Astrophysics Seminar 2012 Fall

- **To Read**
  journal papers, news, …, anything
- **To Present**
  how to show (what you want to show) by a talk? By a poster?
- **To Listen**
  how to be an audience
- **To Write**
  term papers, conference proceedings
  journal papers

Homework Assignment

- Do a survey, as comprehensive as possible, of journals that publish astronomy- or astrophysics-related research results. Which of them have associated publications, e.g., letters or supplements?
- How often does each journal publish?
  In what language?
  (By what publisher?)
  (Do we subscribe to it?) …
- How does the 'style' of each journal differ from each other? Note the title, abstract, references.
- Zoom in to one particular '**core**' journal and browse through one recent paper in it. Do the same for one off-core journal.
- What is the ***Science Citation Index***? What is the ***Impact Factor***? What is the ***Open Access*** policy?

How to do a presentation …

Why? What? To whom? When? Where?

- Be prepared (to show only 10% of what you know/prepare)
- Be confident
- Practice efficient language
- Use proper media (overhead, slides, PowerPoint; words only, blackboard …)
- Write legibly (text & graphics)

How to do a presentation …

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- Be confident
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- Use proper media

  overhead, slides, PowerPoint; words only, blackboard …

- Write legibly (text & graphics)

How to do a presentation (*cont*.)

- Exercise gestures/body language (walk around sometimes)
- Do **NOT** block the screen
- Stick to the time limit
- Pay attention to your audience
- Sprinkle a touch of humor (yes, only a touch!)

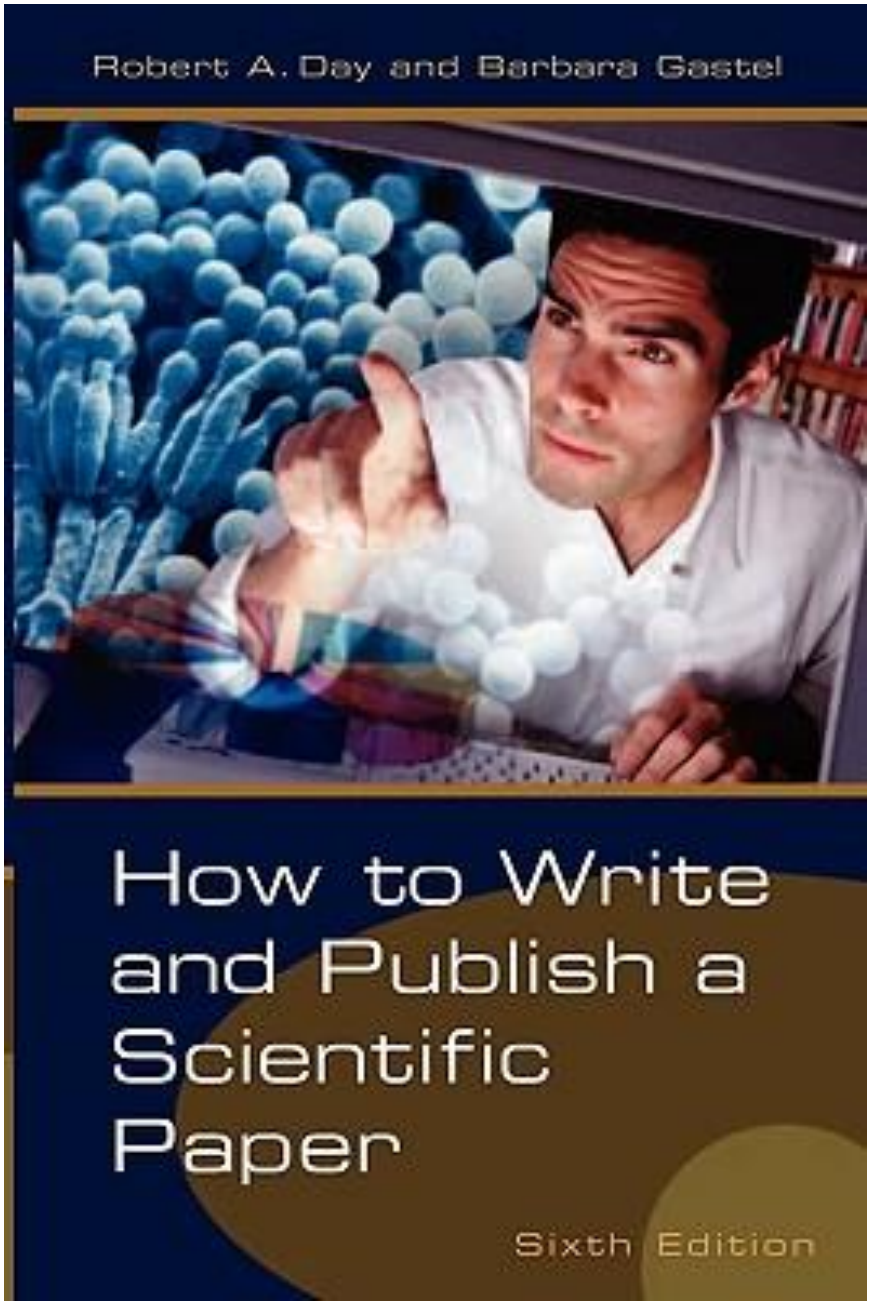
How to be an audience?

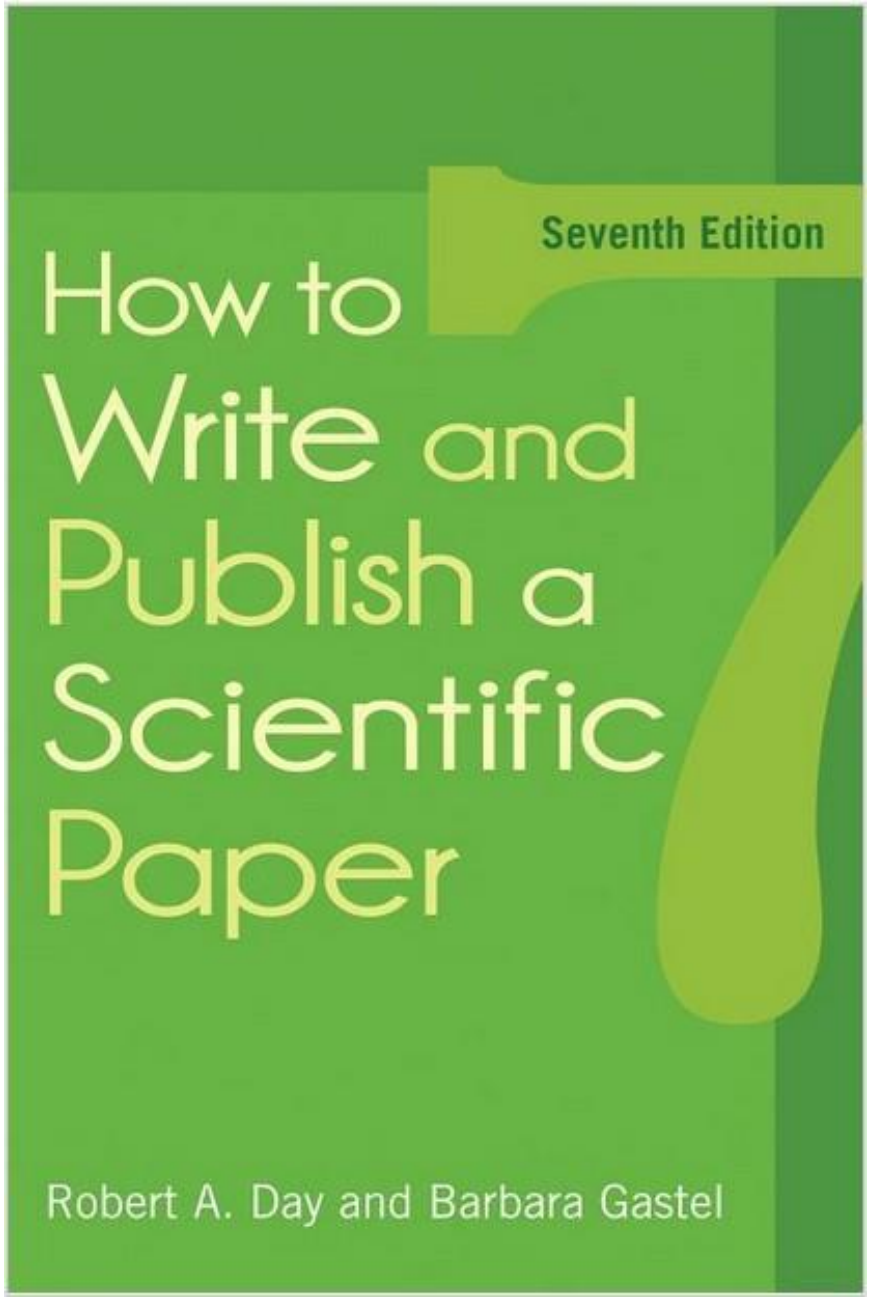
- Homework/preview work
- Learn a thing or/then two
- Do **NOT** chat with others
- Ask questions
- …

