Abstract --- the heart of your paper

Chapter 11 by Jean-Luc Lebrun
Unit 5 by Hilary Glasman-Deal

- What do you as a reader expect to see in an abstract?

Four parts of an abstract

- **What**
  - What is the problem? What is the topic of this paper?
- **How**
  - How is the problem solved (methodology)?
- **Results**
  - What are the specific results? How well is the problem solved? Visuals in abstracts?
- **Impact**
  - So what? How useful is this to science or to the reader?

Very often, the fourth part (impact) is missing, because

- The maximum number of words allowed by the journal ran out too quickly with a long rambling start.
- The author (mistakenly) considered that the results should speak for themselves.
- The author was not able to assess the impact of the scientific contribution.

> *“a result of the myopia caused by the atomization of research tasks among many researchers”*

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- The parts with the largest number of words
  = contribution
- Adjectives ok in the title, but precision in the abstract
- Coherence between abstract and title
- 30%~80% (i.e., > 1/3) significant title words are in the first sentence of the abstract. There are exceptions, but usually at least there should be one word from the title. Otherwise, sentences 2 and 3 mention most of the other title words.
- The first sentence should expand, not just repeat, the title.

- All title words should be in the abstract. Otherwise, why does a word deserve a “title” status of your paper? One exception is using an alternative, interchangeable keyword in the field → to increase the chance of being found by search engines
- If a title word is not important, remove it.
- If a title word is missing in the abstract and is important, put it in.
- If the abstract contains a keyword that should be in the title, rewrite the title to incorporate that keyword.

- The abstract needs to set the problem, but does not need to justify why it is important (the introduction does that.) The abstract, however, needs to justify the significance of the results.
- The abstract should **NOT** (1) mention the work of other researchers (it is done in the introduction), unless the paper is an extension of a previous paper; (2) why the problem is important (also the role of the introduction).
- The abstract should concentrate on the **importance of the results**

- Use the present tense in the abstract is ok. Once the tense is chosen, keep it throughout the abstract.
- Use the past tense in the conclusion.
- The abstract should be stand-alone. It needs nothing else. It sets expectations for the reader.
- It should not be longer than necessary.
- It should tie to the title.

About the tenses

Present Simple

(*Permanent*)
I work at NCU.

(Accepted facts/truths)

The sun rises in the east.

(*Literature; your results*)

We found that star clusters would disperse …

We find that star clusters disperse …

Present Continuous

(*Temporary)*
I am working on the data.

The sun is rising.

Past Simple

I lived in the States for 10 years. (ten?)
(Now I don't.)

- ✓ Double-digit numbers, 10, 33; single-digit numbers, five, nine
- ✓ Spell out the number at the start of a sentence.

We observed the late-M star Wolf 359 last night.

(*Observations; analysis*)

Present Perfect

I have worked at NCU for nearly 30 years.
(*Still do*.)

We have confirmed its position …

(Historical past; relevant to the current situation); (*Literature*)

2. *In a series of three or more terms with a single conjunction, use a comma after each term except the last.*

Thus write,

red, white, and blue
gold, silver, or copper

He opened the letter, read it, and made a note of its contents.

This comma is often referred to as the "serial" comma.

In the names of business firms the last comma is usually omitted. Follow the usage of the individual firm.

Brown, Shipley and Co.
Merrill Lynch, Pierce, Fenner & Smith Incorporated

3. *Enclose parenthetic expressions between commas.*

The best way to see a country, unless you are pressed for time, is to travel on foot.

This rule is difficult to apply; it is frequently hard to decide whether a single word, such as *however*, or a brief phrase is or is not parenthetic. If the interruption to the flow of the sentence is but slight, the writer may safely omit the commas. But whether the interruption is slight or considerable, he must never omit one comma and leave the other. There is no defense for such punctuation as

Marjorie's husband, Colonel Nelson paid us a visit yesterday.

or

My brother you will be pleased to hear, is now in perfect health.

Dates usually contain parenthetic words or figures. Punctuate as follows:

It would have been nice if the improper expressions were printed in different fonts.

February to July, 1972
April 6, 1956
Wednesday, November 13, 1929

Note that it is customary to omit the comma in

6 April 1958 OK

The last form is an excellent way to write a date; the figures are separated by a word and are, for that reason, quickly grasped.

A name or a title in direct address is parenthetic.

