogen-fusion stage, that explains the anomalously high luminosity (α Lyr is in MK luminosity class Va, rather than in the V class that would be observed if its orientation was equator-on); these latitude variations, including possible convection at equator, complicate the efforts to assign a metallicity (for metallicity, notably for the status of α Lyr as mildly metal-weak, cf 1990ApJ...348..712A (published, however, before the current modelling became available)) ¶ because of its IR excess, indicating debris disk, α Lyr has become the prototype of the “Vega-excess stars”: 2005ApJ...628..487S reports SST IR determinations (including imaging), refining earlier IRAS IR (most dramatically from SST, disk radius 815 AU at 169 µm, with an inner boundary (in the sense that no inward material can be detected at SST wavelengths at radius ~90 AU): the authors suggest α Lyr has an analogue of the Kuiper Belt, with the star’s current observed debris disk, comprising perhaps a few tenths of our Moon’s mass, the ephemeral product of a recent collision event at ~100 AU, the post-collision grains (conceivably in silicates, or in silicates and amorphous carbon) being thrust out to the observed large radius by the star’s radiation pressure (but elsewhere in the literature, a competing, steady-state, model is defended) ¶ additionally, 2011A&A...534A...5D discusses hot inner exozodiacal-dust disk: on the authors’ preferred model, the near-IR emission is dominated by ~µm-sized carbonaceous and silicate grains orbiting between 0.1 AU and 0.3 AU from α Lyr; this paper, like 2005ApJ...628..487S, favours a scenario of dust replenishment from recent large-body collision(s) over a steady-state scenario, and indeed proceeds to draw a parallel with our own planetary system’s Late Heavy Bombardment, suggesting the possibility of unseen planets ¶ 2007ASPC..364..305G, reviewing the history of α Lyr photometry, considers modest variability likely (and indeed α Lyr is classified at AAVSO(VSX) as a low-amplitude δ Sct variable, with period 0.19 d) ¶ α Lyr is a weak X-ray source (little or no	**Vega**

												corona? or coronal hole at pole?), and yet 2009A&A...500L..41L finds magnetic field (line-of-sight component has magnitude ~0.6 G, comparable in strength to Earth's field and Sun's dipole field; field is conceivably of ISM-fossil origin, conceivably instead of dynamo origin; the authors comment that α Lyr "is probably the first member of a new class of yet undetected magnetic A-type stars"); consistently with magnetism, 2015A&A...577A..64B finds, via line-profile variations, multiple (bright, not dark) star spots, in some undetermined complex pattern (the authors comment that this is "first strong evidence that standard A-type stars can show surface structure"); additionally, the authors discuss possibility of a close Jupiter-mass exoplanet ¶ E(B–V) =0.00	
φ Sgr	18 46.9	−26 58	3.17	−0.11	B8 III	14	−1.2	240	0.051	89	+22 SB	apparent duplicity now discounted (erroneous lunar-occultation observation) ¶ http://stars.astro.illinois.edu/sow/phisgr.html discusses some difficulties in physical modelling (if pole-on rotator, then there will be troublesome temperature and luminosity gradients along the arcs of photospheric longitude)	
β Lyr	18 50.8	+33 23	3.52v	0.00	B7 Vpe (shell)	~3.4	−3.8	~960	0.004	152	−19 SB	ecl.: 3.30–4.35, 13 d period is increasing at constant rate of ~19 s/y; orbit is seen nearly edge-on; prototype of the β Lyr class of eclipsing systems (but has also been assigned to the new class of "W Ser stars": 1980IAUS...88..251P); AAVSO supplies information both via VSX database (showing, e.g. the high-precision recent determinations of period) and via https://www.aavso.org/vsots_betalyr (a detailed astrophysics discussion, with bibliography): alternating deep and shallow visible-light minima, with the object eclipsed in the deep minima (the "donor") a Roche-lobe-filling giant, currently ~3 $M_\odot$ and diminishing, and the object eclipsed in the shallow minima (the "gainer") embedded in a thick accretion disk, currently ~13 $M_\odot$ and increasing; mass transfer is copious (~2e-5 $M_\odot$/y); this disk renders the gainer dim, and its eclipses consequently shallow, even though the (presently dim) gainer is (now, at this rather late stage in mass transfer) already ~4 times more massive than the (bright) donor (cf 1963ApJ...138..342H); further, instabilities in the accretion disk, from which ~20% of the light comes, make the light curve liable to vary slightly from cycle to cycle; the presently dim gainer is destined to be first (1) brightening, and spun up by conservation of angular momentum, as its obscuring accretion disk disappears by being dumped down into photosphere, and then (2) to become a slower rotator, tidally locked with the secondary; at stage "(1)", the system will be a so-called "Rapidly Rotating Algol", at stage "(2)", on the other hand, the system will be simply a "classical Algol" ¶ 2008ApJ...684L..95Z presents the first (CHARA-interferometric) binary-resolving imaging, achieving resolution ~0.5 mas or ~0.7 mas (and for the first time in astrophysics deduces a β Lyr astrometric orbit); the bright low-mass donor, and the presently dim high-mass gainer, are evident, corroborating the overall conception of 1963ApJ...138..342H ; 2008ApJ...684L..95Z discusses also polar outflow jets on the gainer (these do not alter the essential situation: for the gainer, equatorial gain exceeds polar loss), and deduces a distance to ±15% (a distance consistent-to-within-uncertainties with the *HIPPARCOS* distance) ¶ 2012ApJ...750...59L discusses possible hot spot at edge of accretion disk, on the basis of spectropolarimetry (and 2013MNRAS.432..799M has modelling that provides for a hot spot, and additionally for a bright spot, on the accretion disk) ¶ some observations have been made in radio and (a regime especially relevant to hot-spot studies) X-ray ¶ strictly speaking, this is a hierarchical system, with the just-discussed pair becoming, in the updated nomenclature now canonical in multiplicity studies, "β Lyr Aa1" and "β Lyr Aa2"; for the Aa+Ab pairing, and for possibility of further pairings (AB, AC, …, Be, …), cf WDS	Sheliak

