AN EXAMPLE ARTICLE USING AASTeXV6.0

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ABSTRACT

This example manuscript is intended to serve as a tutorial and template for authors to use when writing their own AAS Journal articles. The manuscript includes a history of AASTeX and documents the new features in the latest version, 6.0, including many figure and table examples. Information on features not explicitly mentioned in the article can be viewed in the manuscript comments or more extensive online documentation. Authors are welcome replace the text, tables, figures, and bibliography with their own and submit the resulting manuscript to the AAS Journals peer review system. The first lesson in the tutorial is to remind authors that the AAS Journals, the Astrophysical Journal (ApJ), the Astrophysical Journal Letters (ApJL), and Astronomical Journal (AJ), all have a 250 word limit for the abstract. If you exceed this length the Editorial office will ask you to shorten it.

Keywords: editorials, notices — miscellaneous — catalogs — surveys

1. INTRODUCTION

LaTeX [1] is a document markup language that is particularly well suited for the publication of mathematical and scientific articles (Lamport 1994). LaTeX was written in 1985 by Leslie Lamport who based it on the TEX typesetting language which itself was created by Donald E. Knuth in 1978. In 1988 a suite of LaTeX macros were developed to investigate electronic submission and publication of AAS Journal articles (Hanisch & Biemesderfer 1989). Shortly afterwards, Chris Biemesdefer merged these macros and more into a LaTeX 2.08 style file called AASTeX. These early AASTeX versions introduced many common commands and practices that authors take for granted today such as long table support in the form of deluxetable. Substantial revisions were made by Lee Brotzman and Pierre Landau when the package was updated to v4.0. AASTeX v5.0, written in 1995 by Arthur Ogawa, upgraded to LaTeX 2e which uses the document class in lieu of a style file. Other improvements to version 5 included hypertext support, landscape deluxetables and improved figure support to facilitate electronic submission. The last major release, AASTeX v5.2 in 2005, introduced additional graphics support plus new mark up to identifier astronomical objects, datasets and facilities.

In 1996 Maxim Markevitch modified the AAS preprint style file, aaspp4.sty, to closely emulate the very tight, two column style of a typeset Astrophysical Journal article. The result was emulateapj.sty. A year later Alexey Vikhlinin took over development and maintenance. In 2001 he converted emulateapj into a class file in LaTeX 2e and in 2003 Vikhlinin completely rewrote emulateapj based on the APS Journal's RevTEX class.

During this time emulateapj gained growing acceptance in the astronomical community as it filled an author need to obtain an approximate number of manuscript pages prior to submission for cost and length estimates. The tighter typeset also had the added advantage of saving paper when printing out hard copies.

Even though author publication charges are no longer based on print pages [2] the emulateapj class file has proven to be extremely popular with AAS Journal authors. An informal analysis of submitted LaTeX manuscripts in early

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[1] http://www.latex-project.org/

[2] see Section B in the Appendix for more details about how current article costs are calculated.

2015 reveals that ∼65% either call emulateapj or have the emulateapj classfile in the comments indicating it was used at some stage of the manuscript construction. Clearly authors want to have access to a tightly typeset version of the article when corresponding with co-authors and for preprint submissions.

When planning the next AASTeX release the popularity of emulateapj played an important roll in the decision to drop the old base code and adopt and modify emulateapj for AASTeX v6.0 instead. The change brings AASTeX inline with what the majority of authors are already using while still delivering new and improved features. AASTeX v6.0 was written by Amy Hendrickson and released in 2016. Some of the new features in v6.0 include:

1. improved citations for third party data repositories and software,

2. easier construction of matrix figures consisting of multiple encapsulated postscript (EPS) or portable document format (PDF) files,

3. figure set mark up for large collections of similar figures,

4. color mark up to easily enable/disable revised text highlighting,

5. improved url support and hyperlinking, and

6. numerous table options such as the ability to hide columns, column decimal alignment, automatic column math mode and numbering, plus splitting of wide tables.

The rest of this article provides information and examples on how to create your own AAS Journal manuscript. Special emphasis is placed on how to use the full potential of AASTeX v6.0. The next section describes the different manuscript styles available and how they differ from past releases. Section 3 describes how tables and figures are placed in a LaTeX document. Specific examples of tables, Section 3.1, and figures, Section 3.2, are also provided. Section 4 discusses how to display math and incorporate equations in a manuscript while Section 5 discuss how to use the new revision mark up. The last section, 6, shows how recognize software and external data as first class references in the manuscript bibliography. An appendix is included to show how to construct one and provide some information on how article charges are calculated. Additional information is available both embedded in the comments of this LaTeX file and in the online documentation at http://journals.aas.org/authors/aastex.html.

2. MANUSCRIPT STYLES

The default style in AASTeX v6.0 is a tight single column style, e.g. 10 point font, single spaced. It can also be called directly with

\documentclass[onecolumn]{aastex6}.

but as the default the argument is not necessary. The single column style is very useful for article with wide equations. It is also the easiest to style to work with since figures and tables, see Section 3, will span the entire page, reducing the need for address float sizing.

To invoke a two column style similar to the what is produced in the published PDF copy use

\documentclass[twocolumn]{aastex6}.

Note that in the two column style figures and tables will only span one column unless specifically ordered across both with the "*" flag, e.g.

\begin{figure*} ... \end{figure*},
\begin{table*} ... \end{table*}, and
\begin{deluxetable*} ... \end{deluxetable*}.

This option is ignored in the onecolumn style.

Some other style options are outlined in the commented sections of this article. Any combination of style options can be used.

Two style options that are needed for fully use the new revision tracking feature, see Section 5, are `linenumbers` which uses the lineno style file to number each article line in the left margin and `trackchanges` which controls the revision and commenting highlight output.

Previous versions of AASTEX accepted other styles most of which have been modified. The old `manuscript` option now produces a single column, double spaced format with 12 point font. `preprint` and `preprint2` now are aliased with `onecolumn` and `twocolumn`, respectively.

