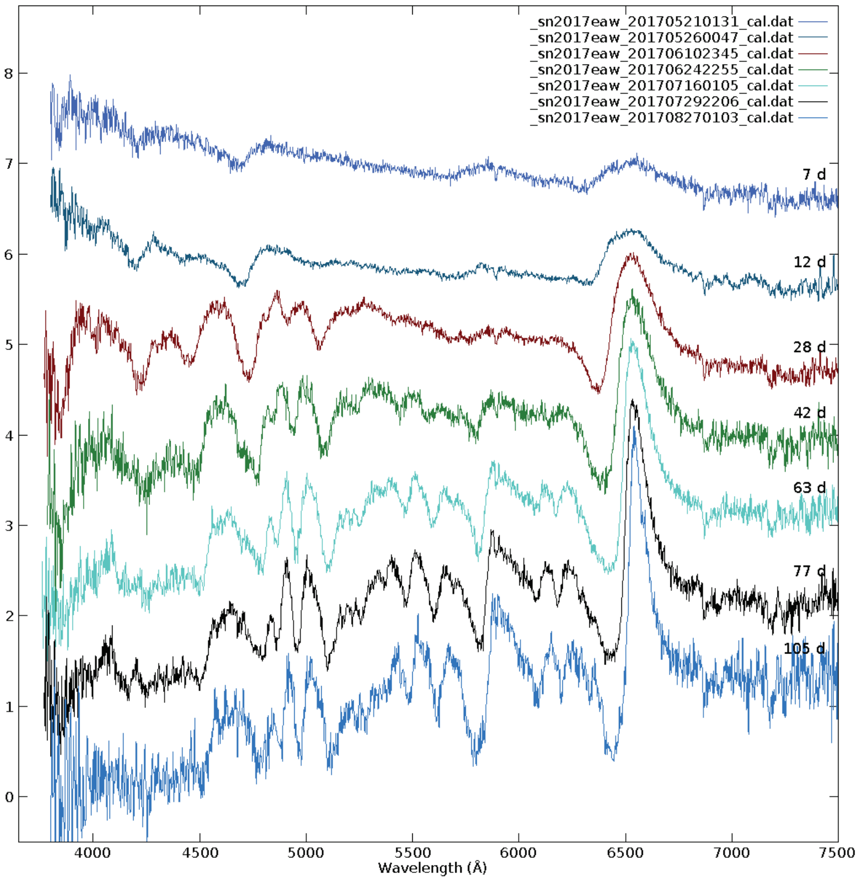
Fachgruppe Spektroskopie

SPEKTRUM

Mitteilungsblatt der Fachgruppe Spektroskopie
in der Vereinigung der Sternfreunde e.V.
Journal of the Section Spectroscopy of the Society of German Amateur Astronomers

NR. 54 2 / 2018



δ CEP
PLANETARISCHE NEBEL
SUPERNOVAE

ISSN 2363-5894

Impressum

Spektrum – Mitteilungsblatt der Fachgruppe Spektroskopie in der Vereinigung der Sternfreunde wird herausgegeben von der Fachgruppe Spektroskopie in der Vereinigung der Sternfreunde e.V. Es erscheint halbjährlich als PDF-Ausgabe oder auf Wunsch als Druckversion. Das Journal dient dem überregionalem als auch dem internationalen Erfahrungsaustausch auf dem Gebiet der Astrospektroskopie besonders für Amateure. Dazu können Beiträge in Deutsch oder English publiziert werden. Senden Sie Ihre Beiträge, Auswertungen, Erfahrungen und Kritiken an **Spektrum** zur Veröffentlichung ein, damit andere Spektroskopiefreunde an Ihren Erkenntnissen teilhaben und davon lernen können.

Spektrum – Mitteilungsblatt der Fachgruppe Spektroskopie in der Vereinigung der Sternfreunde is issued twice a year by Fachgruppe Spektroskopie of Vereinigung der Sternfreunde e.V. (spectroscopy section of the German amateur astronomical society). The journal is published as a PDF or as a printed version on special request. The aim of the journal is to be a national and international communication especially for amateurs, on topics related to astronomical spectroscopy. Contributions are welcome in German or English. Please send your papers, results, experiences and reviews to **Spektrum** for publication. The community can then benefit from your experience.

