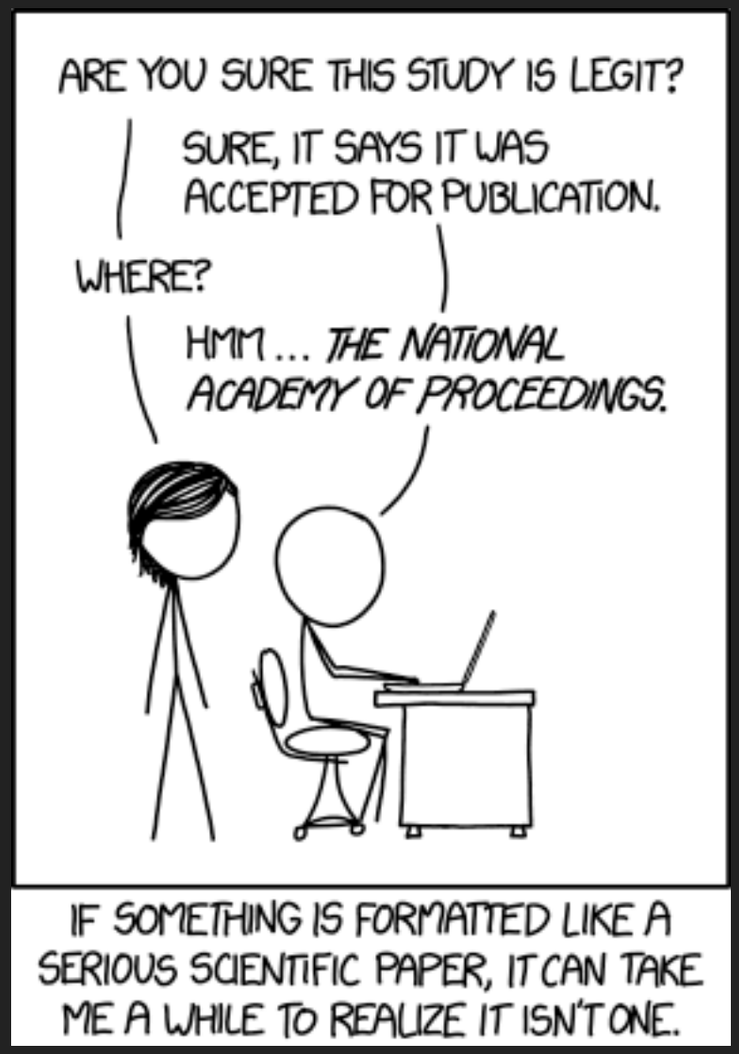
HOW TO READ AN ACADEMIC PAPER



Alex Pizzuto

Professional Development Seminar: 2/21/20

NOTHING MAKES YOU FEEL STUPID QUITE LIKE READING A SCIENTIFIC JOURNAL ARTICLE

Adam Ruben

https://www.sciencemag.org/careers/2016/01/how-read-scientific-paper

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Adam Ruben

10 Stages of Reading a Scientific Paper

1. Optimism
2. Fear
3. Regret
4. Corner-cutting
5. Bafflement
6. Distraction
7. Realization that 15 minutes have gone by and you haven't progressed to the next sentence
8. Determination
9. Rage
10. Genuine contemplation of a career in the humanities

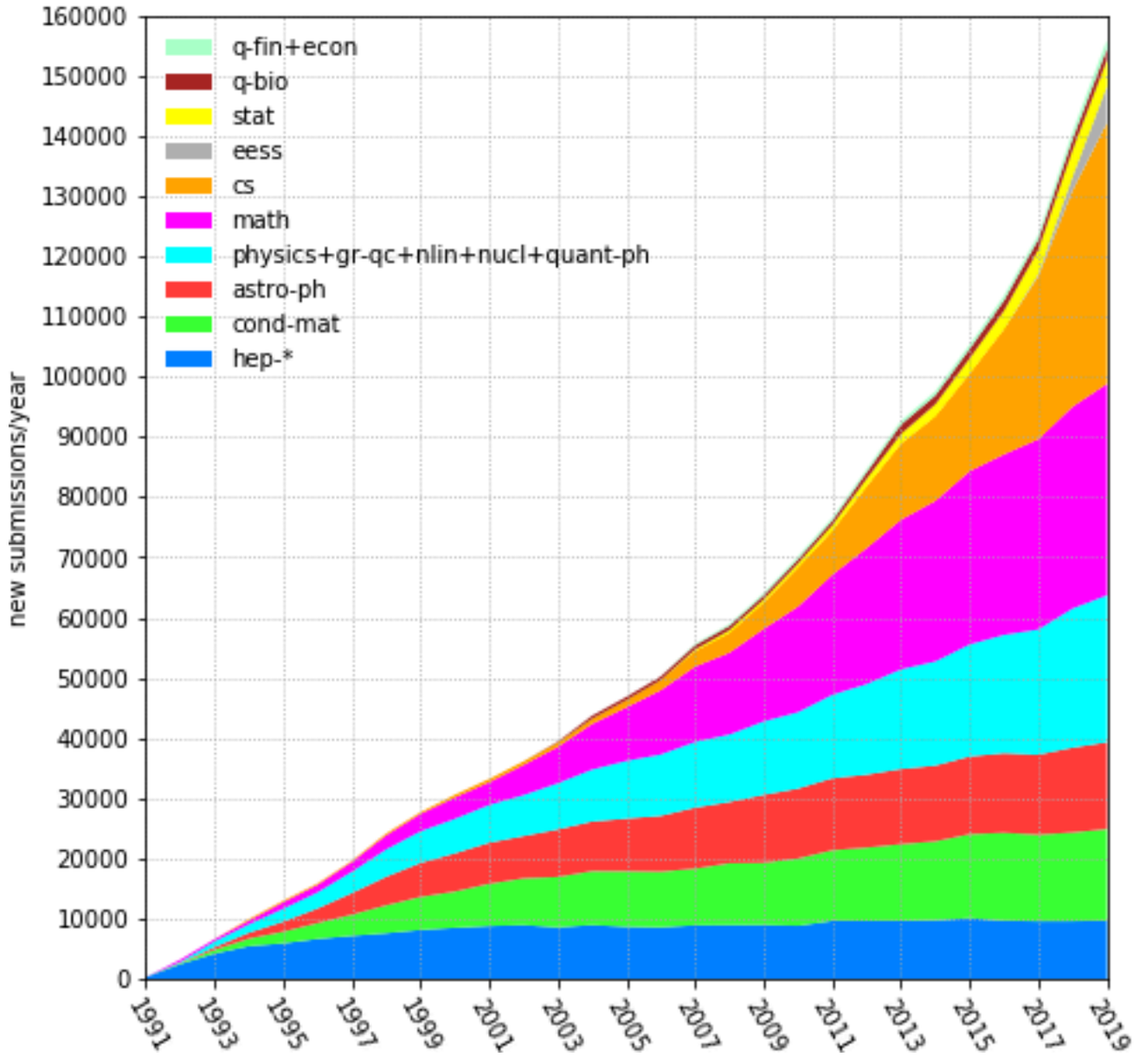
https://www.sciencemag.org/careers/2016/01/how-read-scientific-paper