3. FLOATS

Floats are non-text items that generally can not be split over a page. They also have captions and can be numbered for reference. Primarily these are figures and tables but authors can define their own. LaTeX tries to place a float where indicated in the manuscript but will move it later if there is not enough room at that location, hence the term "float".

Authors are encouraged to embed their tables and figures within the text as they are mentioned. Please do not place the figures and text at the end of the article as was the old practice. Editors and and the vast majority of referees find it much easier to read a manuscript with embedded figures and tables.

Depending on the number of floats and the particular amount of text and equations present in a manuscript the ultimate location of any specific float can be hard to predict prior to compilation. It is recommended that authors not spend significant time trying to get float placement perfect for peer review. The AAS Journal's publisher has sophisticated typesetting software that will produce the optimal layout during production.

Table 1. ApJ costs from 1991 to 2013[a]

Year	Subscription cost ($)	Publication charges[b] ($/page)
(1)	(2)	(3)
1991	600	100
1992	650	105
1993	550	103
1994	450	110
1995	410	112
1996	400	114
1997	525	115
1998	590	116
1999	575	115
2000	450	103
2001	490	90
2002	500	88
2003	450	90
2004	460	88
2005	440	79
2006	350	77
2007	325	70
2008	320	65
2009	190	68
2010	280	70
2011	275	68
2012	150	56

Table 1 *(continued)*

Year	Subscription cost ($)	Publication charges[b] ($/page)
(1)	(2)	(3)
2013	140	55

[a] Adjusted for inflation

[b] Accounts for the change from page charges to digital quanta in April, 2011

NOTE—Note that `\colnumbers` does not work with the vertical line alignment token. If you want vertical lines in the headers you can not use this command at this time.

For authors that do want to take the time to optimize the locations of their floats there are some techniques that can be used. The simplest solution is to placing a float earlier in the text to get the position right but this option will break down if the manuscript is altered, see Table 1. A better method is to force LaTeX to place a float in a general area with the use of the optional `[placement specifier]` parameter for figures and tables. This parameter goes after `\begin{figure}`, `\begin{table}`, and `\begin{deluxetable}`. The main arguments the specifier takes are "h", "t", "b", and "!". These tell LaTeX to place the float here (or as close as possible to this location as possible), at the top of the page, and at the bottom of the page. The last argument, "!", tells LaTeX to override its internal method of calculating the float position. A sequence of rules can be created by using multiple arguments. For example, `\begin{figure}[htb!]` tells LaTeX to try the current location first, then the top of the page and finally the bottom of the page without regard to what it thinks the proper position should be. Many of the tables and figures in this article use a placement specifier to set their positions.

Note that the LaTeX `tabular` environment is not a float. Only when a `tabular` is surrounded by `\begin{table}` ... `\end{table}` is it a true float and the rules and suggestions above apply. In addition, with the addition of the longtable package to span a page break, deluxetable is also no longer a float be default. An author must make a deluxetable a float by adding the command `\floattable` right before the `\begin{deluxetable}` call. This command will allow LaTeXto optimally place the deluxetable but note that long tables will not longer split over a page. It is up to the reader to strike the right balance.

3.1. *Tables*

Tables can be constructed with LaTeX's standard table environment or the AASTeX's deluxetable environment. The deluxetable construct handles long tables better but has a larger overhead due to the greater amount of defined mark up used set up and manipulate the table structure. The choice of which to use is up to the author. Examples of both environments are used in this manuscript. Table 1 is a simple deluxetable example that gives the approximate changes in the subscription costs and author publication charges from 1991 to 2013.

Tables longer than 250 data lines and complex tables should only have a short example table with the full data set available in the machine readable format. The machine readable table will be available via the "DATA" link in the HTML version of the article. Authors are required to indicate to the reader where the data can be obtained in the table comments. Suggested text is given in the comments of Table 2. Authors are encouraged to create their own machine readable tables using the online tool at http://authortools.aas.org/MRT/upload.html.

AASTeX v6.0 introduces five new table features that are designed to make table construction easier and the resulting display better for AAS Journal authors. The items are:

1. Declaring math mode in specific columns,

2. Column decimal alignment,

Table 2. Column math mode in an observation log

UT start time[a] (YYYY-mm-dd)	MJD start time[a] (d)	Seeing (arcsec)	Filter	Inst.
2012-03-26	56012.997	$\sim 0.''5$	Hα	NOT
2012-03-27	56013.944	$1.''5$	grism	SMARTS
2012-03-28	56014.984	$\cdots$	F814M	HST
2012-03-30	56016.978	$1.''5 \pm 0.25$	B&C	Bok

[a]At exposure start.

NOTE—The "C" command column identifier in the 3 column turns on math mode for that specific column. One could do the same for the next column so that dollar signs would not be needed for Hα but then all the other text would also be in math mode and thus typeset in Latin Modern math and you will need to put it back to Roman by hand. Note that if you do change this column to math mode the dollar signs already present will not cause a problem. Table 2 is published in its entirety in the machine readable format. A portion is shown here for guidance regarding its form and content.

3. Automatic column header numbering,

4. Hiding columns, and

5. Splitting wide tables into two or three parts.

Each of these new features are illustrated in following Table examples. All five features work with the regular LaTeX tabular environment and in AASTeX's deluxetable environment. The examples in this manuscript also show where the two process differ.

3.1.1. *Column math mode*

Both the LaTeX tabular and AASTeX deluxetable require an argument to define the alignment and number of columns. The most common values are "c", "l" and "r" for center, left, and right justification. If these values are capitalized, e.g. "C", "L", or "R", then that specific column will automatically be in math mode meaning that $s are not required. Note that having embedded dollar signs in the table does not affect the output. The third and forth columns of Table 2 shows how this math mode works.

