ROTSE1 J164341.65+251748.1: A NEW W UMA-TYPE ECLIPSING BINARY

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RESUMEN

ROTSE1 J164341.65+251748.1 fue observada fotométricamente en la banda V durante tres épocas con el telescopio de 0.84-m del Observatorio de San Pedro Mártir en México. Con base en fotometría BVR adicional, encontramos que la estrella primaria tiene un tipo espectral cercano a G0V. La curva del luz del sistema es característica de los sistemas binarios del tipo W UMa y tiene un periodo orbital de \( \sim 0.323 \) días. Con el propósito de entender mejor a este sistema binario, hemos analizado su curva de luz con ayuda del método de Wilson y Devinney. Hemos encontrado que ROTSE1 J164341.65+251748.1 tiene una razón de masas de \( \sim 0.34 \) y que la componente menos masiva es hasta 230 K más caliente que la estrella primaria. La inclinación del sistema es \( \sim 84.6 \) grados y el sobre-contacto es de 11\%. El análisis también muestra la presencia de manchas brillantes variables sobre la estrella primaria.

ABSTRACT

ROTSE1 J164341.65+251748.1 was photometrically observed in the V band during three epochs with the 0.84-m telescope of the San Pedro Mártir Observatory in Mexico. Based on additional BVR photometry, we find that the primary star has a spectral type around G0V. The light curve of the system is typical of a W UMa type binary stars and has an orbital period of \( \sim 0.323 \) days. In an effort to gain a better understanding of the binary system and determine its physical properties, we analyzed the light curve with the Wilson and Devinney method. We found that ROTSE1 J164341.65+251748.1 has a mass ratio of \( \sim 0.34 \) and that the less massive component is over 230 K hotter than the primary star. The inclination of the system is \( \sim 84.6 \) degrees, and the degree of over-contact is 11\%. The analysis shows the presence of variable bright spots on the primary star.

Key Words: techniques: photometric — binaries: eclipsing — stars: individual: ROTSE1 J164341.65+251748.1

1. INTRODUCTION

The ROTSE-I survey for variable stars \cite{akerlof00} has identified nearly 2000 new variables. Among them is ROTSE1 J164341.65+251748.1 (hereinafter J1643+2517), reported by these authors as a variable source with a V magnitude of around 14.2, varying with an amplitude of 0.69 mag and a periodicity of 0.32343200 days. No further information is given about the nature of its variability. While conducting a spectroscopic and photometric study in the V band on AH Herculis, J1643+2517 was detected as a serendipitous source in the field. Our extensive photometric coverage reveals that J1643+2517 has the typical light curve of W UMa-type systems.

Since the pioneer work by \cite{lucy68} on contact stars, it is now well established that W UMa-type systems are over-contact binary stars, which consist of two late type main sequence stars sharing a common connecting envelope \cite{rucinski10}. There is a considerable number of publications about this kind...
TABLE 1
LOG OF PHOTOMETRIC OBSERVATIONS OF J1643+2517.

| Date       | Filter | Exp. Time (secs) | images | Obs. Time (hours) |
|------------|--------|------------------|--------|-------------------|
| 20130530   | V      | 30               | 439    | 4.85              |
| 20130531   | V      | 30               | 709    | 8.27              |
| 20130601   | V      | 30               | 263    | 2.93              |
| 20130602   | V      | 30               | 683    | 7.87              |
| 20130603   | V      | 30               | 376    | 4.57              |
| 20130604   | V      | 30               | 281    | 3.65              |
| 20130605   | V      | 30               | 340    | 4.57              |
| 20130606   | V      | 30               | 267    | 2.90              |
| 20130607   | V      | 30               | 223    | 2.42              |
| 20130613   | V      | 30               | 603    | 7.19              |
| 20130614   | V      | 30               | 479    | 7.03              |
| 20130617   | V      | 30               | 574    | 6.64              |
| 20130618   | V      | 30               | 373    | 4.52              |
| 20140214   | V      | 180              | 43     | 3.25              |
| 20140215   | V      | 180              | 28     | 2.30              |
| 20140216   | V      | 60               | 42     | 1.526             |
| 20140220   | V      | 120              | 17     | 0.64              |
| 20140308   | V      | 20               | 532    | 4.66              |
| 20140312   | V      | 20               | 475    | 4.86              |
| 20140519   | V      | 60               | 208    | 4.26              |
| 20140520   | V      | 20               | 210    | 1.80              |
| 20150630   | B,V,R  | 30,20,15         | 106,106,106 | 4.47 |
| 20150703   | B,V,R  | 30,20,15         | 47,47,47 | 3.13 |
| 20150729   | B,V,R  | 30,20,15         | 151,151,151 | 5.79 |
| 20150730   | B,V,R  | 30,20,15         | 51,51,51 | 2.91 |