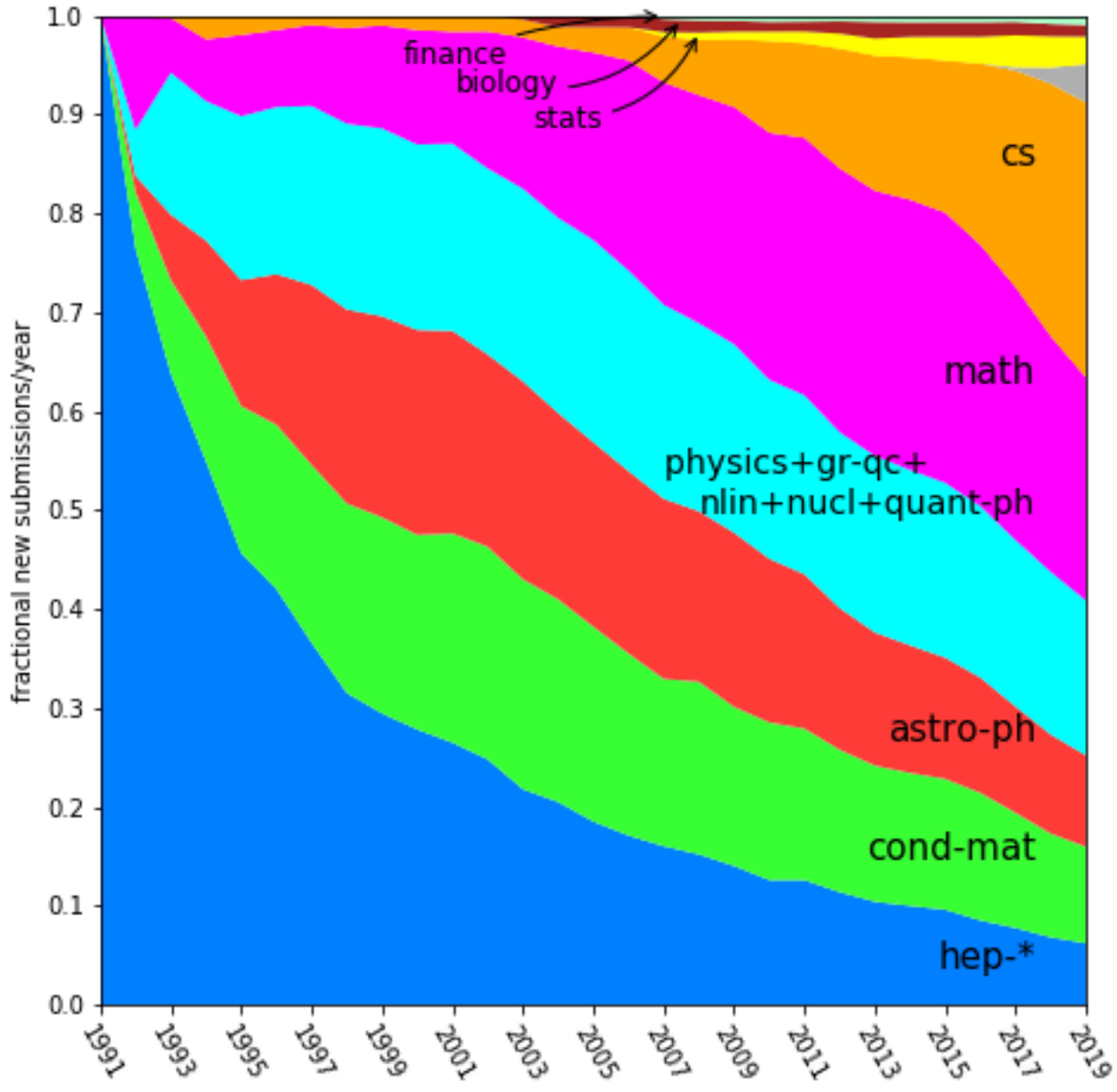
IN ALL SERIOUSNESS . . .

Today, I'll briefly chat about

- How to find articles worth reading
- How to read a paper (efficiently)
- Tools to organize your papers

HOW TO FIND ARTICLES





https://arxiv.org/help/stats/2019_by_area/index

HOW TO FIND ARTICLES: STRAIGHT FROM THE SOURCE

Understanding the arXiv: each "group" consists of "archives," some of which have "subject classes."