3.1.2. *Decimal alignment*

Aligning a column by the decimal point can be difficult with only center, left, and right justification options. It is possible to use phantom calls in the data, e.g. \phn, to align columns by hand but this can be tedious in long or complex tables. To address this AASTeX introduces the \decimals command and a new column justification option, "D", to align data in that column on the decimal. In deluxetable the \decimals command is invoked before the \startdata call but can be anywhere in LaTeX's tabular environment.

Two other important thing to note when using decimal alignment is that each decimal column *must end with a space before the ampersand*, e.g. "&&" is not allowed. Empty decimal columns are indicated with a decimal, e.g. ".". Do not use deluxetable's \nodata command.

The "D" alignment token works by splitting the column into two parts on the decimal. While this is invisible to the user one must be aware of how it works so that the headers are accounted for correctly. All decimal column headers need to span two columns to get the alignment correct. This can be done with a multicolumn call, e.g \multicolumn2c{} or \multicolumn{2}{c}{}, or use the new \twocolhead{} command in deluxetable. Since LaTeX is splitting these columns into two it is important to get the table width right so that they appear joined on the page. You may have to run the LaTeX compiler twice to get it right. Table 3 illustrates how decimal alignment works in the tabular environment with a $\pm$ symbol embedded between the last two columns.

Table 3. Decimal alignment made easy

Column	Value	Uncertainty
A	1234	± 100.0
B	123.4	± 10.1
C	12.34	± 1.01
D	1.234	± 0.101
E	.1234	± 0.01001
F	1.0	±

NOTE. - Two decimal aligned columns

3.1.3. *Automatic column header numbering*

The command `\colnumbers` can be included to automatically number each column as the last row in the header. Per the AAS Journal table format standards, each column index numbers will be surrounded by parentheses. In a LaTeX tabular environment the `\colnumbers` should be invoked at the location where the author wants the numbers to appear, e.g. after the last line of specified table header rows. In deluxetable this command has to come before `\startdata`. `\colnumbers` will not increment for columns hidden by the "h" command, see Section 3.1.4. Table 1 uses this command to automatically generate column index numbers.

Note that when using decimal alignment in a table the command `\decimalcolnumbers` must be used instead of `\colnumbers` and `\decimals`. Table 4 illustrates this specific functionality.

3.1.4. *Hiding columns*

Entire columns can be hidden from display simply by changing the specified column identifier to "h". In the LaTeX tabular environment this column identifier conceals the entire column including the header columns. In AASTeX's deluxetables the header row is specifically declared with the `\tablehead` call and each header column is marked with `\colhead` call. In order to make a specific header disappear with the "h" column identifier in deluxetable use `\nocolhead` instead to suppress that particular column header.

Authors can use this option in many different ways. Since column data can be easily suppressed authors can include extra information and hid it based on the comments of co-authors or referees. For wide tables that will have a machine readable version, authors could put all the information in the LaTeX table but use this option to hid as many columns as needed until it fits on a page. This concealed column table would serve as the example table for the full machine readable version. Regardless of how columns are obscured, authors are responsible for removing any unneeded column data or alerting the editorial office about how to treat these columns during production for the final typeset article.

Table 4 provides some basic information about the first ten Messier Objects and illustrates how many of these new features can be used together. It has automatic column numbering, decimal alignment of the distances, and one concealed column. The Common name column is the third in the LaTeX deluxetable but does not appear when the article is compiled. This hidden column can be shown simply by changing the "h" in the column identifier preamble to another valid value. This table also uses `\tablenum` to renumber the table because a LaTeX tabular table was inserted before it.

3.1.5. *Splitting a table into multiple horizontal components*

Since the AAS Journals are now all electronic with no print version there is no reason why tables can not be as wide as authors need them to be. However, there are some artificial limitations based on the width of a print page. The old way around this limitation was to use landscape mode with the `\rotate` command and the smallest available table font sizes, e.g. `\tablewidth`, to get the table to fit. Unfortunately, this was not alway enough but now along with the hide column option outlined in Section 3.1.4 there is a new way to break a table into two or three components so that it flows down a page by invoking a new table type, splittabular or splitdeluxetable. Within these tables a new "B" column separator is introduced. Much like the vertical bar option, "|", that produces a vertical table lines, e.g. Table 1, the new "B" separator indicates where to Break a table. Up to two "B"s may be included.

Table 5 shows how to split a wide deluxetable in half with the `\splitdeluxetable` command. The `\colnumbers` option is on to show how the automatic column numbering carries through the second table component, see Section 3.1.3.

The last example, Table 6, shows how to split the same table but with a regular LaTeX tabular call and into three parts. Decimal alignment is included in the third column and the "Component" column is hidden to illustrate the

Table 4. Fun facts about the first 10 messier objects

Messier Number	NGC/IC Number	Object Type	Distance (kpc)	Constellation	V (mag)
(1)	(2)	(3)	(4)	(5)	(6)
M1	NGC 1952	Supernova remnant	2	Taurus	8.4
M2	NGC 7089	Cluster, globular	11.5	Aquarius	6.3
M3	NGC 5272	Cluster, globular	10.4	Canes Venatici	6.2
M4	NGC 6121	Cluster, globular	2.2	Scorpius	5.9
M5	NGC 5904	Cluster, globular	24.5	Serpens	5.9
M6	NGC 6405	Cluster, open	0.31	Scorpius	4.2
M7	NGC 6475	Cluster, open	0.3	Scorpius	3.3
M8	NGC 6523	Nebula with cluster	1.25	Sagittarius	6.0
M9	NGC 6333	Cluster, globular	7.91	Ophiuchus	8.4
M10	NGC 6254	Cluster, globular	4.42	Ophiuchus	6.4

NOTE—This table "hides" the third column in the LaTeX when compiled. The Distance is also centered on the decimals. Note that all of the values in a decimal aligned column have to have a space before the next ampersand.