		RA	Dec	V	B–V	Spectral type	π	M	d	μ	PA	RV	Remarks	Name
													and (a source that reports inter alia *Gaia*) https://en.wikipedia.org/wiki/Beta_Lyrae ¶ although we here, following Garrison, assign a rather straightforward spectral type, this should be taken only as a starting point: cf, eg., 2000A&A...353.1009B, which lists six systems of spectral lines, while repeating an old O.Struve warning that spectrum involves circumstellar matter ¶ Kaler comments in http://stars.astro.illinois.edu/sow/sheliak.html "one of the most confusing, heavily studied, and important stars of the nighttime sky" ¶ the rather long period, with the large magnitude swing, and the readily discoverable difference in depths of the alternating minima, make this object a suitable binoculars-or-naked-eye photometry project (using γ Lyr as a comparison) even from locations suffering rather frequent cloud **[THIS STAR ONLY IN ONLINE VERSION OF TABLE]**	
σ	Sgr	18 56.5	−26 16	2.05	−0.13	B3 IV	14	−2.2	230	0.056	164	−11V	fast rotator ¶ lunar occultations are possible, and planetary occultation possible-yet-rare (most recently Venus, 1981-11-17) ¶ E(B–V) =+0.02	**Nunki**
ξ^2	Sgr	18 58.9	−21 05	3.52	1.15	K1 III	9	−1.7	400	0.034	113	−20	occultations (at any rate lunar) are possible ¶ the angular proximity of ξ^1 Sgr is a mere line-of-sight coincidence **[THIS STAR ONLY IN ONLINE VERSION OF TABLE]**	
γ	Lyr	18 59.7	+32 43	3.25	−0.05	B9 II	5	−3.1	600	0.003	290	−21 V	has been both asserted and denied to be SB ¶ 2001A&A...371.1078A reports many metals underabundant	Sulafat
ζ	Sgr AB Ascella	19 03.8	−29 51	2.60	0.06	A2 IV–V + A4:V:	37	0.4	90	n.a.	n.a.	+22 SB	A: 3.2; B: 3.5, 0.6″ (2017), orbit 21.1 y separation 10.6 AU min, 16.1 AU max, average 13.4 AU ¶ http://stars.astro.illinois.edu/sow/ascella.html discusses uncertainty in masses, remarks that temperatures are not yet directly measured ¶ angular proximity of Sgr C (17.6″ in 2013) is probably a mere line-of-sight coincidence	
ζ	Aql A	19 06.3	+13 54	2.99	0.01	A0 Vann	~39.3	1.0	83	0.096	184	−25 SB	among the most rapidly rotating stars known (period 16 h) ¶ in the angular-proximity grouping ζ Aql A, B, C, D, E, B is considered a gravitationally bound companion of A (mag. 12; angular distance 7.20″ in 2009; separation ≥ 125 AU, period ≥ 800 y); additionally, faint (mag. 16.20) E shares in the AB proper motion, and so is likely gravitationally bound ¶ 2008A&A...487.1041A reports near-IR excess around ζ Aql A, and suggests that an unseen close companion is a more likely source than a close-in hot debris disk	Okab
λ	Aql	19 07.3	−4 51	3.43	−0.10	B9 Vnp (kB7HeA0)	26	0.5	120	0.093	192	−12 V	rapid rotator (< 21h) ¶ possibly SB ¶ suspected chemically anomalous (metals-weak, in λ Boo class)	
τ	Sgr	19 08.2	−27 38	3.32	1.17	K1.5 IIIb	27	0.5	120	0.255	191	+45 SB	high velocity relative to Sun suggests origin outside galactic thin disk; underabundance of metals is consistent with this conjecture ¶ slow rotator (≤ 270 d) ¶ possibly SB	
π	Sgr ABC	19 10.9	−20 59	2.88	0.38	F2 II–III	6	−3.1	500	0.036	182	−10	triple system, with AB–C poorly measured B is at angular distance 0.10″ (1989) from A: PA: 152°→179°, 1936→1989; separation ≥ 13 AU, orbit ≥ 15 y; C (mag. 6) was observed in 1936 and 1939 to be at angular distance ~0.3″ from AB (separation ≥ 40 AU, orbit ≥ 100 y), but seems not to have been more recently measured ¶ in HR-diagram terms, π Sgr A lies on blue edge of Instability Strip, without being presently observed to pulsate ¶ lunar occultations of ABC are possible, planetary occultations possible-yet-rare (next by Venus, 2035-02-17)	Albaldah
δ	Dra	19 12.6	+67 42	3.07	0.99	G9 III	33.5	0.7	97	0.133	46	+25 V		Altais
δ	Aql	19 26.5	+3 09	3.36	0.32	F2 IV	64	2.4	51	0.268	72	−30 SB	fast rotator (> 0.9 d) ¶ binary; 1989AJ.....98..686K, addressing the difficulty posed by fast-rotator line broadening, refines previously computed orbital elements spectroscopically, finding period 3.426 d ¶ http://stars.astro.illinois.edu/sow/deltaaql.html discusses points of uncertainty (incl. the just-mentioned	