Registriert bei der Deutschen Nationalbibliothek / Registered at Deutsche Nationalbibliothek: DNB 1013413024

ISSN 2363-5894

Die Fachgruppe Spektroskopie im Internet: spektroskopie.fg-vds.de

Die Vereinigung der Sternfreunde e.V. im Internet: www.vds-astro.de

Kontaktadresse (Redaktion, Bestellung gedruckter Ausgaben, Einsendung von Manuskripten)

Dr. Thomas Hunger
Weinbergstraße 12
D-01129 Dresden
thunger03@web.de

Hinweise für Autoren:
Nur durch Ihre Artikel wird Spektrum gefüllt. Die Redaktion behält sich vor, in Rücksprache mit den Autoren Beiträge zu kürzen, anzupassen oder zu ändern. Für die Inhalte der Artikel ist aber allein der Autor verantwortlich. Mit der Einreichung eines Beitrages erklärt der/die Autor(en) die Bereitschaft zur Publikation auch im Journal für Astronomie der VdS e.V.
Reichen sie Ihren Beitrag bitte elektronisch unter Berücksichtigung folgender Regeln ein:
Form des Textes: Senden sie vorzugsweise als unformatierten ASCII-Text. Tabellen mit Tabulatoren getrennt. Ein zusätzliches PDF des formatierten Gesamttextes ist anzuraten.
Aufbau der Artikel: Die Artikel benötigen einen Titel, eine vollständige Adressangabe des Autors / der Autoren, eine Kurzzusammenfassung, den klar gegliederten Artikel mit Einleitung und Zusammenfassung sowie eine vollständige Literaturangabe.
Abbildungen: Bitte getrennt vom Text senden. Empfehlenswert sind hochauflösende JPG, PNG und TIFF.
Hints for authors:
Your article will be edited to fit the style of Spektrum. The editor is responsible for editing the article in close collaboration with the author. The author is in charge of the content in all cases, however. The author(s) give(s) the permission for a further publication of the contribution in the journal of the VdS e.V. (Journal für Astronomie) right with its transfer to the editor of Spektrum. Please send your contribution via electronic mail considering the following rules:
Text: Prepare it as unformatted text (preferably ASCII). Tables: columns separated by tabs. A PDF printout of the whole document is highly recommended.
Article structure: Each article should include a title, an address line of the author(s), an abstract, a clear text body with introduction and conclusion and complete references.
Figures: Please send them separate from text. High resolution JPG, PNG or TIFF files are recommended.

Umschlagfoto: Die zeitliche Entwicklung der Supernova 2017eaw dokumentierte Gregor Krannich anhand von Spektren. Näheres dazu findet sich im Heft.

Inhaltsverzeichnis / Content

Editorial

Liebe Leser des Spektrums,
liebe Fachgruppenmitglieder,

eine spannende Lektüre über verschiedene spektroskopische Aktivitäten erwartet Sie im Heft. So berichtet Olivier Garde zur erfolgreichen Klassifizierung von potentiellen Planetarischen Nebeln durch Amateure, Gregor Krannich hat sich der Supernovabeobachtung verschrieben.

In unserem Kreis wird seit langem über gemeinsame Aktivitäten mit den Veränderlichenbeobachtern, d.h. die gegenseitige Ergänzung von Photometrie und Spektroskopie, diskutiert. Die Jugend macht es einfach: Josefine Liebisch berichtet zu ihrem Projekt der kombinierten photo- und spektrometrische Beobachtung von δ Cep. Als langjähriger Beobachter der Spektroskopieszene selbst kann ich immer wieder über den beachtlichen Fortschritt staunen!

Im Jahresverlauf gab es aber auch Wermutstropfen: ein besonders bitterer für unsere Gruppe war die Rücktrittsankündigung unseres Sprechers Rainer Borchmann, der über die letzten Jahre die Aktivitäten im Hintergrund und die Jahreskonferenz im Vordergrund mit großem persönlichem Einsatze gemanagt hat. Rainer, ganz, ganz herzlichen Dank dafür!