Table 5. Measurements of Emission Lines: 1 break

Model	Component	Shift (km s^{-1})	FWHM (km s^{-1})	Flux (10^{-17} erg s^{-1} cm^{-2})		
				Lyα	N V	Si IV
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	BELs	-97.13	9117±38	1033±33	< 35	< 166
Model 1	IELs	-4049.123	1974±22	2495±30	< 42	< 109
	NELs	⋯	641±4	449±23	< 6	< 9
	BELs	-85	8991±41	988±29	< 24	< 173
Model 2	IELs	-51000	2025±26	2494±32	< 37	< 124
	NELs	52	637±10	477±17	< 4	< 8

C IV	Mg II	Hγ	Hβ	Hα	He I	Paγ
(8)	(9)	(10)	(11)	(12)	(13)	(14)
637±31	1951±26	991±30	3502±42	20285±80	2025±116	1289±107
995±186	83±30	75±23	130±25	357±94	194±64	36±23
–	275±18	150±11	313±12	958±43	318±34	151±17
623±28	1945±29	989±27	3498±37	20288±73	2047±143	1376±167
1005±190	72±28	72±21	113±18	271±85	205±72	34±21
–	278±17	153±10	317±15	969±40	325±37	147±22

NOTE—This is an example of how to split a deluxetable. You can split any table with this command into two or three parts. The location of the split is given by the author based on the placement of the "B" indicators in the column identifier preamble. For more information please look at the new AASTeX instructions.

new features working together.

3.2. *Figures*

Table 6. Measurements of Emission Lines: 2 breaks

Model	Shift (km s^{-1})	FWHM (km s^{-1})
(1)	(2)	(3)
	-97.13	9117 ± 38
Model 1	-4049.123	1974 ± 22
		641 ± 4
	-85	8991 ± 41
Model 2	-51000	2025 ± 26
	52	637 ± 10

Flux (10^{-17} erg s^{-1} cm^{-2})					
Lyα	N V	Si IV	C IV	Mg II	Hγ
(4)	(5)	(6)	(7)	(8)	(9)
1033 ± 33	< 35	< 166	637 ± 31	1951 ± 26	991 ± 30
2495 ± 30	< 42	< 109	995 ± 186	83 ± 30	75 ± 23
449 ± 23	< 6	< 9	$-$	275 ± 18	150 ± 11
988 ± 29	< 24	< 173	623 ± 28	1945 ± 29	989 ± 27
2494 ± 32	< 37	< 124	1005 ± 190	72 ± 28	72 ± 21
477 ± 17	< 4	< 8	$-$	278 ± 17	153 ± 10

Hβ	Hα	He I	Paγ
(10)	(11)	(12)	(13)
3502 ± 42	20285 ± 80	2025 ± 116	1289 ± 107
130 ± 25	357 ± 94	194 ± 64	36 ± 23
313 ± 12	958 ± 43	318 ± 34	151 ± 17
3498 ± 37	20288 ± 73	2047 ± 143	1376 ± 167
113 ± 18	271 ± 85	205 ± 72	34 ± 21
317 ± 15	969 ± 40	325 ± 37	147 ± 22

Authors can include a wide number of different graphics with their articles in encapsulated postscript (EPS) or portable document format (PDF). These range from general figures all authors are familiar with to new enhanced graphics that can only be fully experienced in HTML. The later include animations, figure sets and interactive figures. This portion of the article provides examples for setting up all these graphics in with the latest version of AASTeX.

3.3. *General figures*

AASTeX has a the `\plotone` command to display a figure consisting of one EPS/PDF file. Figure 1 is an example which uses the data from Table 1. For a general figure consisting of two EPS/PDF files the `\plottwo` command can be used to position the two image files side by side. Figure 2 shows the Swift/XRT X-ray light curves of two recurrent novae. The data from Figures 2 through 4 are taken from Table 2 of Schwarz et al. (2011).