Publication of a Journal Paper

- Original research results
- Nature of the paper? Targeted readership?
- Leading astronomy/astrophysics journals
  - *Astrophysical Journal (ApJ)*
  - *Astronomical Journal (AJ)*
  - *Astronomy & Astrophysics (A&A)*
  - *Monthly Notices of the Royal Astronomical Society (MNRAS)*
  - *Publication of the Astronomical Society of the Pacific (PASP)*
  - *Icarus*
  - *PASJ, PASA, JAA…*

- What about *Nature*, *Science*, *Ann Rev Astron & Astrophy*?
- Name 1-2 recently established journals not listed above.
- Write in a clear and concise way; select a personal “model” paper.


Robert A. Day and Barbara Gastel
How to Write and Publish a Scientific Paper
Sixth Edition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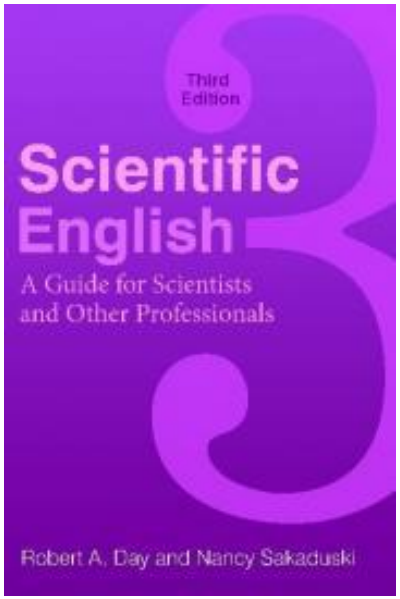
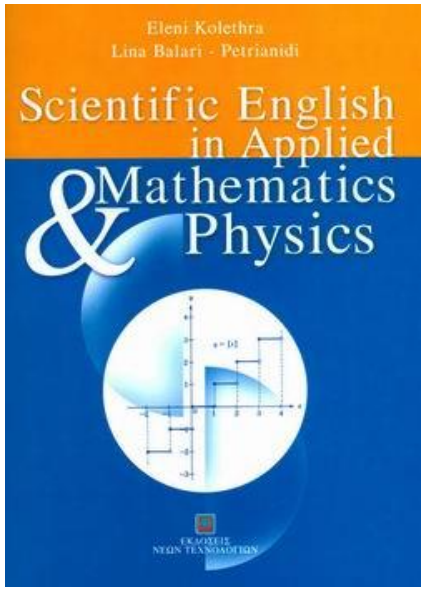
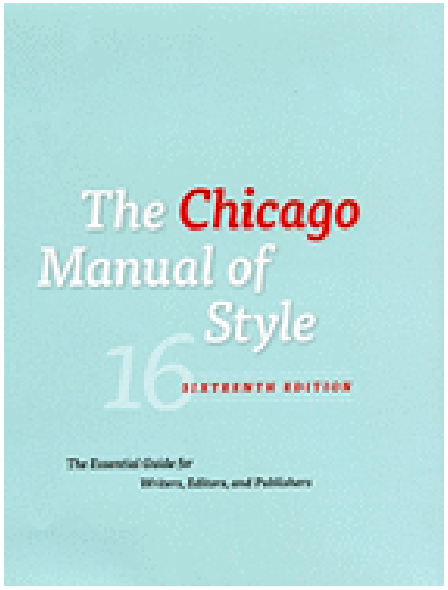
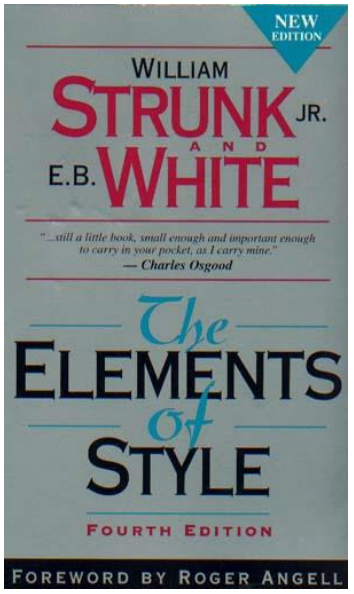
How to Write and Publish a Scientific Paper
Robert A. Day and Barbara Gastel









Common English mistakes made by native Chinese speakers
by Philip Guo

天文物理類英文科技論文寫作的常見問題 張雙南、許云

Evolution of a manuscript

– An example

- the draft
- a revised version
- the final submitted version

Publication of a Journal Paper

- Typesetting the manuscript
  - Latex vs Word or other word processors
  - Text, figures, and tables
- Peer review by referee(s)
- Preprint and astro-ph submissions
- Galley proofs
- … in preparation; in submission; in press
  … private communications

A sample Latex file

```
\documentclass[12pt,preprint]{aastex}

\usepackage{graphicx}                    \usepackage{natbib}

\slugcomment{To be submitted to AJ; today is \today}

\begin{document}

\title{Typesetting by Latex for Graduate Seminar Course }
\author{ W. P. Chen\altaffilmark{1}   }

\altaffiltext{1}{Institute of Astronomy, National Central University, Jhongli 32001, Taiwan}
%
\begin{abstract}
%
 This is a sample                    Latex file, to see how professional typesetting is done.
 %
 \end{abstract}

 \section{Introduction}

 So this is how it works.

  The original file includes some ``commands", but the contents are in ASCII.  Latex is
   particularly convenient to effectively produce Greek letters, $\alpha, \beta, \Omega$, and
    math $\int_0^{100} \sin\omega d\omega$.

 \end{document}
```

Output of the Latex file

To be submitted to AJ; today is March 9, 2011

Typesetting by Latex for Graduate Seminar Course

W. P. Chen[1]

ABSTRACT

This is a sample Latex file, to see how professional typesetting is done.

1. Introduction

So this is how it works.

The original file includes some "commands", but the contents are in ASCII. Latex is particularly convenient to effectively produce Greek letters, α, β, Ω, and math $\int_0^{100} \sin \omega d\omega$.

---

[1]Institute of Astronomy, National Central University, Jhongli 32001, Taiwan

Reference Styles

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Allen, C & Poveda, A. 1974, in *The Stability of the Solar System and of Small Stellar Systems*, ed. Y. Kozai, pp. 239-246. Dodrecht: Kluwer.