Mit sternfreundlichen Grüßen,
Ihr Thomas Hunger

Dear readers of Spektrum,
Dear members of the section group,

An exciting reading on various spectroscopic activities awaits you in the issue. Olivier Garde reports on the successful classification of potential planetary nebulae by amateurs, Gregor Krannich is dedicated to supernova observation.

In our group there has long been discussion on common activities with the variable star observers, i.e. the complementarity of photometry and spectroscopy. The youngsters simply do it: Josefine Liebisch reports on the combined photo- and spectrometric observation of δ Cep. As a long-time observer of the spectroscopy scene itself, I am always amazed about the considerable progress over the years!

During the course of the year, there were also downers: a particularly bitter one was the resignation announcement of our spokesman Rainer Borchmann, who – over the last few years – has managed the activities in the background and the annual conference in the foreground with a large personal mission. Rainer, thank you very much!

Clear skies.
Yours Thomas Hunger

 ISSN 2363-5894,

Planetary Nebulae Confirmation in Spectroscopy

Olivier Garde
Observatoire de la Tourbière, 38690 Châbons, France, E-mail: o.garde@free.fr

Abstract
Uncategorized objects at the sky are regularly discovered by amateur astronomers from their own images or from professional images. Like the DSH list, thanks to the initiative of Agnès Acker and Pascal Le Dû, a list of planetary nebulae candidates is maintained in France and regularly published in the SAF magazine and then in VizieR. Recently, amateur astronomers specializing in spectroscopy have managed to observe the spectra of some of these candidates to confirm their nature.

Zusammenfassung
Bisher unkategorisierte Himmelsobjekte werden regelmäßig von Amateurastronomen anhand eigener Aufnahmen oder in professionellen Bildern entdeckt. Eine Liste von Kandidaten möglicher Planetarischer Nebel wird dank der Initiative von Agnès Acker und Pascal Le Dû ähnlich der DSH-Liste in Frankreich geführt und regelmäßig im SAF-Magazin und dann in VizieR veröffentlicht. Kürzlich gelang es Amateurastronomen, die sich auf Spektroskopie spezialisiert hatten, die Spektren einiger dieser Kandidaten zu beobachten, um ihre Natur zu bestätigen.

Received: 2018-05-05, Revised: 2018-09-06, Accepted: 2018-10-15

1. Introduction

For several years, amateur astronomers have been discovering probable Planetary Nebula (PN) candidates thanks to their own images or by scrutinizing professional surveys available on the Web. The catalogues of these likely candidates are available on Vizier database of University of Strasbourg, ref. 1.

To confirm the nature of a candidate, it is necessary to acquire its spectrum and highlight its characteristic spectral signature, the lines [OIII] 4959-5007 and Hα must be in emission. Other parameters are considered such as the ratio of the two lines [OIII] 4959 and [OIII] 5007. Some other lines can also be in emission (Hβ, [OI], HeI, HeII, [SII], [NII]).

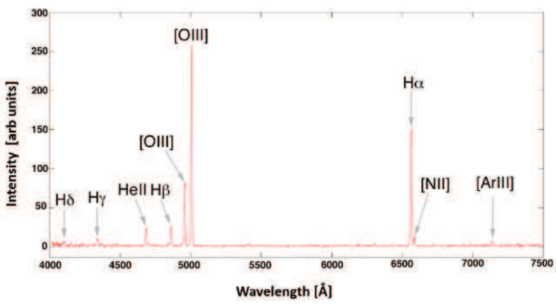


Fig. 1: A typical planetary nebula spectrum obtained with a LISA spectrograph.

The Lisa and Alpy spectrographs of Shelyak [2] are particularly well suited for this work. Depending on the setup used, it will be necessary to use a rather large slit (35 to 50 µm) to increase the flux entering the spectrograph, but one can try with the classical 23 µm slit if the focal length of the optics is small. The resolution will be lower but the goal here is to show the spectral signature of this kind of object. A typical spectrum of a PN is shown in fig. 1.

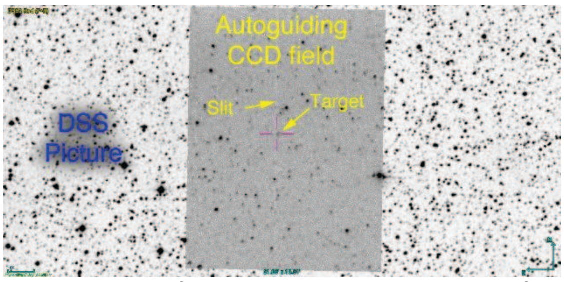


Fig. 2: Example of overlaying the autoguiding sensor field with the DSS image in Aladin.