If, Sir, you refuse, I cannot predict what will happen.
Well, Susan, this is a fine mess you are in.

The abbreviations *etc.*, *i.e.*, and *e.g.*, the abbreviations for academic degrees, and titles that follow a name are parenthetic and should be punctuated accordingly.

Letters, packages, etc., should go here.
Horace Fulsome, Ph.D., presided.
Rachel Simonds, Attorney
The Reverend Harry Lang, S.J.

No comma, however, should separate a noun from a restrictive term of identification.

Billy the Kid
The novelist John Fowles
William the Conqueror
Pliny the Younger

Although *Junior*, with its abbreviation *Jr.*, has commonly been regarded as parenthetic, logic suggests that it is, in fact, restrictive and therefore not in need of a comma.

James Wright Jr.

Nonrestrictive relative clauses are parenthetic, as are similar clauses introduced by conjunctions indicating time or place. Commas are therefore needed. A non-

You probably learned the difference between (a) and (b) years ago: that one of the differences between Past Simple and Present Perfect is the 'time' of the verb, *i.e.* when it happened. The difference between (c) and (d) is harder to understand and more important for you as a writer of science research.

In (c) and (d), 'time', *i.e.* when the verb happened, isn't really what separates the two sentences; it's possible that both (c) and (d) happened last month, this morning, or one nanosecond ago. What is important is that the event in (d) is considered more relevant to the situation now than the event in (c), which is why it is given in the Present Perfect. Why is this idea of relevance useful when you write an Introduction? Look at these sentences from the Introduction in Section 1.1:

> *For example, Penney et al.* ***showed*** *that PLA composites could be prepared using blending techniques*[6] *and more recently, Hillier* ***established*** *the toughness of such composites.*[7] *However, although the effect of the rubber particles on the mechanical properties of copolymer systems* ***was demonstrated*** *over two years ago,*[8] *little* attention* ***has been paid*** *to the selection of an appropriate rubber component.*

* *Note*: **a little** means 'a small amount', but **little** means 'virtually none'.

Where does the tense change? Why do you think the writer changes from the Past Simple to the Present Perfect? Could it be because this research article is NOW paying attention to the selection of an appropriate rubber component?

Now look at what happens if the writer forgets to change tense and continues in the Past Simple:

> *However, although the effect of the rubber particles on the mechanical properties of copolymer systems* ***was demonstrated*** *over two years ago,*[8] *little attention* ***was paid*** *to the selection of an appropriate rubber component.*

Suddenly, the sentence means that little attention was paid THEN, *i.e.* two years ago. Perhaps attention has been paid to this problem since then; perhaps the problem has even been solved! Tense changes are always meaningful, and they always signal a change in the function of the information — so don't change tense randomly and make sure you remember to change tense when you should.

Now check what you have learned about tenses by looking carefully at the way the Past Simple and Present Perfect are used in the Introductions of your target articles. Look in particular at the way the Past Simple tense and the Present Perfect tense are used to refer to previous research.

1.2.2 Signalling language

Sentence connection

One of the most common errors in writing is failing to connect one sentence or idea to the next. Every time you end a sentence, your reader has no idea what the next sentence is going to do or say. As a result, the space between a full stop and the next capital letter is a dangerous space for you and your reader. Perhaps you stopped for ten minutes after a sentence, and during that time you thought about your work and your ideas developed. Perhaps you turned off your computer and went home. When you start typing again, if you don't share the link between those sentences with your reader, you create a gap in the text which will cause problems.

One of your tasks as a writer is to make sure that gap is closed, so that your reader is carried carefully from one piece of information to the next. Connecting sentences and concepts is good for you too, as it forces you to develop your ideas logically.

One way to connect sentences is to **overlap**, meaning to repeat something from the previous sentence:

> *The pattern of inflammation during an asthma attack is different from that seen in stable asthma. In* ***stable asthma*** *the total number of inflammatory cells does not increase.*
>
> *One way to toughen polymers is to incorporate a layer of rubber particles. As a result, there has been extensive research regarding the* ***rubber*** *modification of PLA.*

For example, Penney et al. ***showed*** *that PLA composites could be prepared using blending techniques*[6] *and more recently, Hillier* ***established*** *the toughness of such composites.*[7] *However, although the effect of the rubber particles on the mechanical properties of copolymer systems* ***was demonstrated*** *over two years ago,*[8] *little* attention* ***has been paid*** *to the selection of an appropriate rubber component.*