binarity, and possible δ Sct variability; δ Aql
is not presently (2018) in the AAVSO(VSX) database

β	Cyg A	19 31.5	+28 00	3.36	1.09	K3 II + B9.5 Ve	10	−2.3	330	0.009	229	−24 V	Albireo

B: 5.11, 35″; Aa, Ac: Δm = 1.5, 0.4″ (2008)
if AB is true binary, orbit is possibly ≥ 100 000 y;
the competing mere-optical-companions thesis
is argued by Bob King in *Sky & Tel* 2016 Sep. 21;
same conclusion is reached in 2018 by P.Plait at
https://www.syfy.com/syfywire/long-standing-astronomical-mystery-solved-albireo-is-not-a-binary-star,
on strength of fresh *Gaia* data (which yield for
β Cyg B **π** = 8.4 mas ±2%, implying
distance for β Cyg B, to two significant figures,
390 ly; however, further analysis is needed, since
astrometry of β Cyg A is potentially perturbed
by the multiplicity of A (a troubling multiplicity,
perhaps greater than mere (close) binarity:
https://en.wikipedia.org/wiki/Albireo
recaps literature, with some reference to
recent interferometry)
¶ our values, for β Cyg A, of **π** = 10 mas (strictly,
9.5 mas ± 6.0%), with **d** consequently computed
to two significant figures as 330 ly, are taken
uncritically from *Gaia* ~2018, rather than (as in
our previous Handbook editions) from *HIPPARCOS*;
we do not here attempt a critical investigation of
uncertainties
¶ β Cyg B is a fast rotator (< 0.6 d), and consistently
with this is in emission (as "Be", rather than
plain "B")
¶ β Cyg B is a close binary (companion of mag. 9.2,
at angular distance 0.4″; high eccentricity, with
average separation ~40 AU, period almost 100 y)

δ	Cyg AB	19 45.6	+45 11	2.86	0.00	B9.5 III	20	−0.7	160	~0.066	~42	−20 SB	Fawaris

B: 6.4, F1 V; 2.7″, PA:41°→217°, 1826→2016
orbit 780 y; separation 84 AU min, 230 AU max,
157 AU average, period 780 y
¶ δ Cyg A is a rapid rotator
¶ δ Cyg C is gravitationally bound to the
AB pair: mag. 12, angular distance (2017) 62.5″,
PA only slightly changed over the interval 1913–2017
¶ variability has been suspected both in A and in B
¶ E(B–V)=+0.05

γ	Aql	19 47.2	+10 40	2.72	1.51	K3 II	~8.3	−2.7	390	0.017	100	−2 V	Tarazed

radius ~0.5 AU
¶ variability has been asserted
¶ a rare instance of a "hybrid" star (possessing a
(hot) corona, like our Sun's, and yet also
emitting the cool high-mass wind typical in
an evolved star

α	Aql	19 51.7	+8 55	0.76	0.22	A7 Vnn	195	2.2	16.7	0.660	54	−26	**Altair**

rapid rotator (~9 h): 2007Sci...317..342M
announces CHARA imaging with angular resolution
~0.65 mas (the first direct imaging of any Main
sequence star other than the Sun;
http://news.bbc.co.uk/2/hi/science/nature/6709345.stm
is a news writeup);
2007Sci...317..342M shows oblate
rotation-flattened photosphere,
brighter at pole than at equator; the authors argue
that a new, improved generation of rapid-rotator
models is now needed, going beyond traditional
von Zeipel (with, they suggest, successful future
modelling of their imaging result *(a)* possibly
requiring convection at low latitudes,
and *(b)* possibly requiring higher photosphere
rotation rate at low than at high latitudes, and
(c) possibly requiring a more refined treatment
of opacities
¶ found in 2005ApJ...619.1072B,
via WIRE salvage mission, to be δ Sct
variable (making it the brightest δ Sct
variable, a classification now followed by
AAVSO(VSX)); the 2005ApJ...619.1072B
authors suggest that many δ Sct variables
in the HR diagram Instability
Strip may be oscillating at such
low amplitudes as to evade detection except by
such specially sensitive facilities as WIRE
(their suggestion helps relieve a longstanding
astrophysical bafflement over Instability Strip
stars which seem inexplicably non-pulsating)
¶ low latitudes of α Aql are source of weak
X-rays: 2009A&A...497..511R says they