of objects, both observational and theoretical, since the early work by Eggen (1961), who recognized that binaries with orbital periods of less than a day and with continuous light variations, could be considered stars in full contact. Among these are the reviews published by Rucinski (1993) and Eggleton (1996). In this paper, based on the obtained V light curves of J1643+2517, we determine the most important parameters of the system.

2. OBSERVATIONS AND DATA REDUCTION

CCD observations were made during three observing runs, with the 0.84-m f/15 Ritchey-Chrétien telescope at Observatorio Astronómico Nacional at Sierra San Pedro Mártir (OAN-SPM), theMexman filter-wheel, and the ESOPO CCD detector (e2v CCD42-90), which has a 2048×4608 13.5 μm square pixel array, a gain of 1.7 e−/ADU, and a readout noise of 3.8 e−. A 2×2 binning was used during our observations. The combination of the telescope and detector characteristics ensured an unvignetted field of view of 7.4′×9.3′. Since the observations were obtained with AH Her as the primary target, we obtained V photometry mainly. During our last run we made BVR photometry, basically to obtain information leading to derive the spectral type of the primary. The log of the observations is shown in Table 1. Sky flats and bias exposures were also taken each night.

All CCD images were processed using the IRAF package. Images were bias subtracted and flat field corrected and then cosmic rays were removed with the help of the L.A. Cosmic script. Then, instrumental magnitudes of the stars were computed using the standard aperture photometry method.

During an observing run of UBVRI photometry of Galactic stellar clusters, this field (Fig 1) was included in the list of targets so that its stars could be calibrated in the Johnson-Cousins system. The results are presented in Table 2. Although dimmer than other stars in the field, star number 12 was used as the comparison star to obtain the differential photometry, since it has a similar colour to J1643+2517.

3. PHOTOMETRIC ANALYSIS

The orbital period of the light curve was derived from a frequency search algorithm, using the Per-
TABLE 2: UBVRI photometry of the field stars. The values on the last two columns are those found in the literature.

| ID | RA       | DEC      | U,V,B,R,I | eU | eB | eV | eR | eI | Name       | B0 | V0       |
|----|----------|----------|-----------|----|----|----|----|----|------------|----|----------|
| 1  | 251.04172| +25.25060| 11.517    | 12.354| 12.297| 12.143| 11.954| 0.001| 0.003| V*AHHer   |    |          |
| 2  | 251.03647| +25.25510| 14.788    | 14.747| 14.139| 13.769| 13.408| 0.002| 0.007| [HH95]AHHer-27 | 14.800| 14.187  |
| 3  | 251.02930| +25.24806| 16.202    | 15.815| 15.058| 14.621| 14.238| 0.004| 0.002| [HH95]AHHer-26 | 15.892| 15.117  |
| 4  | 251.03827| +25.24531| 18.520    | 17.322| 16.164| 15.442| 14.843| 0.012| 0.007| [HH95]AHHer-25 | 17.429| 16.205  |
| 5  | 250.96619| +25.19135| 15.274    | 13.851| 12.532| 11.831| 11.194| 0.003| 0.004| 2MASSJ16435186+251128 |    |          |
| 6  | 250.92379| +25.29666| 14.573    | 14.432| 13.784| 13.380| 13.024| 0.016| 0.004| J1643+2517 |    |          |
| 7  | 250.99569| +25.26163| 13.117    | 13.184| 12.670| 12.369| 12.059| 0.002| 0.003| 2MASSJ16435895+2515418 |    |          |
| 8  | 250.97129| +25.24536| 14.762    | 14.749| 14.079| 13.654| 13.224| 0.002| 0.007| [HH95]AHHer-21 | 14.721| 14.035  |
| 9  | 250.97337| +25.24101| 15.990    | 15.580| 14.720| 14.234| 13.751| 0.001| 0.007| [HH95]AHHer-22 | 15.592| 14.938  |
| 10 | 250.93149| +25.19695| 15.181    | 15.029| 14.417| 14.022| 13.692| 0.001| 0.006| 2MASSJ16434356+2511489 |    |          |
| 11 | 250.95348| +25.17302| 14.700    | 14.627| 14.022| 13.605| 13.243| 0.005| 0.011| [HH95]AHHer-18 | 14.592| 13.938  |
| 12 | 250.96468| +25.31011| 15.299    | 15.243| 14.602| 14.201| 13.836| 0.006| 0.010| [HH95]AHHer-33 | 15.226| 14.560  |