A sample ApJ paper heading …

Digital Object Identifier

The Astrophysical Journal, 730:139 (14pp), 2011 April 1 doi:10.1088/0004-637X/730/2/139
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GEOMETRIC AND DYNAMICAL MODELS OF REVERBERATION MAPPING DATA

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Received 2010 December 13; accepted 2011 January 27; published 2011 March 15

ABSTRACT

We present a general method to analyze reverberation (or echo) mapping data that simultaneously provides estimates for the black hole mass and for the geometry and dynamics of the broad-line region (BLR) in active galactic nuclei (AGNs). While previous methods yield a typical scale size of the BLR or a reconstruction of the transfer function, our method directly infers the spatial and velocity distribution of the BLR from the data, from which a transfer function can be easily derived. Previous echo mapping analysis requires an independent estimate of a scaling factor known as the virial coefficient to infer the mass of the black hole, but this is not needed in our more direct approach. We use the formalism of Bayesian probability theory and implement a Markov Chain Monte Carlo algorithm to obtain estimates and uncertainties for the parameters of our BLR models. Fitting of models to the data requires knowledge of the continuum flux at all times, not just the measured times. We use Gaussian Processes to interpolate and extrapolate the continuum light curve data in a fully consistent probabilistic manner, taking the associated errors into account. We illustrate our method using simple models of BLR geometry and dynamics and show that we can recover the parameter values of our test systems with realistic uncertainties that depend upon the variability of the AGN and the quality of the reverberation mapping observing campaign. With a geometry model we can recover the mean radius of the BLR to within ~ 0.1 dex random uncertainty for simulated data with an integrated line flux uncertainty of 1.5%, while with a dynamical model we can recover the black hole mass and the mean radius to within ~ 0.05 dex random uncertainty, for simulated data with a line profile average signal-to-noise ratio of 4 per spectral pixel. These uncertainties do not include modeling errors, which are likely to be present in the analysis of real data, and should therefore be considered as lower limits to the accuracy of the method.

Key words: galaxies: active – methods: data analysis – methods: statistical

Monthly Notices
of the
ROYAL ASTRONOMICAL SOCIETY

Mon. Not. R. Astron. Soc. **412,** 13–25 (2011) doi:10.1111/j.1365-2966.2010.17818.x

Protoplanetary disc evolution and dispersal: the implications of X-ray photoevaporation

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Accepted 2010 October 2. Received 2010 October 2; in original form 2010 August 6

ABSTRACT

We explore the role of X-ray photoevaporation in the evolution and dispersal of viscously evolving T Tauri discs. We show that the X-ray photoevaporation wind rates scale linearly with X-ray luminosity, such that the observed range of X-ray luminosities for solar-type T Tauri stars (10^{28}–10^{31} erg s^{-1}) gives rise to vigorous disc winds with rates of the order of 10^{-10} to 10^{-7} M$_\odot$ yr^{-1}. These mass-loss rates are comparable to typically observed T Tauri accretion rates, immediately demonstrating the relevance of X-ray photoevaporation to disc evolution. We use the wind solutions from radiation-hydrodynamic models, coupled to a viscous evolution model, to construct a population synthesis model so that we may study the physical properties of evolving discs and so-called 'transition discs'. Current observations of disc lifetimes and accretion rates can be matched by our model assuming a viscosity parameter $\alpha = 2.5 \times 10^{-3}$.

Our models confirm that X-rays play a dominant role in the evolution and dispersal of protoplanetary discs giving rise to the observed diverse population of inner-hole 'transition' sources which include those with massive outer discs, those with gas in their inner holes and those with detectable accretion signatures. To help understand the nature of observed transition discs we present a diagnostic diagram based on accretion rates versus inner-hole sizes that demonstrate that, contrary to recent claims, many of the observed accreting and non-accreting transition discs can easily be explained by X-ray photoevaporation. However, we draw attention to a smaller but still significant population of strongly accreting ($\sim 10^{-8}$ M$_\odot$ yr^{-1}) transition discs with large inner holes (>20 au) that lie outside the predicted X-ray photoevaporation region, suggesting a different origin for their inner holes.

Finally, we confirm the conjecture of Drake et al. that accretion is suppressed by the X-rays through 'photoevaporation-starved accretion' and predict that this effect can give rise to a negative correlation between X-ray luminosity and accretion rate, as reported in the Orion data. We also demonstrate that our model can replicate the observed difference in X-ray properties between accreting and non-accreting T Tauri stars.

Key words: accretion, accretion discs – protoplanetary discs – circumstellar matter – stars: pre-main-sequence – X-rays: stars.

ABSTRACT

We explore the role of X-ray photoevaporation in the evolution and dispersal of viscously evolving T Tauri discs. We show that the X-ray photoevaporation wind rates scale linearly with X-ray luminosity, such that the observed range of X-ray luminosities for solar-type T Tauri stars (10^{28}–10^{31} erg s^{-1}) gives rise to vigorous disc winds with rates of the order of 10^{-10} to 10^{-7} $M_\odot$ yr^{-1}. These mass-loss rates are comparable to typically observed T Tauri accretion rates, immediately demonstrating the relevance of X-ray photoevaporation to disc evolution. We use the wind solutions from radiation-hydrodynamic models, coupled to a viscous evolution model, to construct a population synthesis model so that we may study the physical properties of evolving discs and so-called 'transition discs'. Current observations of disc lifetimes and accretion rates can be matched by our model assuming a viscosity parameter $\alpha = 2.5 \times 10^{-3}$.

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Abstract | Full Article (HTML) | PDF(883K) | References

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A sample online HTML version

A sample A&A paper heading …

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Astronomy & Astrophysics

A parsec-scale outflow from the luminous YSO IRAS 17527-2439

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Received 15 October 2010 / Accepted 17 December 2010

ABSTRACT

Aims. We seek to understand the way massive stars form. The case of a luminous YSO IRAS 17527-2439 is studied in the infrared.
Methods. Imaging observations of IRAS 17527-2439 are obtained in the near-IR *JHK* photometric bands and in a narrow-band filter centred at the wavelength of the H_2 1-0S(1) line. The continuum-subtracted H_2 image is used to identify outflows. The data obtained in this study are used in conjunction with *Spitzer*, AKARI, and IRAS data. The YSO driving the outflow is identified in the *Spitzer* images. The spectral energy distribution (SED) of the YSO is studied using available radiative transfer models.
Results. A parsec-scale bipolar outflow is discovered in our H_2 line image, which is supported by the detection in the archival *Spitzer* images. The H_2 image exhibits signs of precession of the main jet and shows tentative evidence for a second outflow. These suggest the possibility of a companion to the outflow source. There is a strong component of continuum emission in the direction of the outflow, which supports the idea that the outflow cavity provides a path for radiation to escape, thereby reducing the radiation pressure on the accreted matter. The bulk of the emission observed close to the outflow in the WFCAM and *Spitzer* bands is rotated counter clockwise with respect to the outflow traced in H_2, which may be due to precession. A model fit to the SED of the central source tells us that the YSO has a mass of 12.23 $M_\odot$ and that it is in an early stage of evolution.

Key words. stars: formation – stars: pre-main sequence – ISM: jets and outflows – stars: protostars – circumstellar matter

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The same …

A&A 527, A97 (2011)
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Key words. stars: formation – stars: pre-main sequence – ISM: jets and outflows – stars: protostars – circumstellar matter

400% cut, paste, and shrink

Class Exercise --- A sample letter

Dear Takahashi-san

I am so concern about the devastations triggering by terrible earthquake and tsunami in Japan. Everyday, I read news and pray for the things will going well many times.
GAO is quite close to the Toyko. Are people and every things in GAO allright?

God Bless you and eveyone in GAO

- What does this letter try to say?
- What are the problems with it?

Let us try to improve it.

Mind the Pronunciation

Read out loud and listen to yourself

- morphology ***vs*** morphological
- molecule ***vs*** molecular
- analysis ***vs*** analyze/analyse
- spectra ***vs*** spectroscopy ***vs*** spectroscopic

Mind the Sentence Structure

- We would like to find out what the dark energy is.
- You may wonder “What is the dark energy?”