													may therefore harbour localized dynamo activity and localized corona (a conjecture consistent with the above-noted 2007Sci...317..342M suggestion of photosphere convection at low latitudes)	
η	Aql	19 53.5	+1 03	3.87v	0.63	F6–G1 Ib	2	−4.3	1000	0.011	140	−15 SB	Cepheid var.: 3.49–4.30, 7.2 d more precisely, AAVSO(VSX) as at 2019-01-03 gives 7.17679 d, adding also that BSC5 asserts 7.176641 d with period changes; 2002ApJS..140..465B (in centre panel of the author's Fig 1) gives (1990s?) photometry (to tighter than ±10 millimag), colour, and radial-velocity curves ¶ hot companion resolved with HST WFC3 (cf 2013AJ....146...93E: the authors, combining this WFC3 work with other work, conclude that η Aql is a triple; their hot-companion binarity result is astrophysically important, as supporting the quest for Cepheid masses, and so ultimately supporting the study of the (astrophysically crucial) Cepheid period-luminosity relation ¶ in the case of novice Northern Hemisphere observers troubled by frequent cloud, its rather long period makes η Aql a better high-amplitude Cepheid demonstration than the more celebrated δ Cep	
γ	Sge	19 59.6	+19 33	3.51	1.57	M0 III	13	−1.0	260	0.070	71	−33 V?	**[THIS STAR ONLY IN ONLINE VERSION OF TABLE]** radius 0.26 AU (from interferometry; the disk subtends an angle of 6.18 mas) ¶ slightly variable; already has a dead carbon core, is not yet a Mira	
θ	Aql	20 12.3	−0 46	3.24	−0.07	B9.5 III	11	−1.5	290	0.036	81	−27 SB2	**[THIS STAR ONLY IN ONLINE VERSION OF TABLE]** SB 17.1 d, separation ~0.26 AU; 1995AJ....110..376H gives orbital parameters, from interferometry ¶ θ Aql A is metal-rich	
β	Cap A	20 22.1	−14 43	3.05	0.79	K0: II: + A5: V:n	10	−2.0	300	0.046	81	−19 SB	hierarchical quintuplet (or greater) https://en.wikipedia.org/wiki/Beta_Capricorni has a diagram summarizing the known gravitationally bound hierarchy: Aa, Ab1 (seen), Ab2 (unseen), Ba, Bb, where Aa is mag. 3.1, Ab1Ab2 is mag. 4.9, Ba is mag. 6.2, Bb is mag. 9.1; WDS also lists, as nearby in angular distance, C (mag. 8.8, 226″), D (mag. 13.0, 116″), and E (mag. 14.4, 3.9 ″ from D): Ab1, Ab2 period is 8.7 d; Aa experiences Ab1Ab2 as essentially a point mass, recently at angular distance 50 mas (period 3.77 y, separation ~4 AU); Ba, Bb 0.5″, according to WDS (and yet https://en.wikipedia.org/wiki/Beta_Capricorni states 3″), PA: 106°→57°, 1884→2017; AB 205″, PA: 268°→267°, 1800→2012; each of AaAb, BaBb experiences the other as essentially a point mass, at separation ≥ 0.34 ly, with the AaAb+BaBb orbit ≥ 700,000 y ¶ spectral type of β Cap A is controverted ¶ β Cap A is overabundant in Hg, Mn, and several other heavy elements ¶ lunar occultations are possible, planetary occultations possible-yet-rare	Dabih
γ	Cyg	20 22.9	+40 19	2.23	0.67	F8 Ib	2	−6.5	2000	0.003	111	−8 V	BC combined light is mag. 11, with B, C mags 10.0, 11.0, respectively; A, BC angular distance 147″ in 2010, with PA unchanged since 1877; however, http://stars.astro.illinois.edu/sow/sadr.html considers the A+BC pairing to be a mere line-of-sight coincidence (and WDS gives the following for BC: 1.9″ in 2015, PA: 305°→302°, 1878→2015) ¶ unusual in being not only a supergiant, but a supergiant in MK type F (among supergiants, it is the hotter and the cooler types that are more usually encountered); γ Cyg A is near the HR diagram Instability Strip: 2010AJ....140.1329G first surveys the observational literature, then discusses spectral variations (possibly pulsation-style oscillation, or alternatively large convection cells are possible; and indeed convection cells can be a driver of oscillation)	Sadr