Typical to expect around 20-30 new papers per day in each subject class

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21 Jan 2020: What is new and upcoming for arXiv in 2020? Please see our 2020 update and roadmap
08 Jan 2020: Congratulations to arXiv founder Paul Ginsparg for being awarded the 2020 Karl Taylor Compton Medal for Leadership in Physics
06 Jan 2020: Martin Luther King, Jr. Holiday Schedule announced

See cumulative "What's New" pages. Read robots beware before attempting any automated download

Physics

- Astrophysics (**astro-ph** new, recent, search)
  includes: Astrophysics of Galaxies; Cosmology and Nongalactic Astrophysics; Earth and Planetary Astrophysics; High Energy Astrophysical Phenomena; Instrumentation and Methods for Astrophysics; Solar and Stellar Astrophysics
- Condensed Matter (**cond-mat** new, recent, search)
  includes: Disordered Systems and Neural Networks; Materials Science; Mesoscale and Nanoscale Physics; Other Condensed Matter; Quantum Gases; Soft Condensed Matter; Statistical Mechanics; Strongly Correlated Electrons; Superconductivity
- General Relativity and Quantum Cosmology (**gr-qc** new, recent, search)
- High Energy Physics - Experiment (**hep-ex** new, recent, search)
- High Energy Physics - Lattice (**hep-lat** new, recent, search)
- High Energy Physics - Phenomenology (**hep-ph** new, recent, search)
- High Energy Physics - Theory (**hep-th** new, recent, search)
- Mathematical Physics (**math-ph** new, recent, search)
- Nonlinear Sciences (**nlin** new, recent, search)
  includes: Adaptation and Self-Organizing Systems; Cellular Automata and Lattice Gases; Chaotic Dynamics; Exactly Solvable and Integrable Systems; Pattern Formation and Solitons
- Nuclear Experiment (**nucl-ex** new, recent, search)
- Nuclear Theory (**nucl-th** new, recent, search)
- Physics (**physics** new, recent, search)

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Cosmology and Nongalactic Astrophysics

Authors and titles for recent submissions

- Mon, 17 Feb 2020
- Fri, 14 Feb 2020
- Thu, 13 Feb 2020
- Wed, 12 Feb 2020
- Tue, 11 Feb 2020

[total of 63 entries: **1-25** | 26-50 | 51-63]
[showing 25 entries per page: fewer | more | all]

Mon, 17 Feb 2020

[1] **arXiv:2002.06127** [**pdf**, **other**]

Tensions in the dark: shedding light on Dark Matter-Dark Energy Interactions
Matteo Lucca, Deanna C. Hooper
Comments: 15 pages, 2 figures. Comments welcome
Subjects: **Cosmology and Nongalactic Astrophysics (astro-ph.CO)**; General Relativity and Quantum Cosmology (gr-qc); High Energy Physics - Phenomenology (hep-ph)

[2] **arXiv:2002.06044** [**pdf**, **other**]

Is there an early Universe solution to the Hubble tension?
Chethan Krishnan, Eoin Ó Colgáin, Ruchika, Anjan A. Sen, M. M. Sheikh-Jabbari, Tao Yang
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New papers (49) Collapse

[astro-ph #3] Outflows in Star-forming Galaxies: Stacking Analyses of Resolved Winds and the Relation to Their Hosts' Properties

0 votes @WIPAC
(19 votes from 16 institutions)
Please log in or create an account to vote!

Guido Roberts-Borsani, Amélie Saintonge, Karen L. Masters[1†], David V. Stark

[1]ICG, Portsmouth/Harvard-SAO CfA

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ArXiv #: 2002.05724 (PDF, PS, ADS, Papers, Other)

Comments: 20 pages, 11 figures. Accepted for publication in MNRAS

Originally posted 02/16/2020

GA

Outflows form an integral component in regulating the gas cycling in and out of galaxies, although their impact on the galaxy hosts is still poorly understood. Here we present an analysis of 405 high mass (log M$_{*}$/M$_{\odot}\geqslant10$), star-forming galaxies (excluding AGN) with low inclinations at $z\sim$0, using stacking techniques of the NaD $\lambda\lambda$5889,5895 A neutral gas tracer in IFU observations from the MaNGA DR15 survey. We detect outflows in the central regions of 78/405 galaxies and determine their extent and power through the construction of stacked annuli. We find outflows are most powerful in central regions and extend out to $\sim$1R$_{e}$, with declining mass outflow rates and loading factors as a function of radius. The stacking of spaxels over key galaxy quantities reveals outflow detections in regions of high Σ_{SFR} ($\gtrsim$0.01 M$_{\odot}$yr^{-1}kpc^{-2}) and $\Sigma_{M_{*}}$ ($\gtrsim$10^{7} M$_{\odot}$kpc^{-2}) along the resolved main sequence. Clear correlations with Σ_{SFR} suggest it is the main regulator of outflows, with a critical threshold of $\sim$0.01 M$_{\odot}$yr^{-1}kpc^{-2} needed to escape the weight of the disk and launch them. Furthermore, measurements of the Hδ and D$_{n}$4000 indices reveal virtually identical star formation histories between galaxies with outflows and those without. Finally, through stacking of HI 21 cm observations for a subset of our sample, we find outflow galaxies show reduced HI gas fractions at central velocities compared to their non-detection control counterparts, suggestive of some removal of HI gas, likely in the central regions of the galaxies, but not enough to completely quench the host.