Gmail by Google

Wen-Ping Chen <wenpchen@gmail.com>

Question about the proceeding of APRIM2011

Po-Shih Chiang <pschiang@gmail.com> **2011年10月26日下午2:41**

收件者: ncs@narit.or.th, ncs_support@narit.or.th

副本: Wen-Ping Chen <wchen@astro.ncu.edu.tw>, IR lab <all@irlab.astro.ncu.edu.tw>

Dear Sir/Madam,

This is Poshih Chiang, a PhD student from Taiwan. I was trying to submit my article with the on-line system but got a problem.
In the 3rd step of the on-line submission system, the country shows "Taiwan, a Province of China" which is incorrect and is very confused.
This problem could be corrected by changed another country list. Would you please inform your IT team to replace a correct country list?
Thank you very much.

Sincerely,
Poshih Chiang

Gmail by Google

Wen-Ping Chen <wenpchen@gmail.com>

2nd Announcement - IAU APRIM2011, Chiang Mai, Thailand, 26-29 July, 2011

Wen-Ping Chen <wchen@astro.ncu.edu.tw> **2010年12月20日下午11:54**
收件者: "Dr. Busaba Kramer" <bkramer@mpifr-bonn.mpg.de>, boonrucksar@narit.or.th, Seline Hu <m989001@astro.ncu.edu.tw>

Dear Busaba

I just registered for the APRIM. Thanks for the efforts. The website is shaping up nicely.

I noticed for us from Taiwan, the selection for "Country" is "Taiwan, Province of China". I understand very well this is because of the particular set of database downloaded by the person who set up the webpage. But you can see this poses an embarrasing situation for us. I am not trying to solve the political dilemma, but do you think it is possible if the webmaster can simple choose a different database, for which Taiwan is just "Taiwan" (I've used many of such). Thanks.

Wen Ping

Nicknames in English --- you should know these, but do not use them unless you know the person very well.

MALE	
Albert	Al
Andrew	Andy
Anthony	Tony
Arthur	Art, Arty
Bernard	Bernie, Bern
Charles	Charlie, Chuck
Christopher	Chris
Daniel	Dan, Danny
Donald	Don
Edward	Ed, Eddie
Eugene	Gene
Francis	Frank, Fran
Frederick	Fred, Freddy
Henry	Hank
Irving	Irv
James	Jim, Jimmy
Joseph	Joe
John	Jack, Jacky

Lawrence	Larry
Leonard	Leo
Nathan	Nat, Nate
Nicholas	Nick
Patrick	Pat
Peter	Pete
Raymond	Ray
Richard	Dick, Rick
Robert	Bob, Bobby, Rob
Ronald	Ron, Ronny
Russell	Russ
Samuel	Sam, Sammy
Stephan	Steve
Stuart	Stu
Theodore	Ted, Teddy
Thomas	Tom, Thom, Tommy
Timothy	Tim, Timmy
Walter	Walt, Wally
William	Bill, Billy, Will, Willy

FEMALE	
Amanda	Mandy
Catherine	Cathy, Cath
Christine	Chris, Chrissy
Cynthia	Cindy, Cynth
Deborah	Deb, Debbie
Elizabeth	Betty, Beth, Liz, Bess
Florence	Flo
Frances	Fran, Francie
Janet	Jan
Katherine	Kathy, Kate
Janice	Jan
Nancy	Nan
Pamela	Pam
Patricia	Pat
Roberta	Bobbie
Sophia	Sophie
Susan	Sue, Suzie
Teresa	Terry
Valerie	Val
Veronica	Ronnie
Yvonne	Vonna

My Model paper …

A SURVEY FOR CIRCUMSTELLAR DISKS AROUND YOUNG STELLAR OBJECTS

STEVEN V. W. BECKWITH
Department of Astronomy, Space Science Building, Cornell University, Ithaca, New York 14853

ANNEILA I. SARGENT
Department of Physics, Mathematics and Astronomy, California Institute of Technology, Pasadena, California 91125

ROLF. S. CHINI AND ROLF GÜSTEN
Max-Planck-Institute für Radioastronomie, Auf dem Hugel 69, D-5300 Bonn 1, Federal Republic of Germany
Received 6 July 1989; revised 3 November 1989

ABSTRACT

Continuum observations at 1.3 mm of 86 pre-main-sequence stars in the Taurus–Auriga dark clouds show that 42% have detectable emission from small particles. The detected fraction is only slightly smaller for the weak-line and "naked" T Tauri stars than for classical T Tauris, indicating that the former stars often have circumstellar material. In both categories, the column densities of particles are too large to be compatible with spherical distributions of circumstellar matter—the optical extinctions would be too large; the particles are almost certainly in spatially thin, circumstellar disks. Models of the spectral energy distributions from 10 to 1300 μm indicate that for the most part the disks are transparent at 1.3 mm, although the innermost ($\leqslant$1 AU) regions are opaque even at millimeter wavelengths. The aggregate particle masses are between 10^{-5} and 10^{-2} $\mathcal{M}_\odot$, implying total disk masses between 0.001 and 1 $\mathcal{M}_\odot$. The disk mass does not decrease with increasing stellar age up to at least 10^7 years among the stars detected at 1.3 mm. There is some evidence for temperature evolution, in the sense that older disks are colder and less luminous. There is little correlation between disk mass and Hα equivalent width among the detected stars, suggesting that the Hα line is not by itself indicative of disk mass. Spectral indices for several sources between 1.3 and 2.7 mm suggest that the particle emissivities ϵ are weaker functions of frequency ν than is the usual case of interstellar grains. Particle growth via adhesion in the dense disks might explain this result. The typical disk has an angular momentum comparable to that generally accepted for the early solar nebula, but very little stored energy, almost five orders of magnitude smaller than that of the central star. Our results demonstrate that disks more massive than the minimum mass of the proto-solar system commonly accompany the birth of solar-mass stars and suggest that planetary systems are common in the Galaxy.

I. INTRODUCTION

There is little doubt that the solar system was born from a disk of gas and dust encircling the Sun five billion years ago. The evidence that similar disks surround many young, solar-mass stars in the Galaxy today is compelling, although it is usually circumstantial. Basic quantities such as the disk mass are poorly constrained by available observations, however, making it impossible to ascertain the number of stars that will eventually have planetary systems like our own. If the distribution of mass and energy, the characteristics principally responsible for disk evolution, were known, we could begin to assess whether planetary systems are common or rare and, by comparing planetary evolution around neighboring stars, gain insight into our origins.

Most estimates suggest that approximately half of all young stars have disks. Strom *et al.* (1989; hereafter referred to as SSECS) use the presence of infrared emission in excess of that expected from a stellar photosphere to infer the presence of disks around 60% of the youngest pre-main-sequence stars in their sample. In a similar study, Cohen, Emerson, and Beichman (1989) examined 72 stars in Taurus–Auriga and concluded that about one-third of the stars have appreciable disks. Calculations of emission from circumstellar disks [Lynden-Bell and Pringle 1974; Adams, Lada, and Shu 1987 (hereafter referred to as ALS), 1988; Kenyon and Hartmann 1987; Bertout, Basri, and Bouvier 1988] demonstrate clear infrared signatures accompanying

disks similar to the proto-solar nebula; these calculations provide the underpinnings for the observations cited above, but are not the only indicators of disk matter. The disks indirectly affect other radiation, for example, by shadowing the receding portions of stellar mass loss and creating preferentially blueshifted spectral lines (Edwards *et al.* 1987), asymmetric scattering of visual and near-infrared light from the stars (Beckwith *et al.* 1989), anomalously large extinction (Cohen 1983), and large degrees of polarization of the starlight (Bastien 1982; Hodapp 1984; Sato *et al.* 1985). But these effects are less useful for understanding the frequency with which disks occur.

At wavelengths shortward of 100 μm, these disks are usually opaque, making infrared and visual observations insensitive to the mass of the disks. The strengths of the far-infrared emission depends on the disks luminosity and temperature distribution, both strong functions of the energy balance in the disk (cf. Sec. IV*c*). To discuss the likelihood of planet formation, it is desirable to measure the total mass in a disk and its spatial distribution.