													¶ radius ~1 AU (http://stars.astro.illinois.edu/sow/sadr.html discusses uncertainty) ¶ BSC5: “no demonstrable connection” between γ Cyg and the so-called γ Cyg supernova remnant	
α	Pav	20 27.2	−56 40	1.94	−0.12	B2.5 V	18	−1.8	180	0.086	175	+2 SB	SB 11.753 d, separation 0.21 AU ¶ 1988A&A...201..273V discusses galactic-astronomy implications of this star’s puzzling deuterium paucity ¶ E(B–V)=+0.02 ¶ the name, although anomalously English, is nevertheless IAU-official: its origins lie in the interwar RAF Air Almanac project, which directed HM Nautical Almanac Office that no air-navigation star was to be left nameless	**Peacock**
α	Ind	20 38.9	−47 13	3.11	1.00	K0 III CN–1	33	0.7	98	0.083	37	−1	Fe overabundant (α Ind born in metal-rich ISM cloud?)	
α	Cyg	20 42.1	+45 21	1.25	0.09	A2 Ia	2	−6.9	~1400	0.003	47	−5 SB	blue supergiant (BSG), of radius ~0.5 AU or ~1 AU; for context pertaining to this particular BSG in the general population of hypergiants and supergiants, cf https://en.wikipedia.org/wiki/List_of_largest_stars (which adopts “~1 AU”); for current state of theoretical investigations into BSG populations (crossing Hertzsprung-Russell diagram for the first time, redward? or, rather, after an RGB episode of mass loss, crossing for the second time, blueward?) cf, e.g., 2014MNRAS.439L...6G ¶ the prototype of the α Cyg variables: AAVSO(VSX) gives V ranges 1.21-1.29; seemingly irregular (in the α Cyg variables, many short-period oscillations are superimposed); 2011AJ....141...17R discusses α Cyg reporting a 1977-through-2001 campaign in both photometric and spectroscopic variability ¶ α Cyg core hydrogen-fusion career started in MK spectral type B, or possibly even in the rare MK spectral type O ¶ present mass loss rate is ~8e-7 $M_{\odot}$/y ¶ slow rotator (period possibly as long as 0.5 y, consistently with its large radius and its ongoing mass loss) ¶ public-outreach astro audiences enjoy comparing and contrasting distance, and therefore intrinsic luminosity, of α Cyg with distance, and therefore intrinsic luminosity, of the other two Summer Triangle stars (nearby α Lyr, nearby α Aql; all three are similar not only in their apparent magnitudes, but also in falling within MK type A, and consequently in lacking tint, even through binoculars); it is perhaps worth stressing in such lectures that the α Cyg distance, although large (1500 ly? more?), is nevertheless not yet well known; Kaler in http://stars.astro.illinois.edu/sow/deneb.html, accepting ~1500 ly, writes that if placed at distance of α Lyr, α Cyg “would /…/ be as bright as a well-developed crescent Moon, cast shadows on the ground, and easily be visible in broad daylight”	**Deneb**
η	Cep	20 45.7	+61 55	3.41	0.91	K0 IV	70.1	2.6	46.5	0.823	6	−87	high velocity relative to Sun indicates interloper status in galactic thin disk (and observed underabundance of Fe is consistent with interloper status) ¶ the angular proximity to η Cep A of η Cep B (46″ in year 2000, mag. 11.3) is a mere line-of-sight coincidence	
β	Pav	20 46.7	−66 08	3.42	0.16	A6 IV	~24.1	0.3	135	0.044	283	+10	still a fast rotator (≤ 2.3 d), although core hydrogen fusion is ended or is close to ending	
ε	Cyg	20 47.0	+34 03	2.48	1.02	K0 III	44.9	0.7	73	0.486	47	−11 SB	C: common proper motion, 79″ (2017) AC PA: 266°→269°, 1959 →2017; AC orbit ≥ 50,000 y, separation ≥ 1700 AU (where C is a red dwarf, mag. 13.4); the SB pairing (with just one set of lines visible) ε Cyg Aa+Ab has period ≥ 15 y ¶ the angular proximity of ε Cyg B (mag. 11.6, 79″ in 2017, at PA 261°) is a mere line-of-sight coincidence ¶ velocity of AaAb+C relative to Sun is high	Aljanah
ζ	Cyg	21 13.8	+30 18	3.21	0.99	G8 IIIa Ba 0.5	23	0.0	140	0.069	175	+17 SB		