Both `\plotone` and `\plottwo` take a `\caption` and an option `\figurenum` command to specify the figure number. Each is based on the `graphicx` package command, `\includegraphics`. Authors are welcome to use `\includegraphics` along with its optional arguments that control the height, width, scale, and position angle of a file within the figure. More information on the full usage of `\includegraphics` can be found at https://en.wikibooks.org/wiki/LaTeX/Importing_Graphics#Including_graphics.
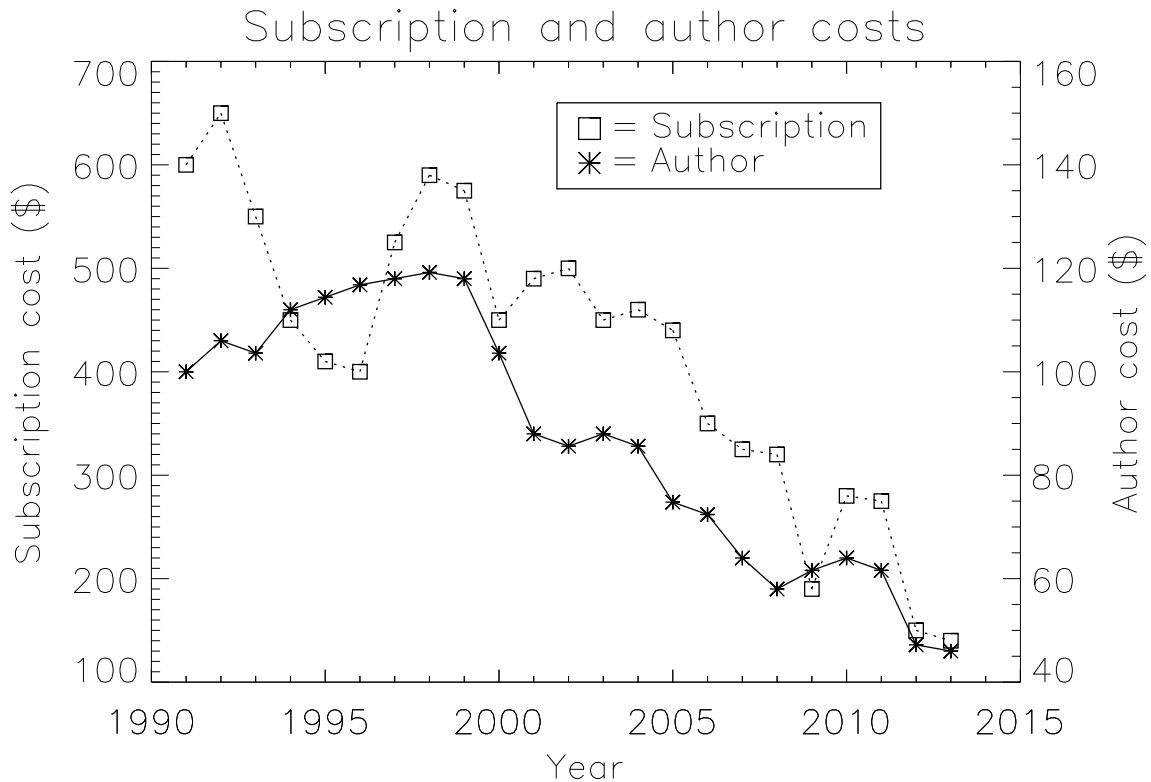
Figure 1. The subscription and author publication costs from 1991 to 2013. The data comes from Table 1.
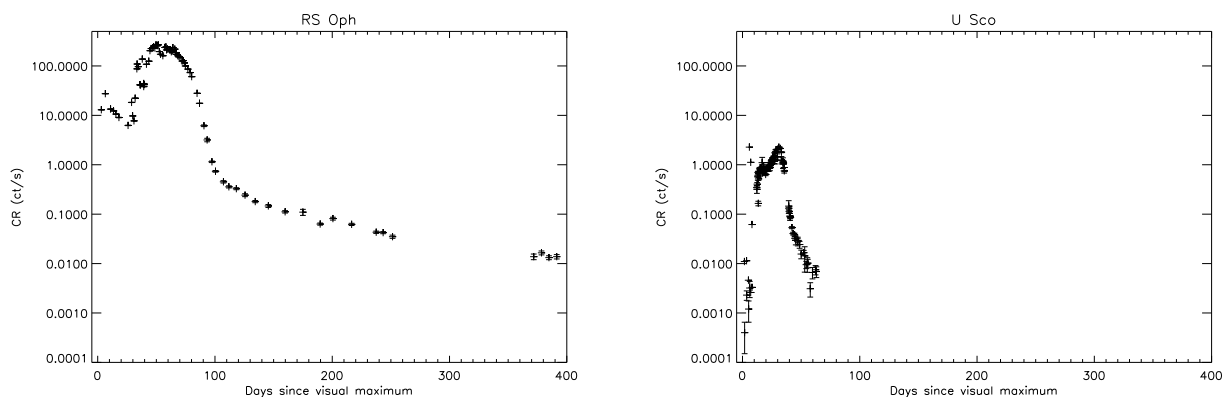

Figure 2. Swift/XRT X-ray light curves of RS Oph and U Sco which represent the two canonical recurrent types, a long period system with a red giant secondary and a short period system with a dwarf/sub-dwarf secondary, respectively.

3.4. *Grid figures*

Including more than two EPS/PDF files in a single figure call can be tricky easily format. To make the process easier for authors AASTEX v6.0 offers `\girdline` which allows any number of individual EPS/PDF file calls within a single figure. Each file cited in a `\girdline` will be displayed in a row. By adding more `\girdline` calls an author can easily construct a matrix X by Y individual files as a single general figure.

For each `\girdline` command a EPS/PDF file is called by one of four different commands. These are `\fig`, `\rightfig`, `\leftfig`, and `\boxedfig`. The first file call specifies no image position justification while the next two will right and left justify the image, respectively. The `\boxedfig` is similar to `\fig` except that a box is drawn around the figure file when displayed. Each of these commands takes three arguments. The first is the file name. The second is the width that file should be displayed at. While any natural LaTeX unit is allowed, it is recommended that author
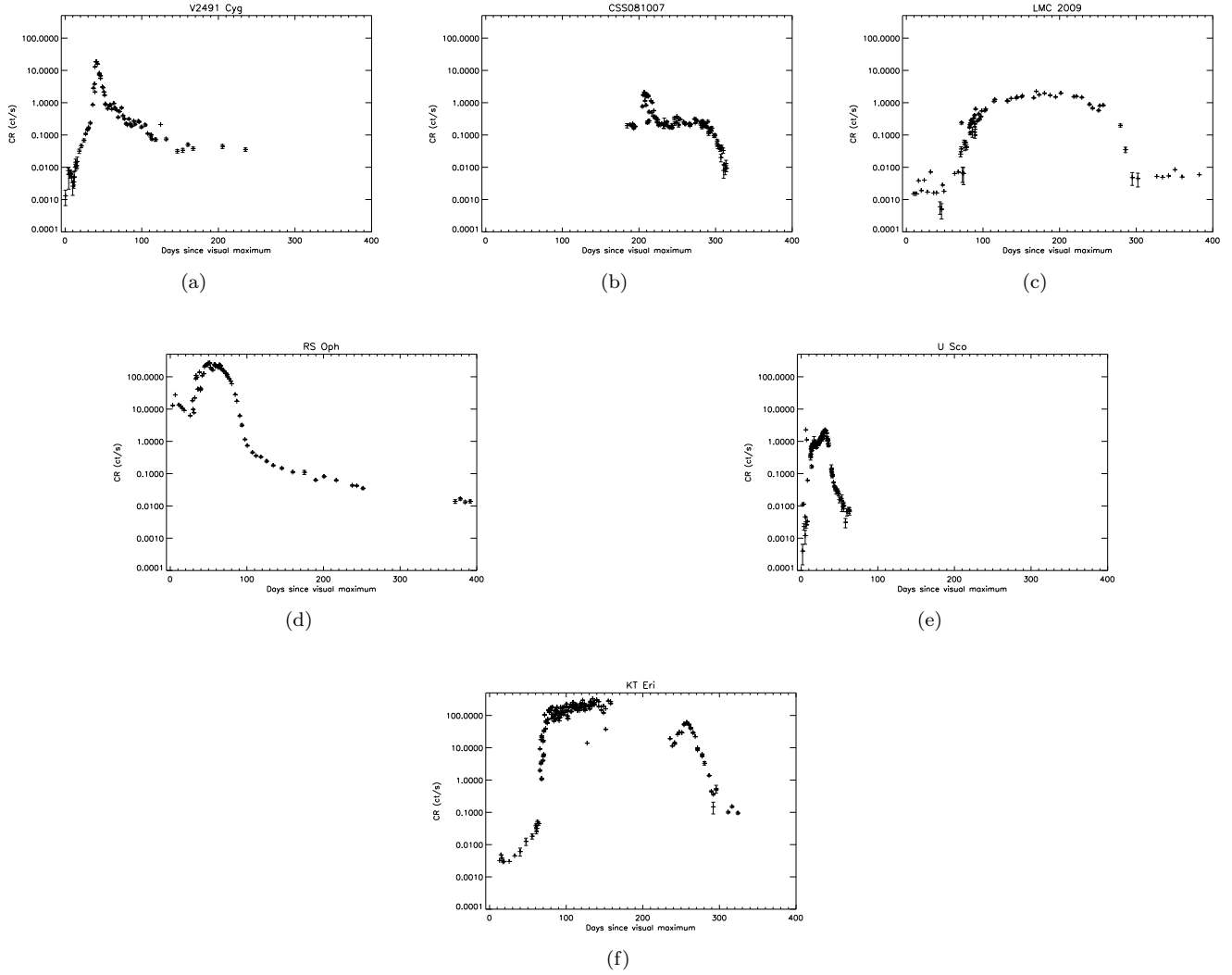
Figure 3. Inverted pyramid figure of six individual files. The nova are (a) V2491 Cyg, (b) HV Cet, (c) LMC 2009, (d) RS Oph, (e) U Sco, and (f) KT Eri.