Thermal emission from small particles entrained in these disks is optically thin at wavelengths of order 1 mm and is proportional to the total particle mass (Beckwith *et al.* 1986; Sargent and Beckwith 1987). Observations of millimeter-wave emission from young stars provide an excellent way to measure disk masses directly, minimizing the uncertainties introduced by energetic activity near the star. With the unprecedented sensitivity and spatial resolution of the new

Sketch a Writing Plan

- (A rough title, clear contents)
- Section headings, subsections …
- Then to each paragraph, and each sentence
- Once concept/issue per paragraph.
- Mind the overall structure of the article.

  Introduction, Observations and Data Analysis, Results and Discussions, Conclusions
- Then tackle a sentence at a time.

Paper Structure

- Title = face
- Abstract = heart
- Key Words = address
- Headings = skeleton
- Introduction = hands
- Data and Analysis
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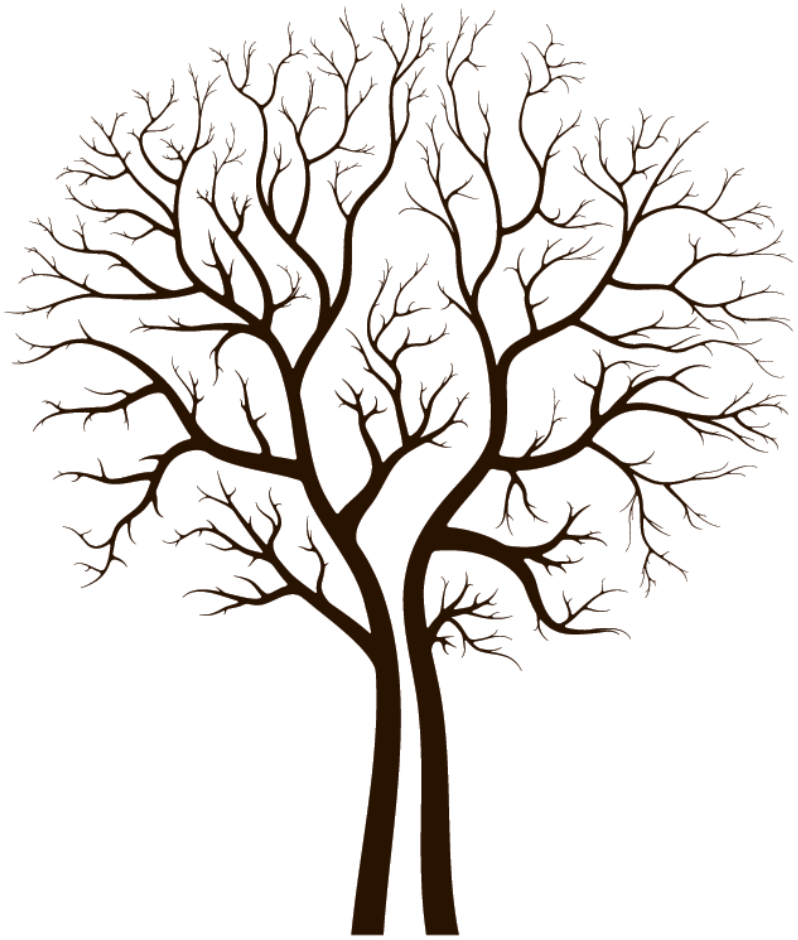

First impression

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The impact of the quality of these parts goes beyond creating a favourable first impression for the reviewer and reader. Improved

Title --- How to select one

Try alternative titles …

- What are the differences
- Pair elimination
- The best one should be tempting and informative
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Title (cont.)

- The title is not read; it is scanned, within 2 seconds at most
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- An old or popular subject → a longer title in order to specify the contribution

Six Techniques to improve titles

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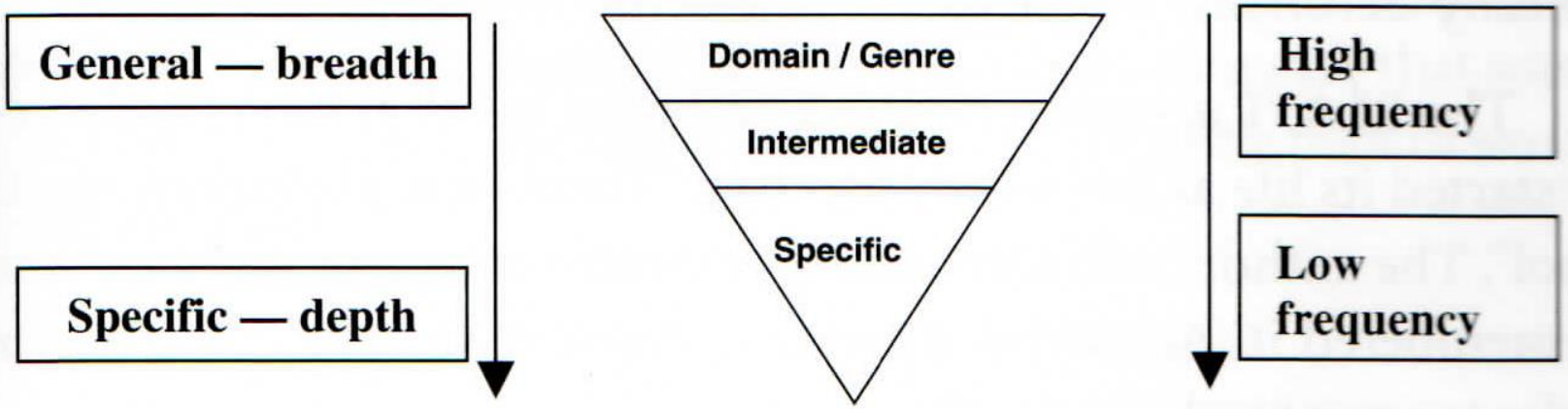

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unique, lasting, concise, clear, easy to find, honest and representative, and (if possible) catchy

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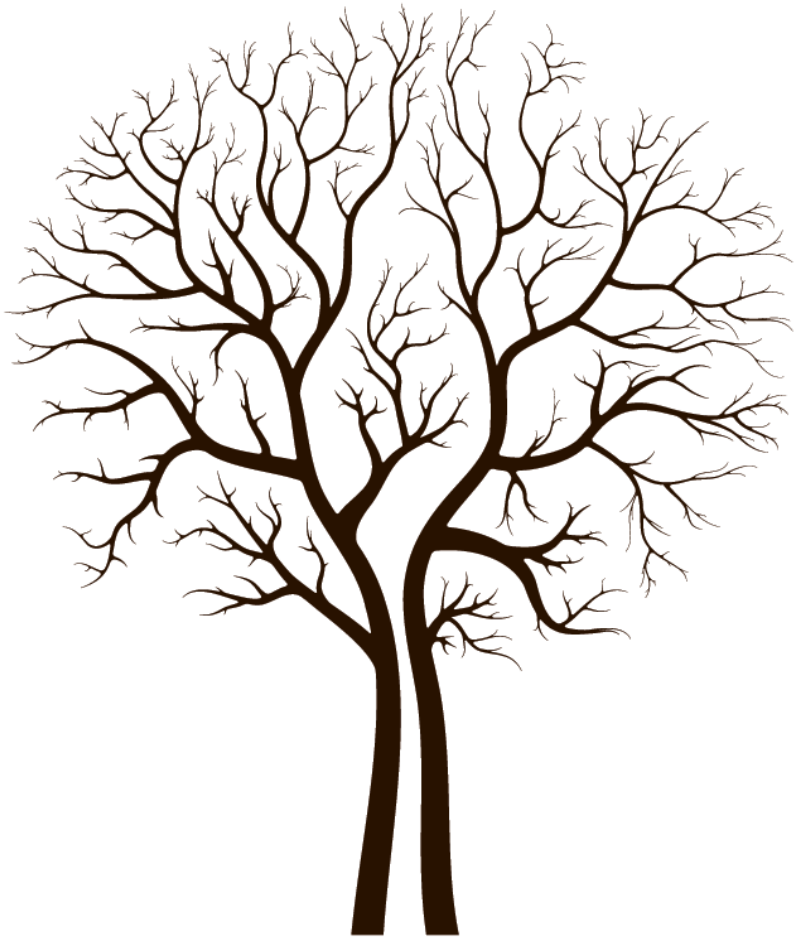