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HOW TO FIND ARTICLES: BITES, PRESS RELEASES, POSTDOCS

Still daunting? Look for places that write summaries of papers:

- "Bites"
- Press releases
  - DES: "the Darchive" (https://www.darkenergysurvey.org/news-and-results/darchives/)
  - IceCube, LIGO, CMS, etc all have websites where they post accessible summaries of new papers
- Bookworm postdocs
  - Some examples from my field https://mbustamante.net/my-daily-arxiv-picks/, https://peterdenton.github.io/Articles/index.html
- Slackbots: #papers-* channels on Slack
  - Suggest your own keywords!
- Either read the summary beforehand as a primer, or after to see if you came to the same conclusions

STILL DON'T KNOW WHERE TO START? REVIEWS

Review papers are the *best* way to get acquainted with a field

- Introduce the basic physics of the field
- Catalogue recent results and the state of the field
- Provide lists of too many references

Most fields have these, ask current students in groups for review papers if you want to get started in a group

I've had good luck with Google:

"reviews in physics + {experiment/field name}"

HOW TO READ ARTICLES

HOW TO READ ARTICLES

HOW TO READ ARTICLES

DON'T

JUST LOOK AT THE PRETTY PICTURES

Once you have a paper, read ONLY the abstract

Teraelectronvolt emission from the γ-ray burst GRB 190114C

Long-duration γ-ray bursts (GRBs) are the most luminous sources of electromagnetic radiation known in the Universe. They arise from outflows of plasma with velocities near the speed of light that are ejected by newly formed neutron stars or black holes (of stellar mass) at cosmological distances[1,2]. Prompt flashes of megaelectronvolt-energy γ-rays are followed by a longer-lasting afterglow emission in a wide range of energies (from radio waves to gigaelectronvolt γ-rays), which originates from synchrotron radiation generated by energetic electrons in the accompanying shock waves[3,4]. Although emission of γ-rays at even higher (teraelectronvolt) energies by other radiation mechanisms has been theoretically predicted[5–8], it has not been previously detected[7,8]. Here we report observations of teraelectronvolt emission from the γ-ray burst GRB 190114C. γ-rays were observed in the energy range 0.2–1 teraelectronvolt from about one minute after the burst (at more than 50 standard deviations in the first 20 minutes), revealing a distinct emission component of the afterglow with power comparable to that of the synchrotron component. The observed similarity in the radiated power and temporal behaviour of the teraelectronvolt and X-ray bands points to processes such as inverse Compton upscattering as the mechanism of the teraelectronvolt emission[9–11]. By contrast, processes such as synchrotron emission by ultrahigh-energy protons[10,12,13] are not favoured because of their low radiative efficiency. These results are anticipated to be a step towards a deeper understanding of the physics of GRBs and relativistic shock waves.

HOW TO READ ARTICLES

Intro to the field

Technical details

Implications

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IMPORTANT

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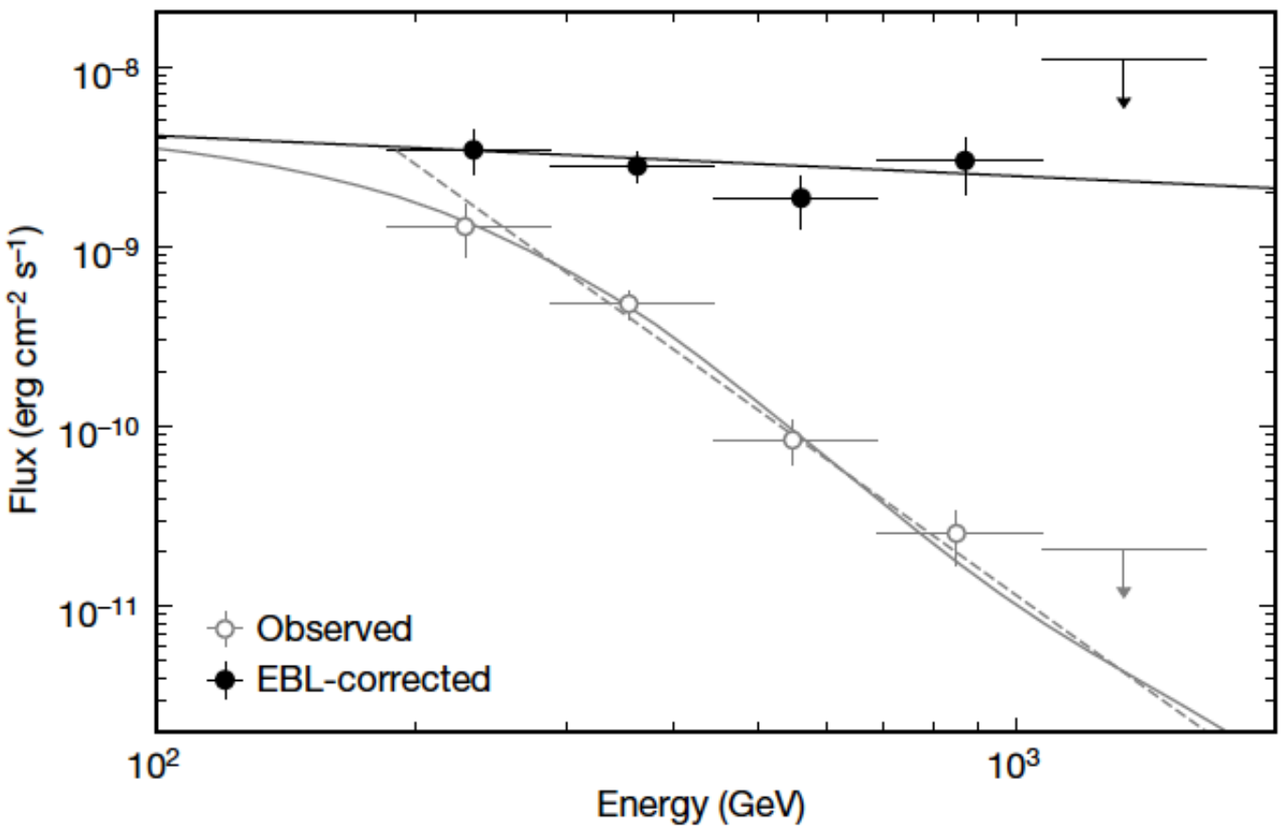

Fig. 2 | Spectrum above 0.2 TeV averaged over the period between T_0 + 62 s and T_0 + 2,454 s for GRB 190114C. Spectral-energy distributions for the spectrum observed by MAGIC (grey open circles) and the intrinsic spectrum corrected for EBL attenuation[25] (blue filled circles). The errors on the flux correspond to one standard deviation. The upper limits at 95% confidence level are shown for the first non-significant bin at high energies. Also shown is the best-fit model for the intrinsic spectrum (black curve) when assuming a power-law function. The grey solid curve for the observed spectrum is obtained by convolving this curve with the effect of EBL attenuation. The grey dashed curve is the forward-folding fit to the observed spectrum with a power-law function (Methods).