The derived period is $P = 0.323456 \pm 0.000024$ days. The following ephemeris has been obtained:

$$HJD_0 = 2456443.5675(9) + 0.3234561(4) \cdot E,$$

where phase zero is defined by the lower of the two minima, corresponding in this case, to the inferior conjunction of the primary star. This definition follows the convention that the deeper minimum of the light curve is defined as the primary minimum (e.g. Binnendijk (1984)). Therefore, the primary maximum occurs at phase 0.25. The parentheses indicate the error in the previous digit. Using this ephemeris, we obtain the phased light curve of J1643+2517 shown in Figure 2. The Figure shows our three observing runs. In order to identify the observing time sequence, we have included a colour bar in which the ticks are in HJD days and show the date starting from 2456443.

4. SPECTRAL TYPE OF THE PRIMARY STAR

From the photometry obtained at phase zero, we find colours $B-V = 0.64$ and $V-R = 0.43$. The $B-V$ index indicates a G2V star, while the $V-R$ index suggests a later spectral type of G9V. Thus the system appears to have a small extinction. We adopt a G0V spectral type to reconcile these indices and an initial temperature of 5900 K. This spectral type and temperature are important, as we said, in the sense that they provide initial values for modeling the binary.

5. MODELING THE-binary

A preliminary solution of the phased light curve was obtained by Fox Machado et al. (2015a) with the PHOEBE package (Prsa & Zwitter 2005), following the strategy explained in Fox Machado et al. (2015b). PHOEBE is an interactive software package for modeling eclipsing binary stars based on the Wilson-Devinney code (WDc) (Wilson & Devinney 1971; Wilson 1990, 1994). It permits the creation of a synthetic light curve that fits the observational data by adjusting interactively the orbital and stellar parameters through a user friendly graphical interface. The preliminary results from Fox Machado et al. (2015a) were used in the present paper as start solution for the latest version of the WDc code (Wilson & Van Hamme 2014) available in 2015 in the electronic link ftp://ftp.astro.ufl.edu/pub/wilson/lcdc2015/.

A final solution was then achieved using this new code. Some insights about the morphology of the
A binary system can be obtained from the shape of the light curve. Since there is a total eclipse of the secondary star, by the primary star, a flat bottom at the primary minimum is seen, indicating a high inclination angle of the system. The primary and secondary eclipses occur at 0.5 phase intervals, with no clear beginning and end of the eclipses suggesting a circular orbit. These properties are consistent with a short period over-contact binary of the W UMa type. The lower minima appears at the primary minimum when the secondary star is covered by the primary star at around phase zero (see Section 3). In this case, we obtain a lower effective temperature of the more massive star. The different magnitudes of two maxima in the light curve is known as the O’Connell effect, after first being recognized by O’Connell [1951].

During all the observations of J1643+2517, the primary maxima show strong variations, with the profile of the light curve changing in the time scale larger than a day. The secondary maxima are much more stable, particularly during the third run. To model all of these variations, we found that the best solution was one with two hot spots on the primary star. Since we cannot make a uniform model for the light curves, we separated the data into the three observed epochs in order to do their independent analyses.

Some of the parameters of the contact binary model could be fixed or well estimated. The thermal albedo $A_1 = A_2 = 0.5$ [Lucy 1967] and the gravitational constant $g_1 = g_2 = 0.32$ [Rucinski 1969] are assumed fixed by the convective envelope of both stars, and the limb darkening is automatically interpolated by the WDc from the Van Hamme’s table [van Hamme 1993]. Based on the BVR observations (see Section 4), the spectral class can be estimated as close to G0V, giving an initial temperature of the primary of $\sim 5700$ K.