													in evolutionary terms, possibly a “clump giant” (with stable He fusion in core); but it might also be the case that core He fusion has yet to begin ¶ chemically a mild Ba star (1992Obs...112..168G discusses spectroscopy, reviewing history at a level of detail so instructive as to make this a case study for spectroscopy technique more generally, even outside the particular domain of ζ Cyg); consistently with this chemical anomaly, ζ Cyg A has WD companion ζ Cyg B (before becoming a WD, this close companion deposited Ba onto ζ Cyg A as it shed mass: WD orbit 17.8 y, separation 8 AU min, 13 AU max, 11 AU average; 2001MNRAS.322..891B announces direct imaging with HST WFPC2 (elongated smear, WD partly resolved, possibly 36 mas))	
α	Cep	21 19.0	+62 40	2.45	0.26	A7 Van	66.5	1.6	49.1	0.158	72	−10 V	fast rotator (< 12h) ¶ listed by AAVSO(VSX) as δ Sct variable, with V mag. range 2.41-2.47 ¶ several factors, including X-ray emission, indicate magnetic activity	Alderamin
β	Cep	21 28.9	+70 39	3.23v	−0.20	B1 III	5	−3.4	700	0.015	56	−8 SB	var.: 3.16–3.27, 0.19 d; B: 7.8; 13.5″ (2016) PA: 255°→251°, 1779 →2016; orbit ≥ 40,000 y ¶ the archetype of the β Cep variables (although this same class is sometimes called the “β CMa variables”), and (as is typical in the class) known to be multiperiodic: AAVSO supplies a 2010-04-13 backgrounder at https://www.aavso.org/vsots_betacep; AAVSO archives a notice for a August 2009 β Cep campaign (coordinated photometry, spectroscopy, CHARA) at https://www.aavso.org/aavso-special-notice-162 ¶ system comprises at least (the much-studied variable) and Ab (mag. 6.6, probably an emission (Be) star, and the origin of the Be behaviour observed in AaAb); Aa+Ab period 85 y (when resolved with speckle interferometry in 1972, angular distance was 250 mas); β Cep B is mag. 8.6, at angular distance 13.5″ in 2016; if B is gravitationally bound to AaAb, then period is ≥ 40,000 y, with separation 3,000 AU ¶ MK luminosity class III (“giant”) notwithstanding, β Cep Aa is still fusing hydrogen in its core	Alfirk
β	Aqr	21 32.6	−5 29	2.9	0.83	G0 Ib	6	−3.2	500	0.020	114	+7 V?	a rare instance of a yellow supergiant; possibly now evolving blueward in a second crossing of the HR diagram ¶ spectroscopically a “hybrid” star, combining signature of hot corona with signature of cool massive wind; 2005ApJ...627L..53A, in a study jointly covering β Aqr and the astrophysically similar hypergiant (likewise a hybrid) α Aqr reports *Chandra* observation of coronal X-rays (first X-ray detection from a hybrid G supergiant; such supergiants are X-ray deficient, their coronae notwithstanding) ¶ β Aqr lies in the HR diagram Instability Strip, and yet is not known to be a pulsator ¶ it is not known whether β Aqr A is gravitationally bound with either of β Aqr B, β Aqr C (B: mag. 11.0, angular distance 38″ in 2013; C: mag. 11.6, angular distance 61″ in 2013)	Sadalsuud
ε	Peg	21 45.1	+9 58	2.38v	1.52	K2 Ib	5	−4.2	700	0.027	89	+5 V	irregular var.: 2.37–2.45 (flare in 1972) 1972IAUC.2392....1W reports extreme flare-like brightening, ~10 minutes, to V mag. 0.7 ¶ orange-class supergiant ¶ 1987MNRAS.226..563S discusses abundances, finding that, earlier literature notwithstanding, ε Peg is unremarkable in its Ba (and unremarkable in its Sr), and therefore discounting an earlier suggestion that ε Peg outer layers have hosted nucleosynthesis in slow-neutron capture ¶ BSC5 suggests “cooler shell surrounding”	**Enif**
δ	Cap	21 48.1	−16 02	2.85v	0.18	A3mF2 IV:	84	2.5	38.7	0.396	139	−6 SB	occ. bin.: 2.81–3.05, 1.0 d, 3.2 + 5.2 δ Cap Aa+Ab classified at AAVSO(VSX) as	Deneb Algedi