use fractional units with the `\textwidth`. The last argument is text for a subcaption.

Figure 3 shows an inverted pyramid of individual figure constructed with six individual EPS files using the `\girdline` option.

3.5. *Figure sets*

A large collection of similar style figures should be grouped together as a figure set. The derived PDF article will only shows an example figure while the enhanced content is available in the figure set in the electronic edition. The advantage of a figure set gives the reader the ability to easily sort through the figure collection to find individual component figures. All of the figure set components, along with their html framework, are also available for download in a .tar.gz package.

Special LaTeX mark up is required to create a figure set. Prior to AASTEX v6.0 the underlying mark up commands had to be inserted by hand but is now included. Note that when an article with figure set is compiled in LaTeX none of the component figures are shown and a floating Figure Set caption will appear in the resulting PDF.

Fig. Set 4. Swift X-ray light curves

Authors are encouraged to use an online tool at own specific figure set mark up to incorporate into their LaTeX articles.
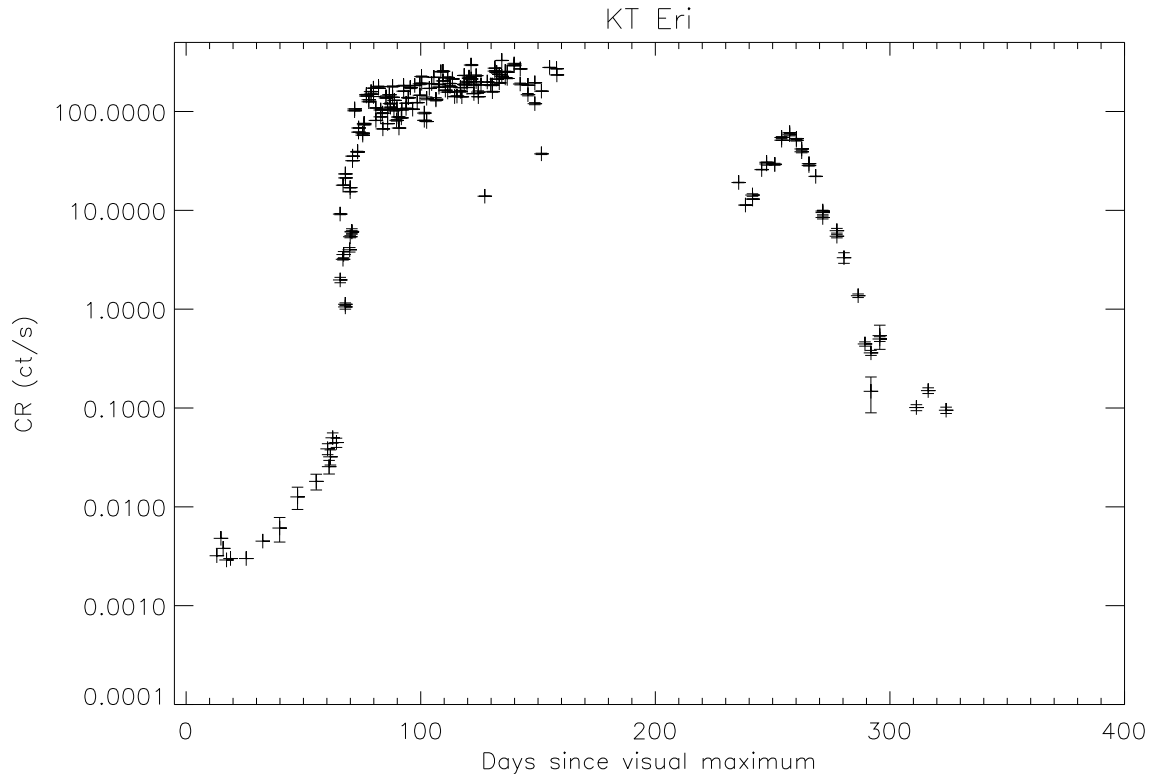
3.6. *Animations*

Figure 4. The Swift/XRT X-ray light curve for the first year after outburst of the suspected recurrent nova KT Eri. At a maximum count rate of 328 ct/s, KT Eri was the brightest nova in X-rays observed to date. All the component figures are available in the Figure Set.

