

# Sacramento Mountains Spectroscopy Workshop

By Gord Tulloch, RASC Winnipeg

## Introduction

I thought it would be interesting to members to get a synopsis of this workshop, which brought together some of the luminaries of the amateur spectroscopy world (many of them from France, where amateur spectroscopy really originated and has a large following.) Amateur spectroscopy, like amateur photometry, is an excellent opportunity for amateurs to make real contributions to the sciences, where amateur / professional collaboration results in a more thorough understanding of our Universe.

Spectroscopy is essentially a technique where a prism or diffraction grating is used to split light from a telescope into it's component colors, which can then be analyzed to learn more about the source. Generally spectra can be of low resolution which can indicate the temperature and composition of a star, or high resolution, which allows specific spectral lines to be examined to learn more about radial velocities and unusual emission or absorption. For example Be stars (a hot topic at the workshop) emit in H $\alpha$  and absorb, indicating the star is surrounded by a hot ring of gas that emits in that wavelength, turning the normal absorption line of the stellar spectra into a characteristic M shape.

## Travel to the Workshop

The workshop was held in Las Cruces, NM, which is about 45 minutes North in the Texas border at El Paso. Flying to Las Cruces turned out to be a bit of a grind but that was due to limiting our flights as much as possible to WestJet to take advantage of a companion pass and dollars earned on our credit card. We flew from Winnipeg to Vancouver to Phoenix, then a cheap flight to El Paso on Southwest Airlines. After an overnight in El Paso (and some of the best authentic Mexican food we've ever had) we drove a rental to the beautiful Hotel Encanto de Las Cruces. The Hotel Encanto is Southern New Mexico's Premier resort hotel and we really enjoyed our stay there, despite disappointing temperatures in the mid-teens centigrade for our entire stay. The next AAVSO Annual Meeting will be held at this hotel so here's your chance!



Figure 1 – Views of Hotel Encanto de Las Cruces

## The Workshop

The workshop began Friday morning with an informal breakfast in the Hotel's nightclub for attendees only. I was pleased to meet up with Dave Lane of the RASC Halifax Centre (former National President) and Dr. Stella Kafka, Director of the AAVSO, at breakfast. Several other Canadians were in attendance

including Mike Jefferson from the Hamilton Amateur Astronomers and Jay Lavender of the Edmonton Centre (we may see Jay at SWSP this year!) It looked like there was approximately 60 attendees and presenters at the workshop so quite a sizable affair. The event sold out so it could get even larger next year!

### Day 1 Sessions

The program for the workshop included some beginner spectroscopy sessions, primarily conducted by François Cochard, who literally wrote the book on amateur spectroscopy (his book was recommended reading before attending the conference.) The first few sessions after opening up the workshop were François presenting basics of spectroscopy and a rundown on available equipment. Cochard is a French amateur astronomer and co-founder and manager of Shelyak Instruments, so the focus was primarily on the Shelyak instruments that are today considered standards: Lhires III, LISA, eShel and Alpy 600. Cochard is also the organizer of the Spectro Star Party every year at the Observatoire de Haute Provence (OHP), where he has assisted many observers in their first steps in spectroscopy.