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If and only if you found that plot interesting / relevant, look at the other figures (10 minutes).
Only read the text if the figures leave you wanting to know more (~hour)

IMPORTANT

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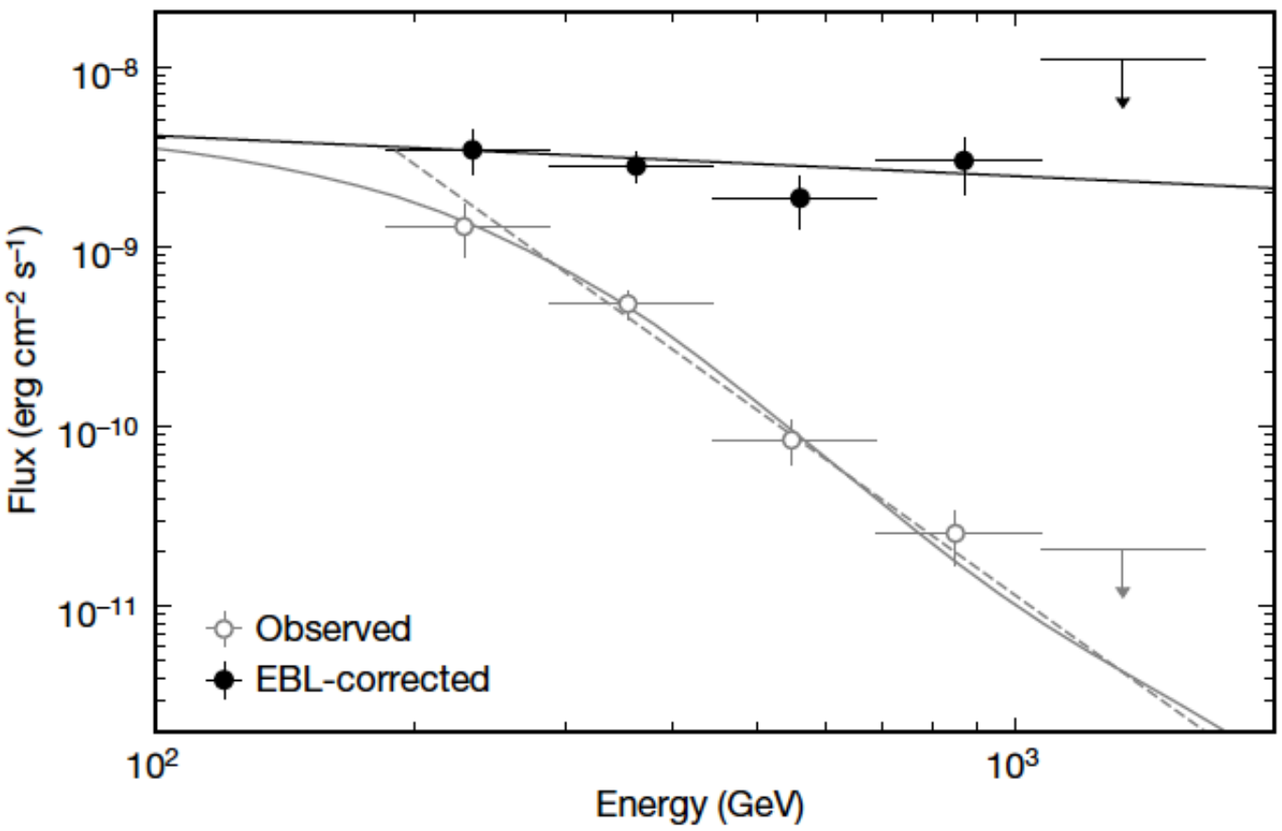

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HOW TO READ ARTICLES: UNDERSTANDING PLOTS

Jargon is unavoidable, familiarize yourself with some of it

- If it's in the abstract, you probably want to know what it is
- Know common types of plots and commonly plotted variables in your field
- Experimentalists, have a basic understanding of detector technologies (photomultiplier tubes vs. silicon PMs, time projection chambers, radio antennae, scintillators, dilution fridges . . .)