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STELLAR EVOLUTION. I. THE APPROACH TO THE MAIN SEQUENCE*

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Received August 18, 1964; revised November 23, 1964

ABSTRACT

The manner in which nuclear reactions replace gravitational contraction as the major source of stellar luminosity is investigated for model stars of population I composition in the mass range $0.5 < M/M_{\odot} < 15$ 0. By following in detail the depletion of C^{12} from high initial values down to values corresponding to equilibrium with N^{14} in the C-N cycle, the approach to the main sequence in the Hertzsprung-Russell diagram and the time to reach the main sequence, for stars with $M \geq 1.25\ M_{\odot}$, are found to differ significantly from data reported previously.

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HOT ACCRETING WHITE DWARFS IN THE QUASI-STATIC APPROXIMATION[1]

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ABSTRACT

Properties of white dwarfs which are accreting hydrogen-rich matter at rates in the range 1.5×10^{-9} to $2.5 \times 10^{-7}\ M_{\odot}\ \mathrm{yr}^{-1}$ are investigated in several approximations. Steady-burning models, in which matter is processed through nuclear-burning shells as rapidly as it is accreted, provide a framework for understanding the properties of models in which thermal pulses induced by hydrogen burning and helium burning are allowed to occur. In these latter models, the underlying carbon-oxygen core is chosen to be in a cycle-averaged steady state with regard to compressional heating and neutrino losses. Several of these models are evolved in the quasi-static approximation. Combining results obtained in the steady-burning approximation with those obtained in the quasi-static approximation, expressions are obtained for estimating, as functions of accretion rate and white dwarf mass, the thermal pulse recurrence period and the duration of hydrogen-burning phases. The time spent by an accreting model burning hydrogen as a large star of giant dimensions versus time spent burning hydrogen as a hot dwarf is also estimated as a function of model mass and accretion rate. Finally, suggestions for detecting observational counterparts of the theoretical models and suggestions for further theoretical investigations are offered.

Subject headings: stars: accretion — stars: interiors — stars: novae — stars: symbiotic — stars: white dwarfs

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Soft bremsstrahlung

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Simple analytic formulas are considered for the energy radiated in low frequency bremsstrahlung from fully ionized gases. A formula that has been frequently cited over many years turns out to have only a limited range of validity, more narrow than for a formula derived using the Born approximation. In an attempt to find a more widely valid simple formula, a soft photon theorem is employed, which in this context implies that the differential rate of photon emission in an electron-ion collision with definite initial and final electron momenta is correctly given for sufficiently soft photons by the Born approximation, to all orders in the Coulomb potential. Corrections to the Born approximation arise because the upper limit on photon energy for this theorem to apply to a given collision becomes increasingly stringent as the scattering approaches the forward direction. A general formula is suggested that takes this into account.

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VARIABLE IRON Kα LINES IN SEYFERT 1 GALAXIES

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ABSTRACT

We find that variability of the iron Kα line is common in Seyfert 1 galaxies. Using data from the *ASCA* archive for objects that have been observed more than once during the mission, we study the time-averaged spectra from individual observations, thereby probing variability on timescales that range from days to years. Since the statistics of the data do not warrant searches for line variability in terms of a complex physical model, we use a simple Gaussian to model the gross shape of the line and then use the centroid energy, intensity, and equivalent width as robust indicators of changes in the line profile. We find that ~70% of Seyfert 1 galaxies (10 out of 15) show variability in at least one of these parameters: the centroid energy, intensity, and equivalent width vary in six, four, and eight sources, respectively. Because of the low signal-to-noise ratio, limited sampling, and time averaging, we consider these results to represent lower limits to the rate of incidence of variability. In most cases changes in the line do not appear to track changes in the continuum. In particular, we find no evidence for variability of the line intensity in NGC 4151, suggesting an origin in a region larger than the putative accretion disk, where most of the iron line has been thought to originate. Mrk 279 is investigated on short timescales. The time-averaged effective line energy (as measured by the Gaussian center energy, which is weighted by emission in the entire line profile) is 6.5 keV in the galaxy rest frame. As the continuum flux increases by 20% in a few hours, the Fe K line responds within ~10,000 s, with the effective line energy increasing by 0.22 keV (~10,500 km s^{-1}). We also examine the *ROSAT* PSPC spectrum of Mrk 279 but find inconsistencies with *ASCA*. Problems with the *ASCA* and *ROSAT* calibration that affect simultaneous spectral fits at low energies are discussed in an appendix.