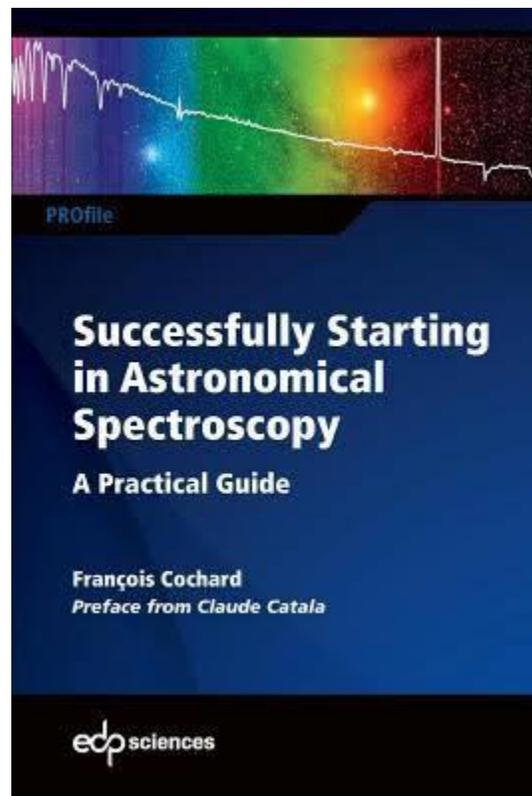


Figure 2 – Cochard's Book

Next up were the conference organizers, Joe Dahlen and Ken Hudson, presenting an overview of the ISIS spectroscopy software (<http://www.astrosurf.com/buil/isis-software.html>) written by revered French amateur Christian Buil, who was in fact in the audience. No pressure there! ISIS is a very complex piece of software so the presentations and instructions included in the workshop website (<http://www.smsweb.com/#software>) were instrumental in many attendees successfully using the software. In fact a story I've heard over and over during the workshop is "I bought an <insert spectrometer here> and never figured out how to get the damned thing working!" By the end of the

conference attendees were confident they could return home and make productive use of their equipment and software.

Dave Whelan of the observatory at Austin College in Sherman TX gave an excellent technical presentation on “Interpreting the Spectra of intermediate and high-mass stars” which included some intriguing information on Be stars and their spectra. While for some this presentation and others like it during the workshop were a little on the difficult side, I found the presenter very engaging and the presentation very accessible.

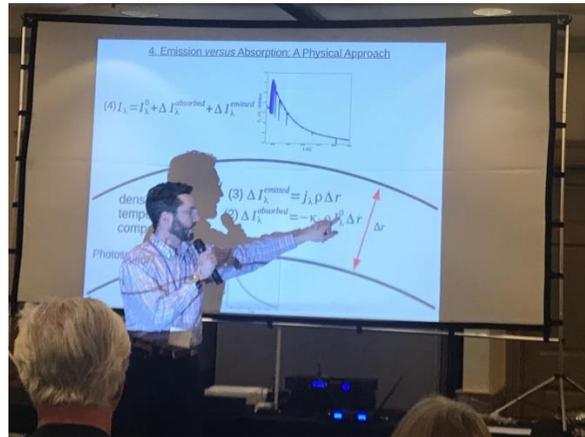


Figure 3 – Dr. Whelan presenting

Dr. Kafka, Director of the AAVSO then gave a presentation about the new AAVSO Spectroscopy Database that will soon be available for submission of spectra obtained by amateur astronomers, a database very similar to the photometry database I submit observations to on a regular basis. Astronomers regularly download data from AAVSO databases to assist them in their papers, and extension of the AAVSO's scope into spectroscopy is a very logical step. Her presentation included a lot of other ways amateurs could get involved in the science of Astronomy.

The evening was cloudy and rainy so a planned observing session at the home of one of the local attendees to collect data for Day 2 was cancelled. However it was an excellent opportunity to take advantage of the strong astronomy culture of the community and see a play named “Silent Sky”, the story of Henrietta Leavitt, who was a “computer” at the Harvard Observatory in Massachusetts responsible for realizing that Cepheid variables varied in proportion to their intrinsic brightness, which opened up a path to understand how far these stars are away from us, and by extension, the galaxies containing them. While this play was quite entertaining, it was a trifle fanciful, with a romance that I suspect was not in character for Ms. Leavitt or her times!



Figure 4 – Poster for *Silent Sky*

## Day 2 Sessions

The second day of the workshop continued with a nice breakfast where attendees mingled, followed by presentations on reducing data using ISIS. After the unfortunate weather the previous night, only sample data was available but the sessions were useful in working through the entire process of calibrating and analyzing spectral images.

François Cochard was then back demonstrating Demetra (<https://www.shelyak.com/logiciel-demetra/?lang=en>) which is a new tool recently released by Shelyak. Entertainingly he completed the same tasks we had taken 4 hours of workshop time to run through in about 30 seconds on Demetra (!) but it was a bit of an unfair comparison, as Demetra is limited in many ways. However Francois's demonstration was refreshingly simple and the user interface was extremely user friendly. That's not saying there are some complexities under the cover, and Francois was careful to note that setting up the data correctly is as important with Demetra as ISIS, but the workflow with Demetra is vastly more effective. The user interface leads the user through the process of acquisition or selection of calibration images as well as acquisition of spectra, and provides effective management of files without needing the user to do a lot of extra work keeping track of file names and folders etc. François also followed his Demetra demonstration with a deeper dive into Shelyak's spectroscopy lineup and how they are used.