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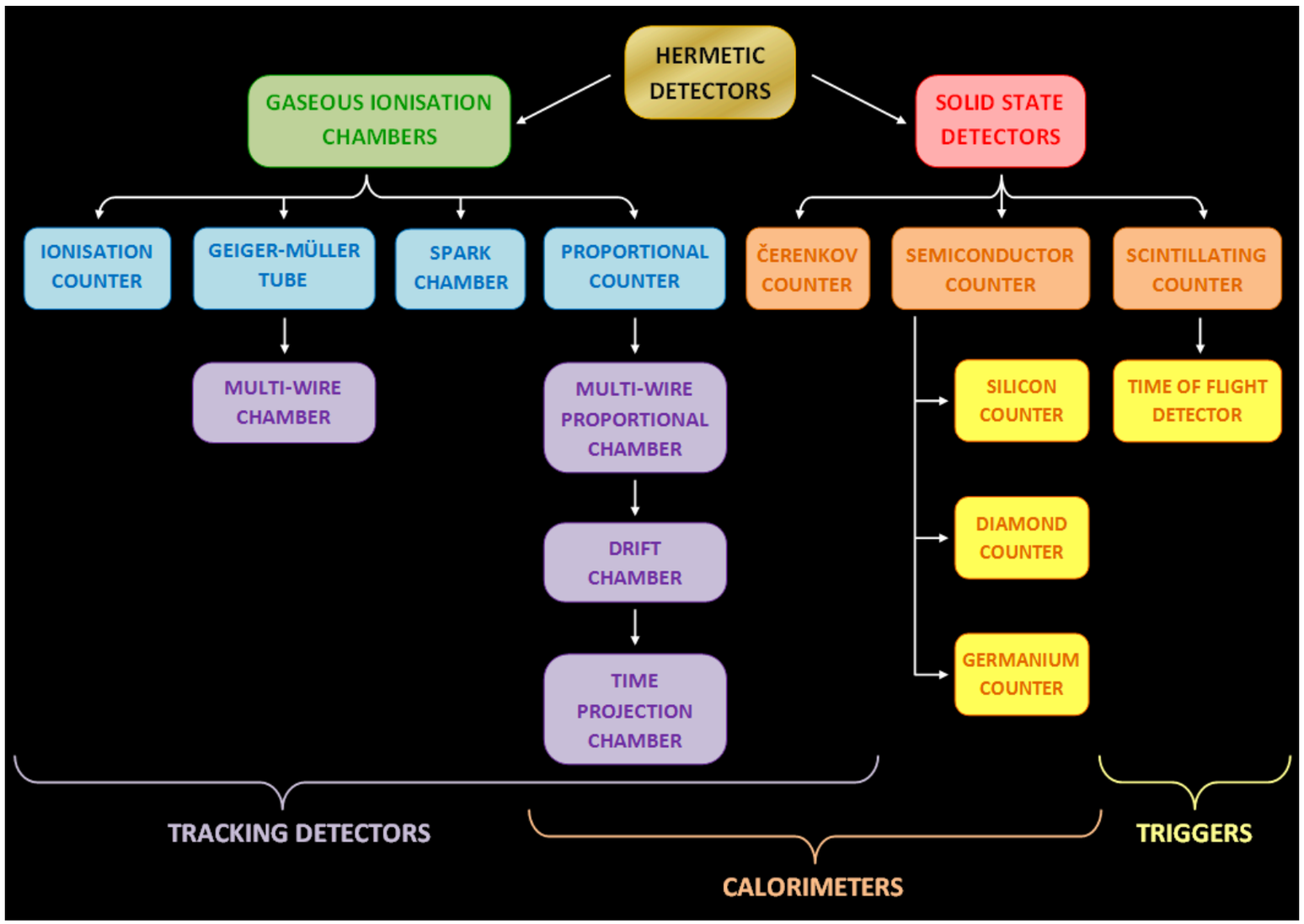