As the standard to build the model for this system, we used the 2013 data, which has the best photometric quality. A q-search strategy is applied to find out the mass ratio of the system (Fig. 4). The best fitted parameters of the simulation are listed in Table 4 and comparisons between simulations and observations are displayed in Fig 5.

We also provide the residuals and the statistics histogram in the same figure. With the Kolmogorov-Smirnov test, the residuals could be considered as a Gaussian distribution with $\sigma \sim 0.0064$ at 95% confidence. We also present in Fig 6 the shape of the system provided by the new feature of the WDc.
Fig. 3. The color index diagram in 2015 data. The B-V and V-R colour indexes at around 0 phase are smaller than those at 0.5 phase, which indicates a lower temperature for the primary star.

Fig. 4. The q-search strategy for the mass ratio determination. The mass ratio at minimum $\sigma$ is at around 0.35.
Fig. 5. *Top.* Simulated (solid lines) light curves fitted to the observations. Blue points correspond to the 2013 observations, green points to the 2014 observations and red points to 2015 observations. *Middle.* The residuals of the simulations. *Bottom.* The statistical distribution of residuals and their Gaussian distribution fits.
Fig. 6. The shape of system for the three epoch. We present four subfigures of the shape for each epoch. The figures from left – top to right – bottom are of first, second, third year, respectively. The blue part is the shape of the star, and the yellow part represent the hot spots.
6. DISCUSSION

Our analysis of this eclipsing binary reveals properties similar in many respects to those of the W UMa systems [Zhu et al. (2010); Dimitrov & Kjurkchieva (2015)], which are characterized by having short orbital periods and an over-contact configuration that is composed of F-K stars sharing a common envelope that thermalizes the stars. This system appears to have a mass ratio of $q \approx 0.323$, an inclination of $i \approx 84.3^\circ$, and a secondary star temperature of $T_2 \approx 5873K$. It is also interesting to note that, based on our results, the degree of over-contact in the system,

$$f = \frac{\Omega_{\text{in}} - \Omega}{\Omega_{\text{in}} - \Omega_{\text{out}}},$$

where the potentials $\Omega_{\text{in}}$ and $\Omega_{\text{out}}$ define the inner and outer critical surfaces in Roche geometry and $\Omega$ is the potential corresponding to the surface of the over-contact binary, is calculated to be $f \sim 11.5\%$.

The fact that the primary maximum is variable and sometimes brighter than the secondary maximum can be explained by hot spot activity. The variation of the light curve profile can be well simulated by adjusting the parameters of the spots. For a simplified strategy, we assumed at the beginning that the location and temperature of the spots were fixed. Fig 7 presents the size variation of two hot spots in 19 days in the first part. Fig 5 and Table 3 present the spots parameter results of the second and third epochs, and Fig 6 presents the star shapes. Two similar spots can be identified in the first and second epochs, but only one spot can be found in the third part of data. With all the parameters found, the temperature of the massive component is about 230 K cooler than the smaller one.

7. CONCLUSIONS

Using the WdC and long term photometric observations of ROTSE-I J1643+25, we were able to determine its basic physical properties and establish that this system belongs to the group of W UMa variables. With a mass ratio of $\sim 0.34$, it presents an inclination of $\sim 84.6$ degrees and a degree of over-contact of 11%. The analysis of the data shows spots variations on the primary star, which imply strong activity on its surface.