Authors may include animations in their articles. A single still frame from the animation should be included as an regular figures to serve as an example. The associated figure caption should indicate to the reader exactly what the animation shows and that the animation is available online.

3.7. *Interactive figures*

Interactive figures give the reader the ability to manipulate the information contained in an image which can add clarity or help further the author's narrative. These figures consist of two parts, the figure file in a specific format and a javascript and html frame work that provides the interactive control. An example of an interactive figure is a 3D model. The underlying figure is a X3D file while x3dom.js is the javascript driver that displays it. An author created interface is added via a html wrapper. The first 3D model published by the AAS Journals using this technique was Vogt et al. (2014). Authors should consult the online tutorials for more information on how to construct their own interactive figures.

As with animations authors should include a non-interactive regular figure to use as an example. The example figure should also indicate to the reader that the enhanced figure is interactive and can be accessed online.

4. DISPLAYING MATHEMATICS

The most common mathematical symbols and formulas are in the amsmath package. AASTeX requires this package so there is no need to specifically call for it in the document preamble. Most modern LaTeX distributions already contain this package. If you do not have this package or the other required packages, revtex4-1, latexsym, graphicx, amssymb, longtable, and epsf, they can be obtained from http://www.ctan.org

Mathematics can be displayed either within the text, e.g. $E = mc^2$, or separate from in an equation. In order to be properly rendered, all inline math text has to be declared by surrounding the math by dollar signs ($).

A complex equation example with inline math as part of the explanation follows.

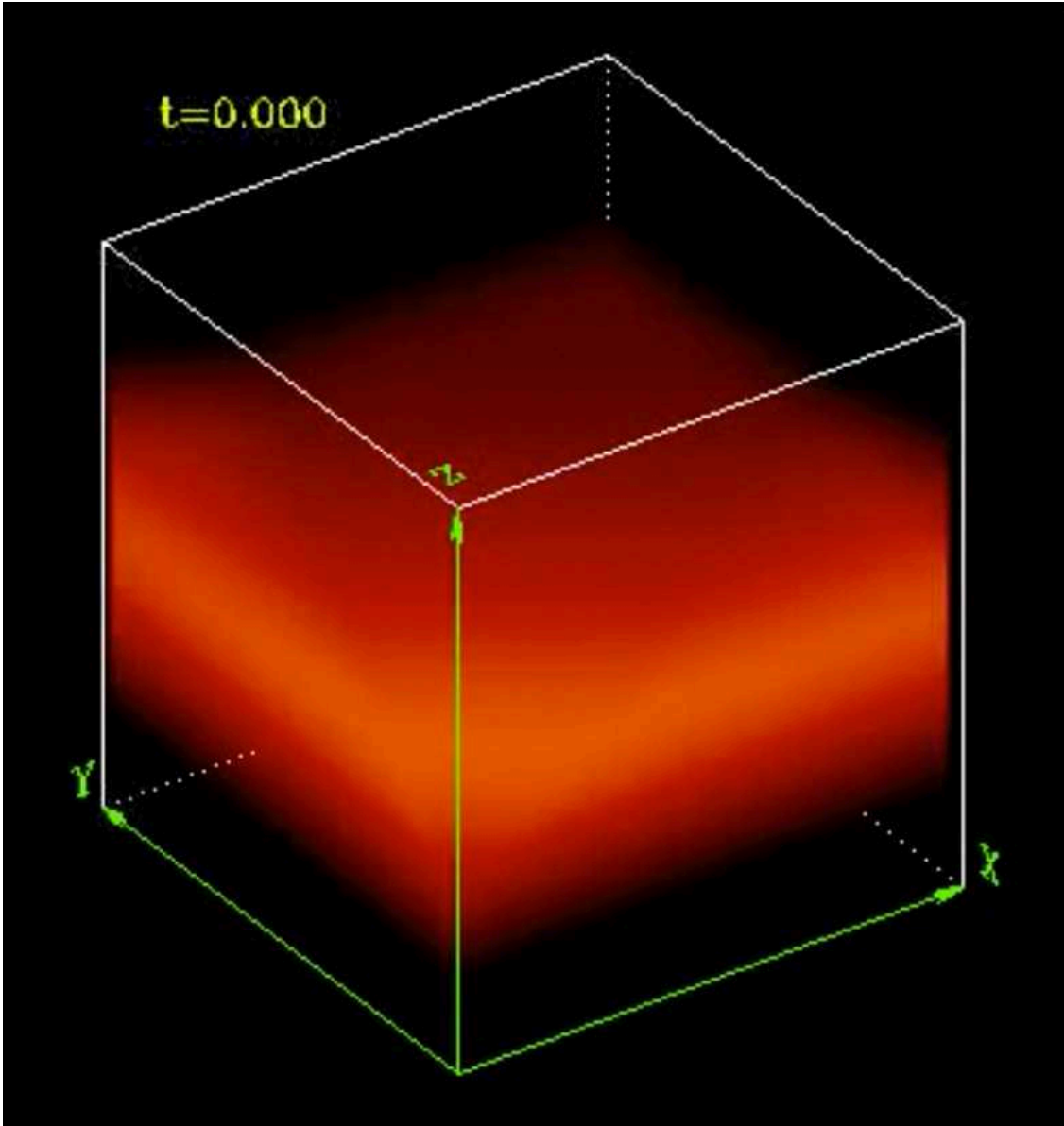$$\bar{v}(p_2, \sigma_2) P_{-\tau} \hat{a}_1 \hat{a}_2 \cdots \hat{a}_n u(p_1, \sigma_1), \tag{1}$$

Figure 5. Example image from the animation which is available in the electronic edition.

where p and σ label the initial $e^{\pm}$ four-momenta and helicities ($\sigma = \pm 1$), $\hat{a}_i = a_i^{\mu}\gamma_{\nu}$ and $P_{\tau} = \frac{1}{2}(1 + \tau\gamma_5)$ is a chirality projection operator ($\tau = \pm 1$). This produces a single line formula. LaTeX will auto-number this and any subsequent equations. If no number is desired then the `equation` call should be replaced with `displaymath`.