HOW TO READ ARTICLES: UNDERSTANDING PLOTS

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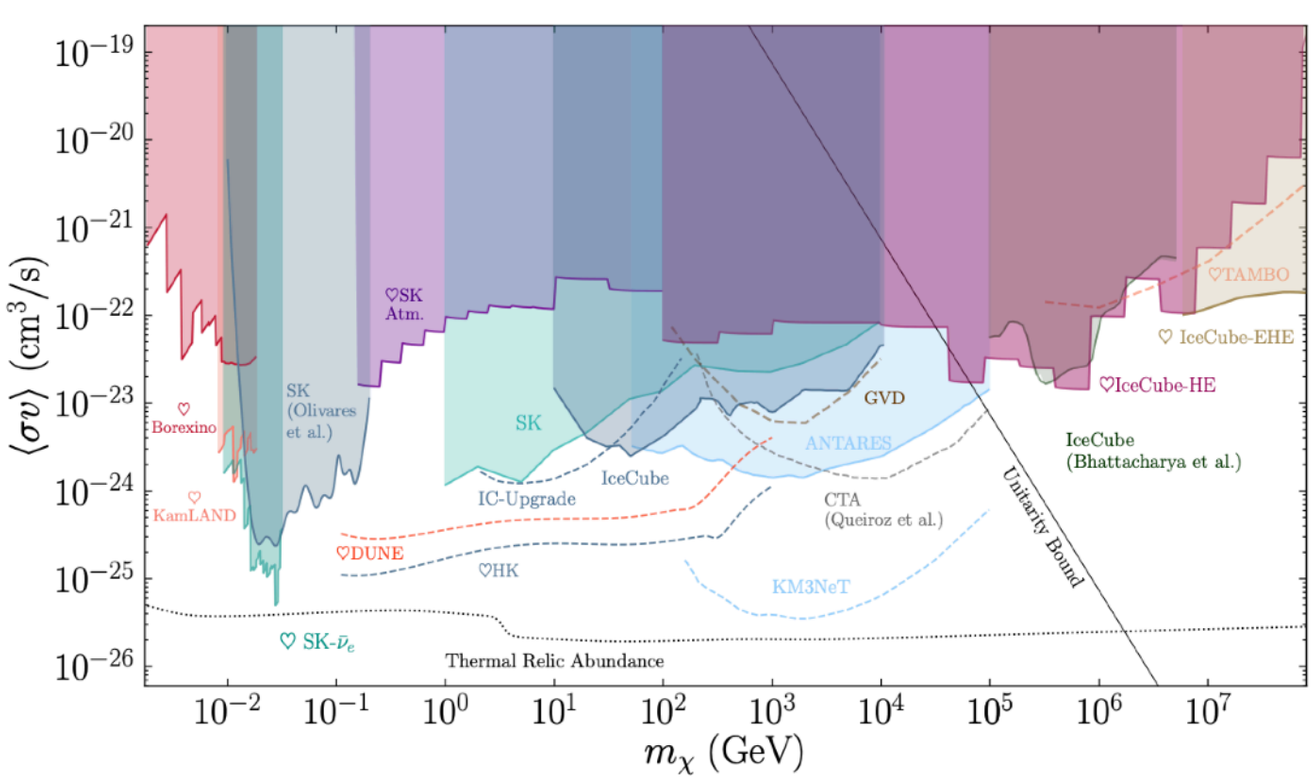
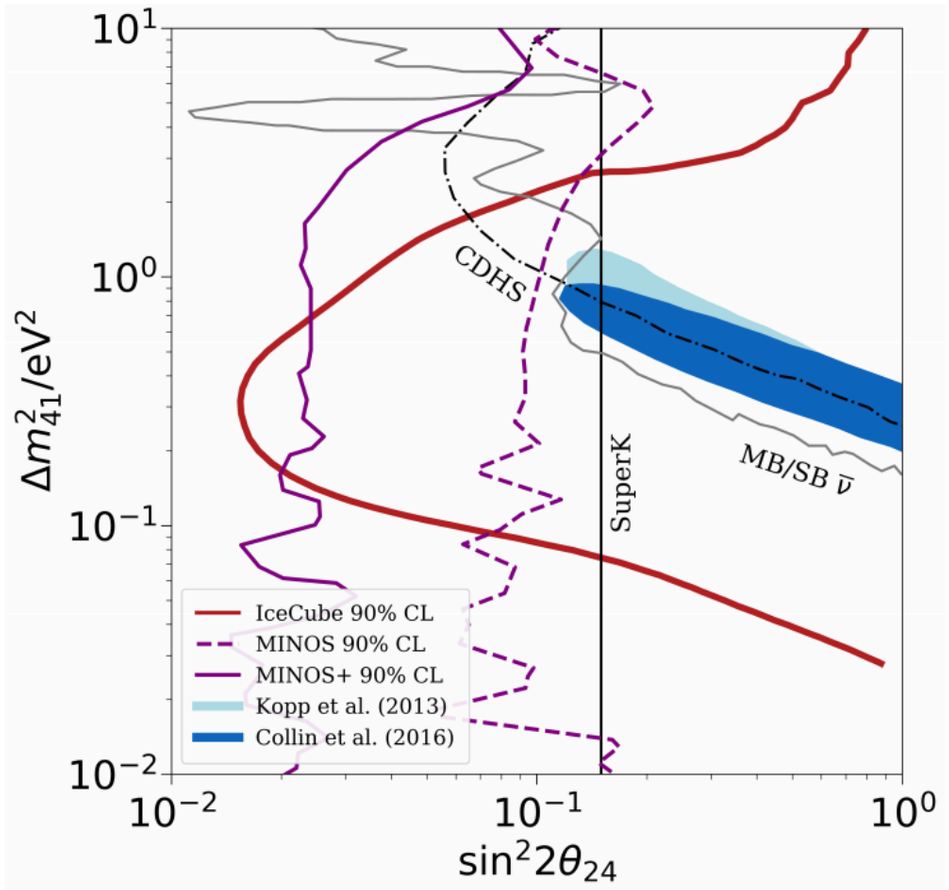
- If it's in the abstract, you probably want to know what it is
- Know common types of plots and commonly plotted variables in your field
- Experimentalists, have a basic understanding of detector technologies (photomultiplier tubes vs. silicon PMs, time projection chambers, radio antennae, scintillators, dilution fridges . . .)

"Sensitivities" or "Upper Limits": Lower is Better





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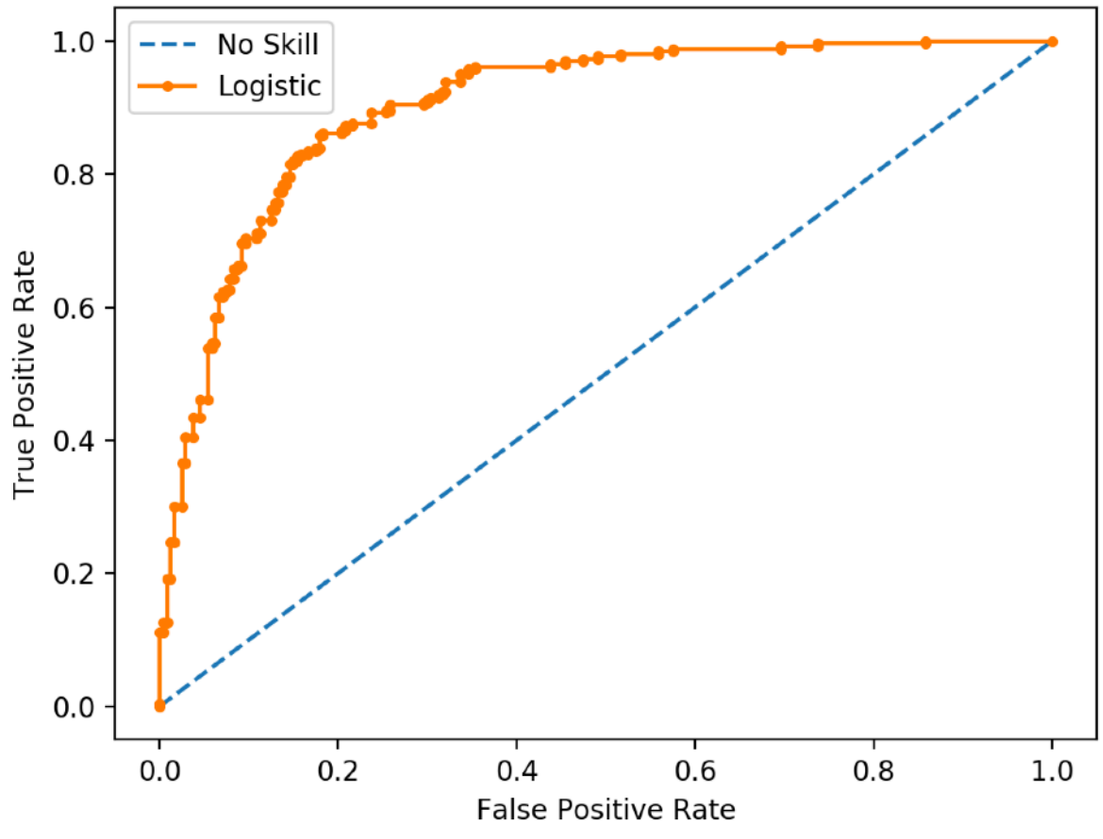
Receiver Operating Characteristic (ROC) curves:

Upper left is best



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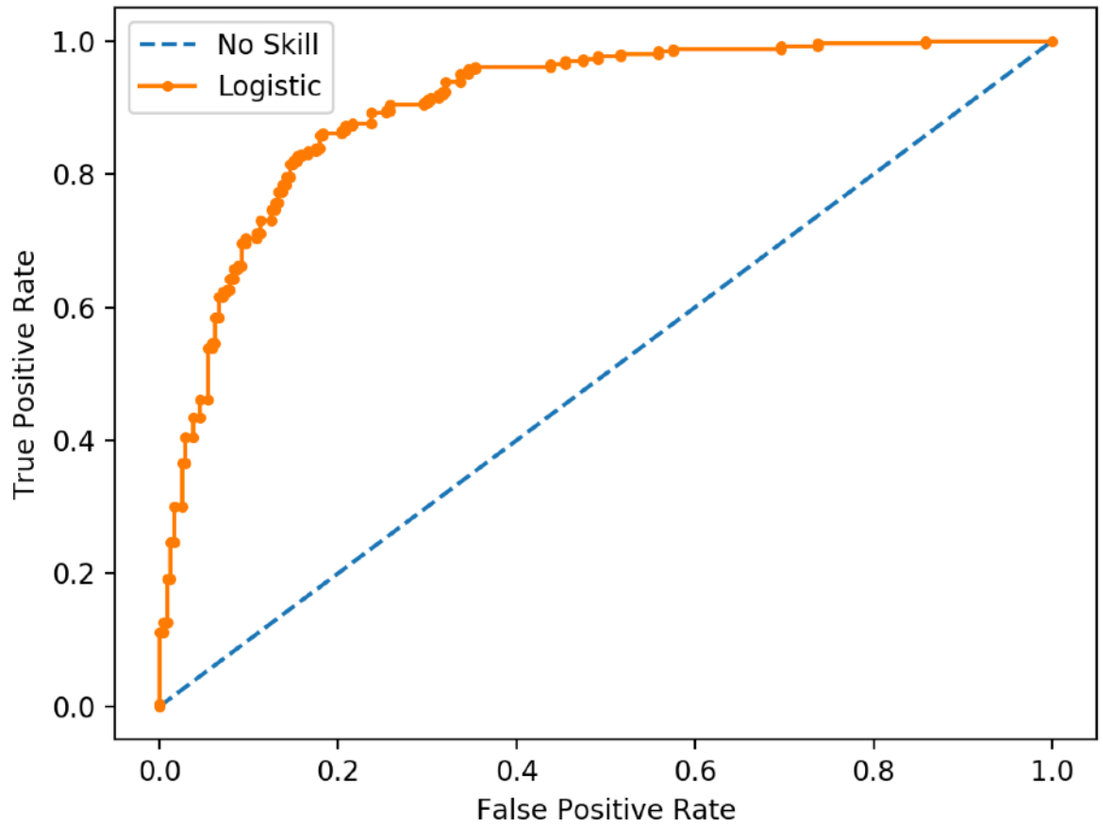

Ask students in the field what *types* of plots are common. Familiarize yourself with them

HOW TO READ ARTICLES: JOURNAL CLUBS

The quickest way to learn more about a topic is talking with others about it in journal clubs

Cosmology: Thursdays @ noon, 5242 Chamberlin

WIPAC: Thursdays @ noon, 222 W. Washington

Bring a paper that seems interesting and understand 1-2 figures. Others in the room will help with the rest

Check out the #research-* channels on Slack. Ask questions about interesting papers there

CITATION MANAGERS: ZOTERO, MENDELEY, ENDNOTE, OVERLEAF

Make your lit review section easier by keeping track of what you've read

- Lots of citation trackers exist (many with the "freemium" model)
  - Mendeley, Zotero, EndNote
- I just have a GIANT .bib file in Overleaf with little notes about every paper I've read

```
1586  %Fermi discovered Gamma-ray novae
1587  %8 gamma-ray detected novae by Fermi-LAT
1588  %Figure 4 gamma-ray spectra vs. energy could be helpful
1589  @article{Franckowiak:2017iwj,
1590        author          = "Franckowiak, A. and Jean, P. and Wood, M. and
      Cheung, C.
1591                           C. and Buson, S.",
1592        title           = "{Search for Gamma-ray Emission from Galactic
      Novae with
1593                           the Fermi-LAT}",
1594        journal         = "Astron. Astrophys.",
1595        volume          = "609",
1596        year            = "2018",
1597        pages           = "A120",
1598        doi             = "10.1051/0004-6361/201731516",
1599        eprint          = "1710.04736",
1600        archivePrefix   = "arXiv",
1601        primaryClass    = "astro-ph.HE",
1602        SLACcitation    = "%%CITATION = ARXIV:1710.04736;%%"
1603  }
```

LET'S READ A PAPER

Rob said there should be an interactive session: blame him for this

1. Get into pairs / small groups
2. Using one of the methods above (arXiv, voxCharta, press releases, etc.) find an interesting paper to read
3. After 5 minutes, be prepared to explain the content of the paper to us

An ARTICLE a day keeps the ADVISOR away.

~ENGLISH PROVERB~