Subject headings: galaxies: individual (Markarian 279) — galaxies: nuclei — galaxies: Seyfert — X-rays: galaxies

On-line material: color figures, machine-readable table

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A POSSIBLE DETECTION OF OCCULTATION BY A PROTO-PLANETARY CLUMP IN GM Cephei

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ABSTRACT

GM Cephei (GM Cep), in the young (∼4 Myr) open cluster Trumpler 37, has been known to be an abrupt variable and to have a circumstellar disk with a very active accretion. Our monitoring observations in 2009–2011 revealed that the star showed sporadic flare events, each with a brightening of $\lesssim$0.5 mag lasting for days. These brightening events, associated with a color change toward blue, should originate from increased accretion activity. Moreover, the star also underwent a brightness drop of ∼1 mag lasting for about a month, during which time the star became bluer when fainter. Such brightness drops seem to have a recurrence timescale of a year, as evidenced in our data and the photometric behavior of GM Cep over a century. Between consecutive drops, the star brightened gradually by about 1 mag and became blue at peak luminosity. We propose that the drop is caused by the obscuration of the central star by an orbiting dust concentration. The UX Orionis type of activity in GM Cep therefore exemplifies the disk inhomogeneity process in transition between the grain coagulation and the planetesimal formation in a young circumstellar disk.

GM Cephei (GM Cep), in the young ($\sim$4 Myr) open cluster Trumpler 37, has been known to be an abrupt variable and to have a circumstellar disk with a very active accretion. Our monitoring observations in 2009–2011 revealed that the star showed sporadic flare events, each with a brightening of $\lesssim$0.5 mag lasting for days. These brightening events, associated with a color change toward blue, should originate from increased accretion activity. Moreover, the star also underwent a brightness drop of $\sim$1 mag lasting for about a month, during which time the star became bluer when fainter. Such brightness drops seem to have a recurrence timescale of a year, as evidenced in our data and the photometric behavior of GM Cep over a century. Between consecutive drops, the star brightened gradually by about 1 mag and became blue at peak luminosity. We propose that the drop is caused by the obscuration of the central star by an orbiting dust concentration. The UX Orionis type of activity in GM Cep therefore exemplifies the disk inhomogeneity process in transition between the grain coagulation and the planetesimal formation in a young circumstellar disk.

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Diagnosing the Clumpy Protoplanetary Disk of the UXor Type Young Star GM Cephei

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Abstract

UX Orionis stars (UXors) are Herbig Ae/Be or T Tauri stars exhibiting sporadic occultation of stellar light by circumstellar dust. GM Cephei is such a UXor in the young (~4 Myr) open cluster Trumpler 37, showing prominent infrared excess, emission-line spectra, and flare activity. Our photometric monitoring (2008–2018) detects (1) an ~3.43 day period, likely arising from rotational modulation by surface starspots, (2) sporadic brightening on timescales of days due to accretion, (3) irregular minor flux drops due to circumstellar dust extinction, and (4) major flux drops, each lasting for a couple of months with a recurrence time, though not exactly periodic, of about two years. The star experiences normal reddening by large grains, i.e., redder when dimmer, but exhibits an unusual "blueing" phenomenon in that the star turns blue near brightness minima. The maximum extinction during relatively short (lasting $\leqslant$50 days) events, is proportional to the duration, a consequence of varying clump sizes. For longer events, the extinction is independent of duration, suggestive of a transverse string distribution of clumps. Polarization monitoring indicates an optical polarization varying ~3%–8%, with the level anticorrelated with the slow brightness change. Temporal variation of the unpolarized and polarized light sets constraints on the size and orbital distance of the circumstellar clumps in the interplay with the young star and scattering envelope. These transiting clumps are edge-on manifestations of the ring- or spiral-like structures found recently in young stars with imaging in infrared of scattered light, or in submillimeter of thermalized dust emission.