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| Parameter       | Spot 1     | Spot 2     |
|-----------------|------------|------------|
| **Epoch 1**     |            |            |
| Colatitude (deg)| 68.0 ± 1.3 | 75.0 ± 1.4 |
| Longitude (deg) | 112.00 ± 0.02 | 16.00 ± 0.02 |
| Radius (deg)    | 22.0 ± 4.7   | 30.0 ± 1.4 |
| Temp. factor    | 1.07 ± 0.012 | 1.0500 ± 0.002 |
| **Epoch 2**     |            |            |
| Colatitude (deg)| 55.0 ± 0.52 | 85.0 ± 1.46 |
| Longitude (deg) | 155.00 ± 0.016 | 22.01 ± 0.02 |
| Radius (deg)    | 21.0 ± 2.7   | 19.0 ± 1.1 |
| Temp. factor    | 1.06 ± 0.022 | 1.0500 ± 0.015 |
| **Epoch 3**     |            |            |
| Colatitude (deg)| 60.0 ± 9.4  |            |
| Longitude (deg) | 34.90 ± 0.16 |            |
| Radius (deg)    | 28.1 ± 9.48 |            |
| Temp. factor    | 1.026 ± 0.002 |            |
Fig. 7. The variation of spots in the first epoch. Spot 2 (red) presents a significant decline in decades of days.
| Parameter | Primary | Secondary |
|-----------|---------|-----------|
| HJD\(_0\) | 2456443.5675±0.0009 | |
| \(P_{\text{orb}}\) (day) | 0.3234561±0.0000004 | |
| \(i_{\text{cl}}\) | 84.35±0.31 | |
| q=m2/m1 | 0.3425±0.0014 | |
| \(\Omega=\Omega_1=\Omega_2\) | 2.520±0.005 | |
| \(T (K)\) | 5648\(^a\) | 5873±7 |
| g1=g2 | 0.32\(^a\) | |
| A1=A2 | 0.5\(^a\) | |
| \(x_1(\text{bolo})=x_2(\text{bolo})\) | 0.646\(^a\) | |
| \(y_1(\text{bolo})=y_2(\text{bolo})\) | 0.212\(^a\) | |
| \(x_{1v}=x_{2v}\) | 0.749\(^a\) | |
| \(y_{1v}=y_{2v}\) | 0.209\(^a\) | |
| \(L/(L_1+L_2)_V\) | 0.6857±0.0012 | |
| \(r=R/a\) (pole) | 0.4547±0.0005 | 0.2767±0.0014 |
| \(r=R/a\) (side) | 0.4895±0.0007 | 0.2892±0.0017 |
| \(r=R/a\) (back) | 0.5187±0.0008 | 0.3267±0.0032 |

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THE RevMexAA \LaTeX\ MACROS: A GUIDE FOR EDITORS\footnote{The latest version of the macros should be available from http://www.astrosmo.unam.mx/rmaa}

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RESUMEN
Este documento describe como usar el “\LaTeX\ document class” \texttt{rmaa.cls} para preparar un número entero de la \textit{Revista Mexicana de Astronomía y Astrofísica} o \textit{RevMexAA (Serie de Conferencias)}.

ABSTRACT
This document describes how to use the \LaTeX\ document class \texttt{rmaa.cls} to produce an entire issue of the \textit{Revista Mexicana de Astronomía y Astrofísica} or \textit{RevMexAA (Serie de Conferencias)}.

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4 Glossary

1. INTRODUCTION

This Guide discusses some of the trickier aspects of using the \texttt{rmaa} class. In particular, how to use it to format an entire volume of the RevMexAA or RevMexAA(SC) by writing a container file that simply \texttt{\input}'s the individual stand-alone article files. With very little extra effort on the part of the editors, a fully cross-referenced “Table of Contents” and “Index of Authors” will be automatically generated. Commands also exist for producing the “Preface”, “Group Photograph”, “List of Participants”, etc., and for formatting the abstracts of authors who couldn’t manage to write up their contribution \textit{in extenso} on time. Furthermore, a script is provided that will then extract the postscript files of the individual components (articles, index, preface, etc.) and generate an HTML table of contents that points at them\footnote{Appending plate pages if appropriate.}. The idea is that these can then be linked to from ADS.

1.1. Intended audience

This guide may be of interest to the following:

- My future self
- Guest editors of volumes of RevMexAA(SC)
- Editors/editorial assistants of RevMexAA
- Even authors, if they’re brave…

1.2. Shortcomings of this Guide

Many, I’m sure, but most notably:

- It is far from complete
- I assume throughout that you are working on a Unix (or Linux) system.

\footnotetext[3]{The HTML part still needs some work.}
2. INDIVIDUAL PAPERS

Before you try to format the entire book, you should first make sure that each individual paper is exactly how you want it and can be \LaTeX\ed without producing any errors. Most of the necessary information is given in the Guide for Authors, but in this section I give further technical details.

2.1. References

These are a major source of author errors. References to conference proceedings are particularly troublesome, especially when the proceedings are part of a series. Try to follow ApJ style, but don’t worry about it too much, even they are inconsistent sometimes.

2.2. Figures

Here I discuss various issues related to figures: how to get them to come out where you want them, how to curmudgeon misbehaving PostScript files into submission, and how to deal with plates.