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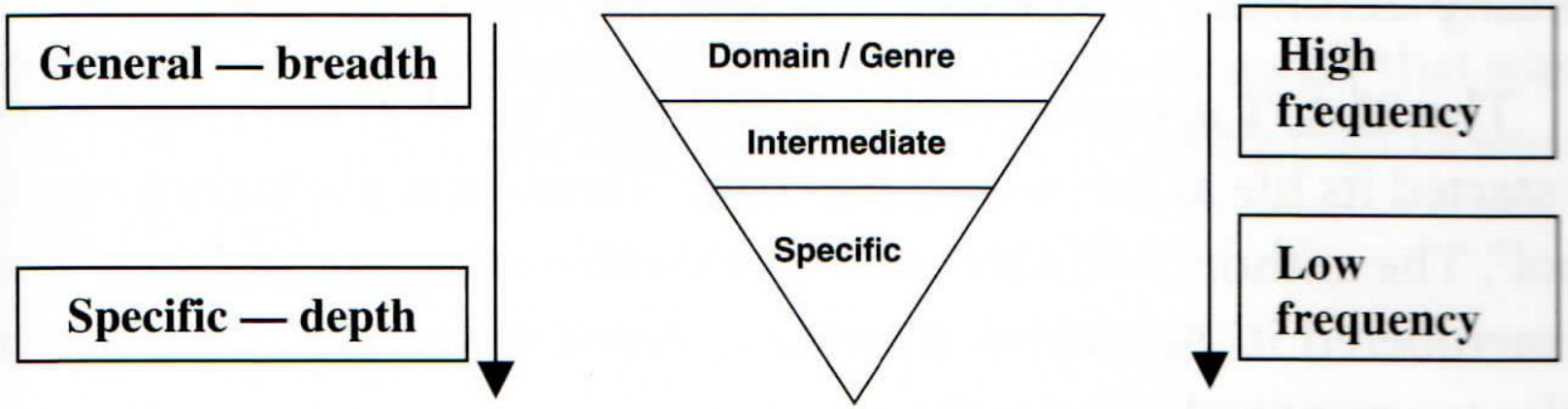

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Draft version November 29, 2011

ABSTRACT

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 very active accretion. Our monitoring observations in 2009–2011 revealed the star to show sporadic flare events, each with amplitude $\lesssim 1$ mag lasting for about 10 days. These brightening events were associated with a bluing color, and could be accounted for by increased accretion activity. Moreover, the star also underwent a brightness ditch of $R \sim 1$ mag lasting for about a month, during which the star became bluer. This ditch seems to have a recurrence time scale of a year, as evidenced in our data and the photometric behavior of GM Cep over a century long. Between consecutive ditch events, the star experienced a gradual brightening and fading of an amplitude of 1 mag, during which the star became blue at peak luminosity. It is hypothesized that the ditch is caused by obscuration by an orbiting concentration of circumstellar dust. GM Cep therefore exhibits both the EX Lupi type and UX Orionis type activity, and appears to have undergone the inhomogeneity process in transition between grain coagulation and planetesimal formation in a young circumstellar disk.

Subject headings: Occultations — Planets and satellites: formation — Protoplanetary disks — Stars: Individual: GM Cep — Stars: pre-main sequence — Stars: variables: T Tauri, Herbig Ae/Be

Abstract --- the heart of your paper

Chapter 11 of Jean-Luc Lebrun

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

Four parts of an abstract

- **What**
  - What is the problem? What is the topic of this paper?
- **How**
  - How is the problem solved (methodology)?
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- **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.
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- 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.

Headings and Subheadings:

The Skeleton of Your Paper

- The skeleton is standard, but it allows for variations in shape and size.
- Bones are bones. But are they bird bones, or wolf bones?
- **Headings may be generic**, i.e., the same from one article to the next (*introduction, observations and data analysis, discussion, conclusions*), **but subheadings differ**.
- The most sophisticated parts are also the most detailed = the largest amount of contribution.

Three principles for a good structure

1. The contribution guides its shape.
2. Title words are repeated in its headings and subheadings. That is, headings and subheading should be connected to the title.
3. It tells a story clearly and completely in its broad lines.

Review papers may have exceptions.

- A section with only one or two short paragraphs does not deserve its own subheadings; is should be merged with other sections.
- Write more informative headings and subheadings.
- Use the same syntactic rules for headings
  - Introduction
  - Data analysis
  - ***Proposing*** a solution
  - Simulation studies

- It is a good practice to use structure as the framework for writing. After you come up with the title, write all the headings and subheadings in the order they appear in your paper, i.e., a table of contents. Identify words common in the structure and in the title. Do you see any discrepancy?
- Then ask someone else to read your ToC. The less this person knows of your work, the better. Is the logic clear to that person? Ask the person to explain the story of the paper to you.

\title{A Kinematic and Photometric Study of the Galactic Young Star Cluster NGC\,7380 }

Chen et al. AJ, **142**, 71 (15 pp) (2011)

- \section{INTRODUCTION}
- \section{DATA AND ANALYSIS }
  - \subsection{Photometric Data}
  - \subsection{Archival Data}
  - \subsection{Kinematic Data} % 2.3
    - ✓ \subsubsection{Proper Motion Measurements}
    - ✓ \subsubsection{Radial Velocity Measurements}
- \section{Characterization of the Cluster} % Sec 3
  - \subsection{Morphology and Size of the Cluster} % Sec 3.1
  - \subsection{Interstellar extinction and Reddening } % Sec 3.2
  - \subsection {Distance and age of the cluster} % Sec 3.3
  - \subsection {Stellar Population of the Cluster and surrounding region} % Sec 3.4
  - \subsection {Initial Mass Function and K-band luminosity function}
- \section {Discussion} % Sec 4
- \section{Summary}

\title{
A Possible Detection of Occultation by a Proto-planetary Clump in GM\,Cephei
}

Chen et al. ApJL, to be submitted (2011) < 4 pages

- \section{Introduction}
- \section{Light Curves and Color Variations }
- \section{Discussions}

Introduction

The hands of your paper

Chapter 13-14 of Lebrun (2007)

- Introduction is something more difficult to write than the methodology or results section.
- It should bring the reader up to speed and reduce the initial knowledge gap. It poses the problem, the proposed solution, and the scope. It answers the questions raised by the title and the abstract.
- The introduction should be written, or at least in a preliminary form, right at the beginning of the writing, or even when the research project starts (when the observing proposal was written). It shows the skill of communication of the writer, in a personal way.
- Much of the readership may be outside of your field. So many of your readers, sometime even the referee, will require an introduction of your paper.

- Too often an introduction contains (i) a short paragraph to describe the problem, (ii) a paragraph to place the contribution in context with densely packed references, and (iii) a final “table of contents”. Only a few experts in the field --- who are familiar with the material already anyway --- would appreciate this kind of an introduction. What purpose does it serve?

Application of a Probabilistic Neural Network in radial velocity curve analysis of the spectroscopic binary stars Schulte 3, HD 37366, HD 195987, HD 101131 and HD 93205

Using measured radial velocity data of five double-lined spectroscopic binary systems Schulte 3, HD 37366, HD 195987, HD 101131 and HD 93205, we find corresponding orbital and spectroscopic elements via a Probabilistic Neural Network (PNN). Our numerical results are in good agreement with those obtained by others using more traditional methods.

1. Introduction

Analysis of both light and radial velocity (hereafter V_R) curves of binary systems helps us to determine the masses and radii of individual stars. One historically well-known method to analyze the V_R curve is that of Lehmann-Filhés [1]. Some other methods were also introduced by Sterne [2] and Petrie [3]. The different methods of the V_R curve analysis have been reviewed in ample detail by Karami & Teimoorinia [4]. Karami & Teimoorinia [4] also proposed a new non-linear least squares velocity curve analysis technique for spectroscopic binary stars. They showed the validity of their new method to a wide range of different types of binary See Karami & Mohebi [5-7] and Karami et al. [8].