														Algol-type eclipsing binary, 1.0227688 d (period current as of 2018-12-21; the AAVSO(VSX) lookup also yields O-C, i.e. period-monitoring, plotting from 2016); Ab is ~3 mag. fainter than Aa, and is judged in 1992MNRAS.259..251W to be mildly active, possibly tidally locked, with large spot: Aa+Ab is known to be SB since 1906 (Slipher), and yet is known to be eclipsing only as of 1956PASP...68..541E ¶ lunar occultations are possible, planetary occultations Possible yet rare ¶ 1994MNRAS.266L..13L rebuts earlier assertion of δ Sct variability, and remarks that “given the brightness of the system, δ Cap is poorly observed,” with period awkward for any one solitary observatory (an implication of this remark is that coordinated intercontinental photometry would now be helpful)
γ	Gru	21 55.1	−37 16	3.00	−0.08	B8 IV–Vs	15	−1.1	210	0.099	98	−2 V?	Aldhanab	
α	Aqr	22 06.8	−0 13	2.95	0.97	G2 Ib	6	−3.1	~520	0.021	117	+8 V?	Sadalmelik	a rare instance of a yellow supergiant; possibly now evolving blueward in a second crossing of the HR diagram ¶ spectroscopically a “hybrid star”, combining signature of hot corona with signature of cool massive wind; 2005ApJ...627L..53A, in a study jointly covering α Aqr and the astrophysically similar supergiant (likewise a hybrid star) β Aqr reports *Chandra* observation of coronal X-rays (first X-ray detection from a hybrid G supergiant; such supergiants are X-ray deficient, their coronae notwithstanding) ¶ in HR-diagram terms, α Aqr lies in the HR diagram Instability Strip (under at least one definition of the strip) and yet is non-pulsating (cf further 2017AstL...43..265U)
α	Gru	22 09.5	−46 52	1.73	−0.07	B7 Vn	32	−0.7	101	0.194	139	+12	**Alnair**	rapid rotator (< 1d) ¶ E(B–V)=–0.02
θ	Peg	22 11.2	+6 18	3.52	0.09	A2mA1 IV–V	35	1.3	90	0.284	84	−6 SB2	Biham	rapid rotator (< 20 h); consistently with rapid rotation, and therefore with a stirred atmosphere, elemental abundances are unremarkable ¶ earlier assertion of δ Sct variability is now discounted **[THIS STAR ONLY IN ONLINE VERSION OF TABLE]**
ζ	Cep	22 11.5	+58 18	3.39	1.56	K1.5 Ib	3.9	−3.7	800	0.014	69	−18 SB		orange supergiant, either approaching core He fusion or already in core He fusion ¶ an eclipsing companion has been suggested, with suggestion later questioned ¶ metals somewhat overabundant
α	Tuc	22 19.8	−60 10	2.87	1.39	K3 III	16	−1.1	200	0.081	241	+42 SB		SB 11.5 y, separation possibly 11.5 AU ¶ primary in the SB is a giant, with C underabundant, N overabundant ¶ http://stars.astro.illinois.edu/sow/alphatuc.html discusses uncertainties in the evolutionary stage of this giant, offering three scenarios
δ	Cep A	22 29.9	+58 31	4.07v	0.78	F5–G2 Ib	4	−3.0	900	0.016	77	−15 SB		prototype Cepheid var.: 3.49–4.36, 5.4 d second-nearest Cepheid (α UMi is still nearer) ¶ AAVSO offers a tutorial at https://tinyurl.com/y9qpkp9f and an initial backgrounder at www.aavso.org/vsots_delcep; the first three sections of a paper directed inter alia to AAVSO observers, 2016JAVSO..44..179N, constitute a deeper backgrounder on the Cepheids ¶ AAVSO(VSX) has, from 2013-09-24, period 5.366266 d; although Cepheids experience both period jitter and (monotonic) period slide, with a slide of even 200 s/y possible, 2014ApJ...794...80E finds δ Cep period sliding slowly, at just -0.1 s/y (period decrease-increase is a signature of evolution, specifically of density increase-decrease, as a Cepheid passes across the HR diagram (δ Cep is now making its second such passage, moving blueward)) ¶ 2015ApJ...804..144A announces that δ Cep is SB, with period 2201 d ¶ accurate distances to Cepheids are foundational in cosmology, which needs independently known