2.2.1. Figure placement

If you are having problems with a floating figure appearing where it is not wanted, then using [!t] as the optional argument to the figure environment usually does the trick. The t asks \LaTeX\ to put the figure at the top of a page, while the ! overrides any qualms it may have about minimum text fractions or other such niceties.

If all else fails, you can ditch the figure environment entirely and place it by hand. In this case, you must use \figcaption instead of \caption. The same can be done with tables (using \tabcaption). Obviously, it’s not a good idea to do this until you have virtually finished editing the paper.

2.2.2. Recalcitrant PostScript files

Many authors will send you totally broken PostScript files. Examples include figures that stubbornly refuse to be re-sized, or that always appear in the bottom right corner of the page, or that mysteriously rub out bits of the surrounding text. Prime offenders seem to be SuperMongo and sundry MS-Windows and Mac programs.

In many cases, the problem is due to the lack of a proper BoundingBox (\LaTeX needs this in order to know the size of the figure). Look for a line like

```
\%BoundingBox: 0 0 612 792
```

near the top of the PostScript file. If the file doesn’t have one, then you will have to add one. The easiest way to do this is with gs (Ghostscript). If you type something like `gs -sDEVICE=bbox -q -dNOPAUSE example.ps`, you should get something like

```
\%BoundingBox: 97 231 514 561
```

Just type ‘quit’ at the GS> and then paste the \%BoundingBox line into the top of the file (in this case, example.ps). With luck, your problems will then disappear.

In other cases, however, the problem lies with some of the PostScript operators used in the file. Somewhere I remember seeing a list of operators that should not be used in "encapsulated" PostScript files. An example is the command \texttt{initmatrix}, beloved of SuperMongo. Sometimes, simply removing the offending command from the file is sufficient. At other times, more drastic measures are required, such as the use of \texttt{psescape} to convert the file to the FIG format. The resulting .fig file can then be edited with \texttt{xfig} and subsequently re-saved as another PostScript file. This can produce miraculous results in many (but not all) cases.

If none of the above work, then you can always print out the figure and rescan it as a bitmap. To get good results with this, print out the figure at the largest size you can manage. Then, carefully select the magnification on your scanner so that the resolution of the scanned bitmap will match that of your printer (or an integer divisor thereof). If you have virtually finished editing the paper, rather than just being sent straight to a printer.

2.2.3. Plates

First, ask yourself if you really need them. If you do, then you can use the \plate command in the following way:

```
\plate{
  \includegraphics[width=\textwidth]{example.ps}
  \figcaption{Caption to plate figure}
  \label{fig:example} }
```

Note that you do not use the figure environment inside the argument of the \plate command. As a result, you must use \figcaption instead of \caption. It is possible to include multiple figures in a single plate (if they will fit), in which case you should specify the number of distinct figures, i.e.

```
\includegraphics[width=\textwidth]{example.ps}
\caption{Caption to plate figure}
```

That is, files intended to be embedded inside another document, rather than just being sent straight to a printer.

Sometimes you will have to adjust the line widths with xfig.

\footnote{Sometimes you will have to adjust the line widths with xfig.}

\footnote{Make sure you scan it as a 1-bit image (B\&W only, no color, no grays).
\footnote{300dpi is a reasonable compromise between image quality and file size.}
\footnote{This sounds a lot more complicated than it really is.}
\figcaption commands, as an optional first argument to \plate, for example:
\begin{verbatim}
\plate[2]{
  \includegraphics[width=\textwidth]
  {example1.ps}
  \figcaption{Caption to first figure 
  \label{fig:example1} }
}
\vfil
\includegraphics[width=\textwidth]
  {example2.ps}
  \figcaption{Caption to second figure 
  \label{fig:example2} }
\end{verbatim}

You can freely mix \plate commands and figure environments in a document and the figure numbering should always come out right (so long as you use the optional argument discussed above). The only restriction is that if there are multiple figures in one plate, then these will be numbered consecutively (e.g., you can’t have Figures 4 and 6 on a single plate page with Figure 5 appearing normally in the text).

The plates are actually formatted by the \outputplates command, which should appear at the very end of the article, just before the \end{document}.