Probabilistic Neural Network (PNN) is a new tool to derive the orbital parameters of the spectroscopic binary stars. In this method the time consumed is considerably less than the method of Lehmann-Filhés and even less than the non-linear regression method proposed by Karami & Teimoorinia [4].

In the present paper we use a Probabilistic Neural Network (PNN) to find the optimum match to the four parameters of the V_R curves of the five double-lined spectroscopic binary systems: Schulte 3, HD 37366, HD 195987, HD 101131 and HD 93205. Our aim is to show the validity of our new method to a wide range of different types of binary.

Schulte 3 is a double-lined eclipsing binary and it is a probable member of Cyg OB2. The spectral type is O6IV and O9III for the primary and the secondary star, respectively, and the orbital period is P =4.7464 days [9]. HD 37366 is a double-lined spectroscopic binary with a period of P =31.8188 days. The primary of HD 37366 is classified as O9.5 V, and it contributes approximately two-thirds of the optical flux. The less luminous secondary is a broad-lined, early B-type main-sequence star [10]. HD 195987 is a moderately metal-poor double-lined binary system with an orbital period of P =57.32161 days. The continuum from the secondary typically tends to fill in the spectral lines of the primary, which then appear weaker as if the star were more metal-poor and the combined-light photometry is reddened [11]. HD 101131 is a brightest objects in the young open cluster IC 2944. This system is a double-lined spectroscopic binary in an elliptical orbit with a period of P= 9.64659 days. It is a young system (approximately 2 million years old) and The spectral type is O6.5 V((f)) and O8.5 V for the primary and the secondary star , respectively [12]. HD 93205 is an O-type spectroscopic binary and The spectral type is O3V and O8V for the primary and the secondary star, respectively, and the orbital period is P=6.0803 days [13].

This paper is organized as follows. In Sect. 2, we introduce a Probabilistic Neural Network (PNN) to estimate the four parameters of the V_R curve. In Sect. 3, the numerical results are reported, while the conclusions are given in Sect. 4.

An introduction should

- ***be clear*** of the objectives/motivations, and of what is new in the paper.
- ***answer key questions***. Identify the question that your title and abstract are supposed to answer. If you cannot phrase your contribution in a question form, you are not ready to write the paper. State the question as soon as possible in your introduction. Why now? Why this? Why this way? Why should the reader care? The readers rely on you to answer these questions.
- ***set the foundation of your credibility***. One should present both sides of an issue, i.e., "intellectual honesty". What are the limitations of your work?

An introduction should

- ***justify your choice of method*** in the introduction to strengthen the credibility.

  Our classification algorithm does not make any assumption on the resolution of the images, nor does it make any assumption on the shape of a galaxy.

- ***give your own definition***; frame your own scope of the of your contribution.

  An effective classification scheme should have the following desirable features …

- be ***active and personal***. You want to tell a story, your story, not a report. Use "we" or "our".

  We were curious to see whether we could resolve the discrepancy between these models by using our new observations.

  Passive voice is acceptable in the rest of your paper. But in introduction, use active voice.

An introduction should

- be ***engaging and motivating***. The readers should want to read further. They should appreciate you as a writer, not just as a scientist.

  "*I do not usually read introductions. Most of what's in there is repeated verbatim elsewhere in the paper anyway. They are a water of time. They always say the same thing: the problem is important, everybody else but the author is doing it wrong, and they usually end up with a boring table of contents. So, I skip them*."

  --- quoted from "Kumar" in Lebrun's book

Lebrun thinks some introductions are repetitive because they are written after the work is done, so the fun and excitement are gone! Write the introduction early, with the tantalizing hypothesis, supportive preliminary data, and fruitful methods.

An introduction should

- ***avoid a vacuous false start***

  In the age of all-sky surveys, we are confronted with a large amount of data …

  Significant progress in detector technology in general, and data analysis in particular, often prompts to enable …

  *(**Reader OS**:) Is there anything I do not know already?*

- ***avoid a considerable false start***

  There has been a surge, in recent times, toward the increasing use of …

  There has been considerable interest in recent years in this technology, and, as trends indicate, it is expected to show continuing growth over the next decade …

  *(**Reader OS**:) Should I be excited by the sheer popularity of the problem (not the solution)?*

- ***avoid a dead table-of-contents ending***

- Do not cut and paste sentences from various parts of your paper into the introduction.
- Check this example

  Abstract … The HBLRs and non-HBLRs identified in this data set had significantly different [NII]/Fe ratios, in accord with analysis of other AGN samples. These results demonstrate the emission to originate from different regions …

  Introduction … We demonstrate that the emission of HBLRs and non-HBLRs comes from different parts of the ….

- The abstract is more precise than the introduction for key numerical results. The abstract is factual and passive *"These results demonstrate …"*; the introduction is personal and active *"We demonstrate …".*

Popular Traps

☐The Trap of the Story Plot

A story (from Lebrun)

I'm so excited about telling you this great story. My father is on the front lawn cleaning the lawn mower. My sister is in the back kitchen making a cake. My mom has gone shopping, and I am playing my electric guitar in my bedroom.

- Your readers are left ice cold. There is no plot, no relationship or connection between the elements of the story.
- Identify your story plot in the introduction.

A better story --- with a thread

I'm so excited. I am going to tell you a great story. My father is on the front lawn cleaning the lawn mower. Do you know what this means? Trouble! He hates it. He wants everyone to help bring him this or that in order to feel less miserable. Whenever that happens, we all run away, not because we refuse to help him, but because he wants us to stand there and watch idly while he works. So, my sister is taking refuge in the back kitchen and is plunging her hand in flour to slowly making a cake. My mom has suddenly discovered that she is missing something, and has rushed out to shop, saying she would be gone for an hour or so. As for me, I am in my bedroom playing the electric guitar with my amplifier at maximum volume.

A terrible story

I'm so excited. I am going to tell you my second best story. A red Ferrari would take me to Vladimir Toldoff's house in 5 hours. It is fast. ***However****, it is very expensive. A red bicycle is much less expensive and is quite convenient for short trips. So, if Vladimir Toldoff came to live near my house, it would be quite cost effective.* ***However****, a bicycle that does not have a mudguard requires a bicycle clip so as not to dirty trousers. Since red athletic shoes do not require a bicycle clip, they are a better solution than a bicycle to travel short distances.* ***However****, their color is easily degraded by adverse weather conditions, particularly in the muddy rainy season.* ***On the other hand****, brownish open plastic sandals do not have any of the previous problems: they are cheap, convenient, require no bicycle clip, and do not show mud stains.* ***Furthermore****, they are easy to clean, and are fast to put on.* ***However****, contrary to the Ferrari, they reflect poorly on the status of their owners. Therefore, I am working on a framework to integrate self-awareness into the means of transportation, and will validate it through the popular Sims 2 simulation package.*

The disconnect plot and however plot are frequently found because they are convenient:

- They allow a list of loosely related references to be easily assembled.
- The shallow analysis of related works is fast because it does not require extensive reading of other people's works (abstracts or even titles are enough in most cases)

Usually a plot that works well in movies is also useful in scientific writing. It is all right if you show the readers how the story ends before it even starts. The readers have a full picture, so they can place your contribution in it. They know your limitations and expect that you will deal with them.

☐ The Trap of Plagiarism

- Plagiarism happens when someone else's words are found in your paper without proper quotes or references.
- For an academic position, plagiarism = end of career.
- Changing a word here and there does not get rid of plagiarism → "patchwork plagiarism"
- Changing every word except the keywords does not help.
- Even quoting yourself can be dangerous. You might have coauthors. The copyright, after a paper is published, no longer belongs to you.
- Free or open access does not imply free right of use.
- Quoting is a good practice. You do not interpret; you cite.