Another technical session followed lunch, this time from Dr. Katie Devine from the physics faculty at the University of Idaho. Dr. Devine covered Radial Velocity and Line Broadening in Spectra, which was extremely useful in understanding and interpreting spectra.

Finally, Drew Chojnowsky, a PhD candidate at New Mexico State University gave a very interesting presentation on the Spectroscopy of Be Stars, expanding on the presentation Dr. Whelan did on the first day.

The evening of the second day consisted of a cocktail party with heavy appetizers (eg dinner) for attendees and guests, which was a very welcome time to spend getting to know other attendees and their significant others.

### Final Day Sessions

The final day of the workshop was heavy on French accents! First of all Valerie Desnoux was kind enough to demonstrate her free Vspec software for spectral analysis. Once you have spectral data “in the can” VSpec is a powerful tool to analyze the results.

Next a trio of students from Dr. Devine’s class provided a demonstration of work they’d done while interning at an amateur observatory owned by Joe Dagan, one of the workshop organizers. The students spent a week at the observatory capturing spectra and analyzing them, producing results that were extremely impressive. Drew Chojnowsky commented at one point “Wow, good job, that’s totally close to the published value for radial velocity of that object.” This was a really compelling presentation for how well equipped amateurs (or clubs!) can participate in the STEM education of our youth.

Christian Buil was then on tap for a talk on his new UVEX (UltraViolet Explorer) 3D printable spectroscope. Mr. Buil is a brilliant professional engineer in optics at Centre National d’Etudes Spatiales and his designs helped launch both amateur use of CCDs (Christian made the first CCD amateur image of an astronomical object in 1984 and designed multiple experimental cameras. His book *CCD Astronomy* was published in 1990 by Willmann-Bell helped launch amateur CCD imaging and he was instrumental in launching amateur spectroscopy by launching Shelyak Instruments. His new product is open source, with optical components easily obtainable from suppliers and a 3D printed structure. The spectroscope will augment the existing lineup by providing a cheap (about \$300) entry for amateurs into the discipline when the design becomes freely available later this year. Even though the device will be accessible for beginners, the ability to rotate the diffraction grating enables even advanced observer to image in the UV, visible, and IR wavelengths with the same device. An Alpy 600 is a necessary add-on component to this camera as it will require use of the Alpy slit attachments as well as the Alpy off-axis guider to be useful.



Figure 4 – An early UVEX 3D printed Prototype

Ms. Desnoux also provided a presentation on submitting Be spectra to the BeSS database, while Olivier Garde presented a method for Confirmation of Planetary Nebula Candidates with Spectroscopy, which was a fascinating look at planetaries that might be lurking in the images amateurs make of common objects, and how spectra can confirm that they are indeed the puffs of gas emitted by stars in their death throes.

Finally there was a panel discussion on Spectroscopy with our French visitors, and the conference wound up with some lessons learned in Spectroscopy from the organizers.

### Activities for Guests

While it was no effort whatsoever to get my wife Marie to agree to take a trip to New Mexico in February, I was concerned that shopping would get a little boring after a few days. Luckily, the spouses of the conference organizers put together a program of interesting things to do that kept everyone busy for the entire conference.

### Workshop Presentations and Materials

Given that the web site for the workshop will not be up and running for more than a few months I have mirrored the entire site including presentation slide decks and associated support materials on my web site at <https://www.gordtulloch.com/www.smswweb.com>.

### Final Thoughts

We were not unhappy to head home as 5 days is quite long enough to be away. New Mexico is quite alien to us as there's little green to be found, and the whole place looks like a gravel pit. We enjoyed the milder temperatures – as we were leaving temps were heading towards the mid-20s which would have made excursions uncomfortable, as acclimatized as we are to the deep freeze back home.

The Sacramento Mountains Spectroscopy Workshop 2019 was however quite a success, and I am pleased that I had the opportunity to attend. It was a very worthwhile trip!

While the approximately \$3,000 cost to get set up to properly take spectra is still accumulating in my piggy bank, once I'm ready to move forward I'll do so with a very comprehensive understand of the software and techniques required to submit very competent and useful observations to the AAVSO database. I know now my own journey will probably include an Alpy 600 low resolution spectrograph and a UVEX when available. I'd strongly recommend future conferences for those at all interested in spectroscopy. See you there!



Figure 5 – Workshop Group Photo