													(galactic) Cepheid distances before embarking on its external-galaxy distance deductions through applications of the Cepheid Period-Luminosity (PL) Law; it is reassuring that the 2007 *HIPPARCOS* distance and the distance implied by the usual PL calculation agree to within uncertainties; although we have here stated the 2007 *HIPPARCOS* parallax, on which distance of δ Cep depends, as 4 mas, our cited 2007 *HIPPARCOS* determination is more formally, with decimal fractions and the uncertainty made explicit, 3.77±0.16 mas; 2015ApJ...804..144A proposes instead 4.09±0.16 mas, with the remark that impending *Gaia* may be expected, in part in the light of these authors' SB announcement, to secure an authoritative parallax; an already reassuring state of affairs may thus be expected to improve further ¶ mass loss ~1e-6 $M_{\odot}$/y; bow shock in ISM has now been detected ¶ strictly δ Cep A; neighbor, known in WDS as δ Cep C, mag. 6.1, at angular distance 41″ (2017), is a true binary companion, with period ≥ 300,000, separation ≥ 11,000 AU	
ζ	Peg	22 42.4	+10 56	3.41	−0.09	B8.5 III	16	−0.6	210	0.078	98	+7 V?	**[THIS STAR ONLY IN ONLINE VERSION OF TABLE]** our (Garrison) MK type notwithstanding, B8 V has been suggested ¶ fast rotator (< 1.4 d) ¶ microvariable (2007PASP..119..483G discusses satellite detection of amplitude ~0.5 millimag); assigned by AAVSO(VSX) to the class of "slowly pulsating B stars"	Homam
β	Gru	22 43.8	−46 47	2.07v	1.61	M5 III	18	−1.6	180	0.135	92	+2	irregular var.: 2.0–2.3 among the rather uncommon cool red giants, with radius slightly > 0.8 AU ¶ classified at AAVSO(VSX) as semiregular late-type giant, perhaps on the basis of 2006JAVSO..34..156O (this paper might serve as a case study for effective amateur-budget intercontinental photometry collaboration)	Tiaki
η	Peg	22 43.9	+30 19	2.93	0.85	G8 II + F0 V	15	−1.2	210	0.029	153	+4 SB	η Peg Aa+Ab period 813 d ¶ slow rotator (818 d?) ¶ system is possibly more than a binary: cf WDS, which lists, apart from Aa and Ab, also celestial-sphere neighbours B, C, D, E, F, G, H, I	Matar
ε	Gru	22 49.7	−51 13	3.49	0.08	A2 Va	25	0.5	130	0.126	121	0 V	rapid rotator (< 0.65 d)	
ι	Cep	22 50.4	+66 18	3.50	1.05	K0 III	28.3	0.8	115	0.141	208	−12	**[THIS STAR ONLY IN ONLINE VERSION OF TABLE]**	
μ	Peg	22 50.9	+24 42	3.51	0.93	G8 III	31	0.9	106	0.151	106	+14	**[THIS STAR ONLY IN ONLINE VERSION OF TABLE]**	Sadalbari
δ	Aqr	22 55.7	−15 43	3.27	0.07	A3 IV–V	20	−0.2	160	0.051	237	+18 V	**[THIS STAR ONLY IN ONLINE VERSION OF TABLE]** (weak λ4481) ¶ rapid rotator (< 3.0 d)	Skat
α	PsA +1P	22 58.7	−29 31	1.17	0.14	A3 Va	130	1.7	25.1	0.368	1 17	+7	2008 exoplanet image (HST) HST shows exoplanet Dagon (so named at IAU after a Semitic deity) at ~125 AU, in the outermost of the debris rings; Dagon is in always-wide (albeit eccentric) orbit, making direct imaging, as opposed both to spectroscopy (for star Doppler wobble) and astrometry (for star transverse wobble) the tool of choice: 32 AU min, 320 AU max; period ~1700 y ¶ in recent years, it has been suggested that Dagon could be a mere dust cloud, or an aggregation of rubble, or a single rocky body (with the first possibility more recently disfavoured?); an explanation is needed for the fact that Dagon proves so readily HST-visible (e.g.: visibility enhanced by circumplanetary dust sphere, or by circumplanetary ring system?); Dagon mass is uncertain (< 2x Jupiter, perhaps even ~Earth) ¶ the nested circumstellar dust rings extend as far as radius ~150 AU (a distance recalling the solar system Kuiper Belt); 2017ApJ...842....8M reports complete outer debris-ring mapping, via ALMA (223 GHz radio), finding ring mass of 0.015 Earths, eccentric, with α PsA A offset from the ring centroid ¶ α PsA A is a fast rotator (< 1d) ¶ in evolutionary terms, α PsA A is sufficiently young to be undergoing an analogue of the	**Fomalhaut**

												Solar System’s Late Heavy Bombardment (and consistently with this, 2017ApJ...842....9M says exocometary gas is detected, by ALMA 230 GHz radio) ¶ 2017ApJ...842....8M comments that “given its unique characteristics and architecture, the Fomalhaut system is a Rosetta stone for understanding the interaction between planetary systems and debris disks” ¶ α PsA A has low metallicity ¶ 2013AJ....146..154M, working both from proper motion (across the celestial sphere) and from velocities along the line of sight, concludes that α PsA, B, and C belong to the same system: B (a flare star) is V mag. 7.1, at angular distance almost 2° (period ≥ 7.6 My), while C is V mag. 13.2, at enormous angular distance 5.7° (and yet at a sufficiently low separation from AB to have the AB gravitational field dominate the general external gravitational field at its location; period ≥ 35 My) ¶ β Peg, α Peg serve as pointers: since α PsA lies a couple of arcminutes N of DEC=-30°, α PsA rises (if briefly) above the horizon even for such Canadian subarctic communities as Churchill, and for such Scandinavian communities as Stavanger	
β	Peg	23 04.7 +28 11	2.44v	1.66	M2 II–III	16.6	−1.5	~196	0.232	54	+9 V	irregular var.: 2.31–2.74 classified by AAVSO(VSX) as semireg. variable, with period 43.3 d ¶ an intermediary between straightforward red giant and red bright giant (radius ~0.5 AU); mass loss rate is notably low for such a star (≤ 1e-8 $M_\odot$/y; i.e. ~100x lower than mass loss rate of α Ori; IRAS detected no IR excess)	Scheat
α	Peg	23 05.7 +15 19	2.49	0.00	A0 III–IV	24	−0.6	133	0.073	124	−4 SB	rapid rotator (1.5 d)	**Markab**
γ	Cep +1P	23 40.2 +77 44	3.21	1.03	K1 III–IV	71	2.5	46	0.135	339	−42 V?	a tight double (angular distance 0.9″ in 2006, separation 12 AU min, 25 AU max, period 66 y or 67 y; 2007A&A...462..777N reports the first direct imaging of γ Cep B, by Subaru) ¶ γ Cep A possible rotation period 781 d (making this star a slow rotator) ¶ exoplanet γ Cep Aa is among the few discovered in a binary system; it is circumstellar without being circumbinary: period 2.47 y, average separation 2.05 AU, mass between 3x Jupiter and 16x Jupiter	Errai