- When doing the electronic literature study, keep relevant documentation about the information source.
- Completely rewrite without looking at the original, and express your point of view.

  In apparent support of the cold dark matter cosmology, Chen (2012) provided observational evidence of …

With the skillful use of the word "***apparent***", the author starts in the next paragraph with "***However***" to express disagreement.

☐ The Trap of Imprecision

- So your paper mentions 30 or more references. Did you read them all? Or did you just skim the abstracts?
- Words like *typical, generally, commonly, can/may, a number of, the majority of, substantial, probably, several, less, various, frequent, many, others, more, often, most, a few, the main*…

> *Many people have been working on this problem [1,2,3,4,5,6,7,8,9,10], and others have recently improved on the method [11,12,13,14,15,16,17].*

- Very often, the rest of the paper does not contain as many references.
- As a referee, how do you think of this paper?

If you read only the abstracts, or fill your paper with references of papers you have not read (or even do not have them), it will hurt you in the following ways:

- Your paper will have superficial statements, so the referee will lower the value of your contribution.
- Your research will be clearly positioned on the research landscape.
- Your story will lack of details and, therefore, interest.
- The reader will doubt your expertise. Why should they believe you otherwise?

☐ The Trap of Judgmental Adjectives

- When you refer to other's work, some adjectives are dangerous (*poor, good, fast, faster, not reliable, primitive, naïve, limited*).
- Every adjective is a claim, and in science, claims have to be substantiated. How do you justify "poor"?
- Use those adjectives that you later justify with data or figures. Let adjectives be based on facts, or on quotes from other authors stating their own limitations of assumptions.

- State that your work agrees (or disagrees) with another paper's conclusions. State that your results are different or consistent.
- Use facts and numbers.
- Define your uniqueness.
- Quote another paper that independently supports your views.

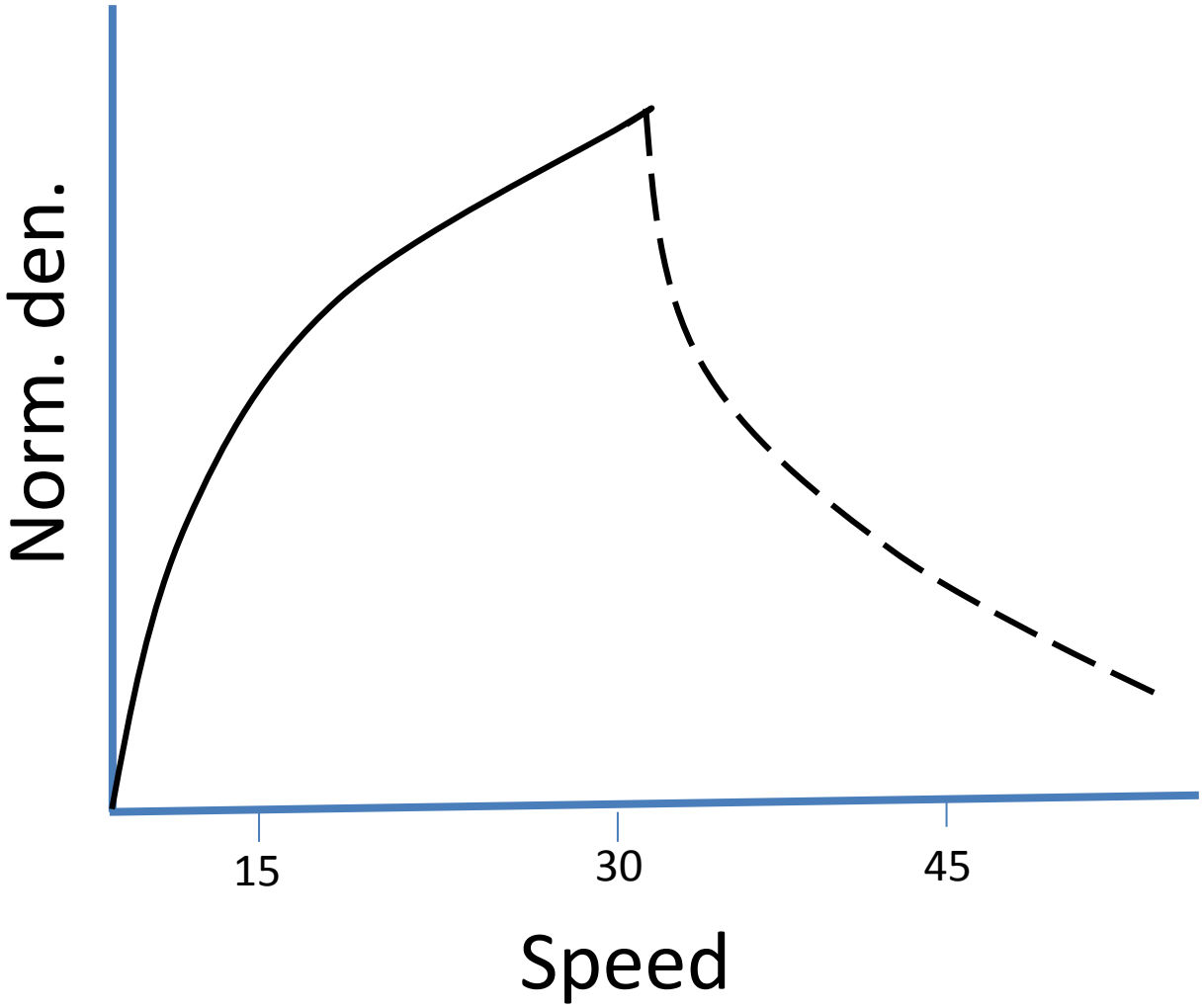
Visuals

The voice of your paper

Be Published or Not, Reviewers Decide.
Be Cited or Not, Readers Decide.
http://www.scientific-writing.com/

Chapter 15 of Lebrun (2007)

- A voice attracts attention. Likewise, photos and graphics shout their messages.
- Visuals have a loud and convincing voice, but only if you can make them speak. The language is based on a special grammar that describes the correct use of fonts, blocking, typesetting, framing, white space, line (space), and colors, etc.
- Figures form the plot (story) of the paper so should be made first before starting to write the paper.
- It is often straightforward to generate figures out of data. But what story do you intend to tell?


Norm. den.
15
30
45
Speed

Seven Principles for Good Visuals

1. A visual does not ask more question than it can answer.

   Mind the axis labeling and legends. Too many details are distracting

2. A visual is custom-designed to support the contribution of only one paper.

   Redraw a figure if needed.

3. A visual keeps its complexity in step with readers' understanding.

   A compelling visual should compare "before" versus "after", or "with" versus "without".

   More complex visuals are placed closer to the end of the paper.

   Avoid using small font types, so resizing does not affect readability.

4. A visual is designed based on its contribution, not on its ease of creation.

   Does this visual replace much text or strongly support your contribution?

   More visuals → your contribution is diluted.

5. A visual has its elements arranged to make its purpose immediately apparent.

   A visual may be impressive, but the readers are not impressed.

   Like the first text version of the paper, the first visual is rarely the best.

6. A visual is concise if its clarity declines when a new element is added or removed.

   Be aware of the "everything but the kitchen sink" visual.

7. Beside the caption, a visual requires no external text support to be understood.

   See text?

- Choose the key figure in your paper and show it to your colleagues. Do not show the caption. Ask them to hypothesize what you want to show. Do they have questions? Then show them the caption. Are their questions answered?

Conclusions

The smile of your paper

Chapter 16 of Lebrun (2007)

- Using past tense in the conclusions is fine, except where you want to emphasize your contribution.
  - *In conclusions, our modified model has not yet provided definitive evidence for or against the predicted end of the Universe. However, it **confirms** that a proper selection of the observed sample may bias …*
- Preempt with assumptions and limitations
  - *We expect that with an enlarged observed sample …*
- Be consistent with the abstract and introduction. But do not cut and paste.

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