3. PUTTING THEM ALL TOGETHER

Now you are ready to make a single \LaTeX document of the entire volume. First, I recommend copying the final version of all the individual articles (.tex file plus .ps figures) to a clean directory. Now, create a new .tex file, which will be the master file for the entire volume. In what follows, I will assume it is called master.tex, but you can call it what you like. In this file, you should use the book option to the \documentclass command, e.g.:
\begin{verbatim}
\documentclass[proceedings,book]{rmaa}
\end{verbatim}

3.1. What to put in the \texttt{preamble}\footnote{This is so that the macros can increment the figure counter accordingly. The plate itself is not output until the end of the document.} \texttt{rmaa}

Eventually, you may need some \usepackage commands here if optional packages have been loaded by individual authors. Look for lines like

Class rmaa Warning: Package floatflt was requested by rksmith on input line 3.

\begin{verbatim}
\usepackage{floatflt}
\end{verbatim}

in the output when you \LaTeX main.tex. In the example given, you would need to add \usepackage{floatflt}. The reason for this is that \usepackage is one of the commands that is disabled within individual articles in the book style, since it is illegal to try and load the same package twice.

You will probably want the following commands to set up the details of the volume:
\begin{verbatim}
\SetVolume{10}
\SetYear{2000}
\SetMes{junio}
\end{verbatim}

and if it is a RevMexAA(SC) volume you may want these:
\begin{verbatim}
\SetReunion{México, D.F.}
  {octubre 25--29}
  {setEditors{\textquote{Jane Arthur}, ...}}
\end{verbatim}

Finally, you want
\begin{verbatim}
\makeindex
\end{verbatim}

so that the index will be generated.

3.2. What to put in the \texttt{main body}\footnote{After the \begin{document}}

First off, you do not want a \maketitle command.

\begin{verbatim}
\frontmatter
\tableofcontents
\end{verbatim}

which will make the “Table of Contents” magically appear when it is ready.

Next, you can put all the other material that you want to have before starting the articles proper. This can include (but need not be limited to) a Preface, a List of Participants, a Group Photograph, etc. All these can be formatted using the \frontsection environment, which has the following syntax:
\begin{verbatim}
\begin{frontsection}{\langle \texttt{SHORTTITLE} \rangle}{\langle \texttt{TITLe} \rangle}{\% \langle \texttt{COMMANDS} \rangle}
\end{verbatim}

3.2.1. Front matter

Second, you should put
\begin{verbatim}
\frontmatter
\end{verbatim}
to begin the front matter (this turns on roman page numbering and a few other necessary things). Then, you put
\begin{verbatim}
\tableofcontents
\end{verbatim}

After the \begin{document}
3.2.2. Main matter

Include individual articles. Optionally separate them with \part commands.

3.2.3. Short abstracts

\begin{abstracts}
  \title{...
  \author{...
  \listofauthors{...}
  \indexauthor{...}
  \abstract{...}
  ...
  \end{abstracts}

3.2.4. The index

Explain how it is done.

3.2.5. The plates

The book option disables the \outputplates command in the individual articles, so you must put this command at the end of the master file if any of the included articles contain plates. The plates will then all appear at the end of the book.

A further point to remember is that any macros defined by the author in his/her article will have been “forgotten” by the time the plates are being output\[15\]. Hence, if any macros are used in the caption text of the plate figures, then the definitions of these must be repeated inside the argument of the \plate command\[16\].

4. GLOSSARY

Auxiliary Files

Bounding Box

Class See Document Class.

Document Class A self-contained set of \LaTeX macros that specify the markup for a certain type of document. These are found in files with the .cls suffix, and can be used as the argument of a \documentclass command. Examples include rmaa, article, and letter. Compare Package.

Encapsulated PostScript

Float

15I have made all such user macros local to their article so that there is no problem with “contaminating” subsequent articles (e.g., Author A redefines \alpha to be something weird, while Author B is still expecting it to be $\alpha$).

16And better use \def rather than \(\texttt{(re)}\)\texttt{newcommand}. 

\LaTeX 2\epsilon

Main Body

Package A set of \LaTeX macros to achieve a particular task, that can be used with many different Document Classes (qv). These are found in files with the .sty suffix, and can be used as the argument of a \usepackage command. Examples include inputenc, babel, color.

Preamble The \LaTeX commands that come between the \documentclass command and \begin{document}. These commands should not produce any printed output.

Style File

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