LaTeX can also handle a a multi-line equation. Use `eqnarray` for more than one line and end each line with a \\. Each line will be numbered unless the \\ is preceded by a `\nonumber` command. Alignment points can be added with ampersands (&). There should be two ampersands per line. In the examples they are centered on the equal symbol.

$$\gamma^\mu = \begin{pmatrix} 0 & \sigma^\mu_+ \\ \sigma^\mu_- & 0 \end{pmatrix}, \gamma^5 = \begin{pmatrix} -1\,0 \\ 0\ 1 \end{pmatrix}, \tag{2}$$

$$\sigma^\mu_\pm = (\mathbf{1}, \pm\sigma), \tag{3}$$

$$\hat{a} = \begin{pmatrix} 0 & (\hat{a})_+ \\ (\hat{a})_- & 0 \end{pmatrix},$$

$$(\hat{a})_\pm = a_\mu \sigma^\mu_\pm \tag{4}$$

5. REVISION TRACKING AND COLOR HIGHLIGHTING

Authors sometimes use color to highlight changes to their manuscript in response to editor and referee comments. In AASTeX new commands have been introduced to make this easier and formalize the process.

The first method is through a new set of editing mark up commands that specifically identify what has been changed. These commands are \added{<text>}, \deleted{<text>}, and \replaced{<old text>}{<replaced text>}. To activate these commands the trackchanges option must be used in the \documentclass call. When compiled this will produce the marked text in red. The \explain{<text>} can be used to add text to provide information to the reader describing the change. Its output is purple italic font. To see how \added{<important added info>}, \deleted{<this can be deleted text>}, \replaced{<old data>}{<replaced data>}, and \explain{<text explaining the change>} commands will produce important added information and replaced data, toggle between versions compiled with and without the trackchanges option.

A summary list of all these tracking commands can be produced at the end of the article by adding the \listofchanges just before the \end{document} call. The page number for each change will be provided. If the linenumbers option is also included in the documentcall call then not only will all the lines in the article be numbered for handy reference but the summary list will also include the line number for each change.

The second method does not have the ability to highlight the specific nature of the changes but does allow the author to document changes over multiple revisions. The commands are \edit1{<text>}, \edit2{<text>} and \edit3{<text>} and they produce <text> that is highlighted in bold red, italic blue and underlined purple, respectively. Authors should use the first command to **indicated which text has been changed from the first revision.** The second command is to highlight *new or modified text from a second revision*. If a third revision is needed then the last command should be used to show this changed text. Since over 90% of all manuscripts are accepted after the 3rd revision these commands make it easy to identify what text has been added and when. Once the article is accepted all the highlight color can be turned off simply by adding the \turnoffediting command in the preamble.

Similar to marking editing changes with the \edit options there is also the \authorcomments1{<text>}, \authorcomments2{<text>} and \authorcomments3{<text>} commands. These produce the same bold red, italic blue and underlined purple text but when the \turnoffediting command is present the <text> material does not appear in the manuscript. Authors can use these commands to mark up text that they are not sure should appear in the final manuscript or as a way to communicate comments between co-authors when writing the article.

6. SOFTWARE AND THIRD PARTY DATA REPOSITORY CITATIONS

The AAS Journals would like to encourage authors to change software and third party data repository references from the current standard of a footnote to a first class citation in the bibliography. As a bibliographic citation these important references will be more easily captured and credit will be given to the appropriate people.

The first step to making this happen is to have the data or software in a long term repository that has made these items available via a persistent identifier like a Digital Object Identifier (DOI). A list of repositories that satisfy this criteria plus each one's pros and cons are given at https://github.com/AASJournals/Tutorials/tree/master/Repositories.

In the bibliography the format for data or code follows this format:

author year, title, version, publisher, prefix:identifier

Corrales (2015) provides a example of how the citation in the article references the external code at http://dx.doi.org/10.5281 Unfortunately, bibtex does not have specific bibtex entries for these types of references so the "@misc" type should be used. The Repository tutorial explains how to code the "@misc" type correctly. The most recent apj.bst file, available with AASTeX v6.0, will output bibtex "@misc" type properly.

Facilities: HST(STIS), Swift(XRT and UVOT), AAVSO, CTIO:1.3m, CTIO:1.5m,CXO

Software: IRAF, cloudy, IDL

APPENDIX

A. APPENDIX INFORMATION

Appendices can be broken into separate sections just like in the main text. The only difference is that each appendix section is indexed by a letter (A, B, C, etc.) instead of a number. Likewise numbered equations have the section letter appended. Here is an equation as an example.

$$I = \frac{1}{1 + d_1^{P(1+d_2)}} \tag{A1}$$

Appendix tables and figures should not be numbered like equations. Instead they should continue the sequence from the main article body.

B. AUTHOR PUBLICATION CHARGES

Finally some information about the AAS Journal's publication charges. In April 2011 the traditional way of calculating author charges based on the number of printed pages was changed. The reason for the change was due to a recognition of the growing number of article items that could not be represented in print. Now author charges are determined by a number of digital "quanta". A single quantum is 350 words, one figure, one table, and one enhanced digital item. For the latter this includes machine readable tables, figure sets, animations, and interactive figures. The current cost is $27 per word quantum and $30 for all other quantum type.

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