UX Orionis stars (UXors) are Herbig Ae/Be or T Tauri stars exhibiting sporadic occultation of stellar light by circumstellar dust. GM Cephei is such a UXor in the young ($\sim$4 Myr) open cluster Trumpler 37, showing prominent infrared excess, emission-line spectra, and flare activity. Our photometric monitoring (2008–2018) detects (1) an $\sim$3.43 day period, likely arising from rotational modulation by surface starspots, (2) sporadic brightening on timescales of days due to accretion, (3) irregular minor flux drops due to circumstellar dust extinction, and (4) major flux drops, each lasting for a couple of months with a recurrence time, though not exactly periodic, of about two years. The star experiences normal reddening by large grains, i.e., redder when dimmer, but exhibits an unusual "blueing" phenomenon in that the star turns blue near brightness minima. The maximum extinction during relatively short (lasting $\leqslant$50 days) events, is proportional to the duration, a consequence of varying clump sizes. For longer events, the extinction is independent of duration, suggestive of a transverse string distribution of clumps. Polarization monitoring indicates an optical polarization varying $\sim$3%–8%, with the level anticorrelated with the slow brightness change. Temporal variation of the unpolarized and polarized light sets constraints on the size and orbital distance of the circumstellar clumps in the interplay with the young star and scattering envelope. These transiting clumps are edge-on manifestations of the ring- or spiral-like structures found recently in young stars with imaging in infrared of scattered light, or in submillimeter of thermalized dust emission.

Prefix	Meaning	Examples
a-, an-	without, lack of, not	amoral, acellular, abyss, achromatic, anhydrous
ante-	before, earlier, in front of	antecedent, antedate, antemeridian, anterior
anti-	against, opposite of	anticlimax. antiaircraft, antiseptic, antibody
auto-	self, same	autopilot, autobiography, automobile, autofocus
circum-	around, about	circumvent, circumnavigate, circumscribe
co-	with, together	co-pilot, co-worker, co-exist, co-author
com-, con-	together, with	companion, commingle, contact, concentrate
contra-, contro-	against, opposite	contradict, contrast, contrary, controversy
de-	down, off, away from	devalue, deactivate, debug, degrade, deduce
dis-	not, apart, away	disappear, disagreeable, disbar, dissect
en-	put into, cover with	enclose, entangle, enslave, encase
ex-	out of, from, former	extract, exhale, excavate, ex-president
extra-	beyond, outside, more than	extracurricular, extramarital, extravagant
hetero-	different, other	heterosexual, heterodox, heterogeneous
homo-, homeo-	same, alike	homonym, homophone, homeostasis, homosexual
hyper-	over, more, beyond	hyperactive, hypersensitive, hypercritical
il-, im-, in-, ir-	not, without	illegal, immoral, inconsiderate, irresponsible

Nordquist, Richard. "35 Common Prefixes in English." ThoughtCo, Feb. 11, 2020, thoughtco.com/common-prefixes-in-english-1692724.

in-	in, into	insert, inspection, infiltrate
inter-	between, among	intersect, interstellar, intervene, interpenetrate
intra-, intro-	within, inside	intravenous, intragalactic, introvert
macro-	large, prominent	macroeconomics, macrostructure, macrocosm
micro-	very small	microscope, microcosm, microbe
mono-	one, single, alone	monocle, monologue, monogamy, monotony
non-	not, without	nonentity, nonaggressive, nonessential, nonfiction
omni-	all, every	omniscient, omnivorous, omniscient, omnidirectional
post-	after, behind	postmortem, posterior, postscript, postoperative
pre-, pro-	before, forward	precede, predict, project, prologue
sub-	under, lower	submarine, subsidiary, substandard
sym-, syn-	same time, together	symmetry, symposium, synchronize, synapse
tele-	from or over a distance	telecommunications, telemedicine, television, telephone
trans-	across, beyond, through	transmit, transaction, translation, transfer
tri-	three, every third	tricycle, trimester, triangle, triathlon
un-	not, lacking, opposite of	unfinished, unskilled, ungraceful, unfriendly
uni-	one, single	unicorn, unicellular, unicycle, unilateral
up-	to the top or north, higher/better	upbeat, updo, upgrade, upload, uphill, upstage, upscale, up-tempo

Exercise

Identify a recent astro-ph paper of your scientific interest, judged by its title. Preassume what the paper is about. Then read the abstract.

Submit a short essay to describe the paper, including its title, authors (affiliations), and contents of the abstract in your own words.

Learn to skim the paper first, in no more than a few minutes, before a careful reading.