2. Methodology

Once determined a target candidate, one need a field chart made with free software available online such as Aladin database, ref. 3. After entering the coordinates of the target in Aladin one can see the chart of the target whose magnitude is usually very faint (magnitude generally larger than 16 mag). The image of the autoguiding sensor field can be overlaid on the image produced by Aladin, see fig. 2.

It is not uncommon that the target does not stand out on the autoguiding sensor because of the weak source of light. We will position the slit of the spectrograph depending on the surrounding stars. Save an image of the autoguiding sensor field on your PC to attach it to the future observation report of this target. The autoguiding will be done on a bright star close to the target while you check that the slit is on the target. Once centered, we start the autoguiding then we go to the acquisitions of the spectra.

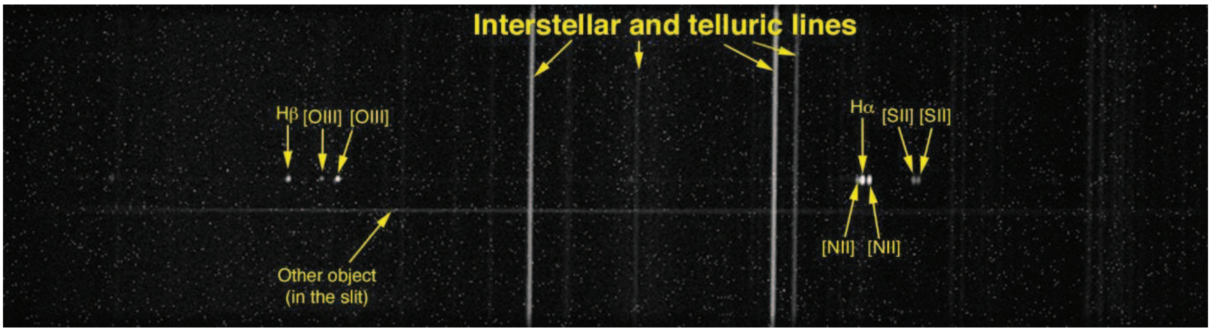


Fig. 3: Example of a raw spectrum as it appears on the PC screen during acquisitions by finely tuning the display thresholds.

(1) Produce a first image with a unit exposure time of 600 to 1200 s. If there is no apparent signal drop this target. This phase is delicate: an adjustment of the thresholds is sometimes necessary to try to perceive the signal. If nebular lines appear, acquisition can continue. Fig. 3 shows the appearance of a raw single spectrum of a rather punctual PN candidate.

(2) Take *n* object exposures of 900 s. The number *n* depends on the appearance of the unit spectrum and can vary from 3 to 12 depending on the targets. The goal is to increase the signal to noise ratio to highlight the main emission lines.

(3) Take a spectrum of a calibration lamp (Neon) without modifying the position of the spectrograph or the telescope.

(4) To perfectly calibrate the spectrum, it is necessary to take the spectrum of a reference star (spectral class A or B) close to the target and preferably at the same height in the sky. For that one can use the Excel spreadsheet offered by François Teyssier, see ref. 4. Pointing the reference star take a series of 7 to 9 spectra whose exposure times depends on the magnitude of the star (e.g. between 2 and 5 s).

(5) Take a spectrum of the calibration lamp (Neon) without modifying the position of the spectrograph and/or the telescope.

(6) Switch to the next target. Note that each spectrum is made exactly at the same x and y coordinates of the slit which allows for better accuracy during processing.

(7) At the end of the acquisitions a series of 21 to 33 flat images using a tungsten lamp is done.

3. Spectrum processing and analysis

The spectral processing will be carried out with ISIS [5] which makes it possible to choose the right treatment zone of the spectrum. The reference star is first processed to calculate the effects of instrumental and atmospheric response at the time of observation. Once the processing is done the resulting spectrum is compared to a generic spectrum of a star of the same type in the ISIS database. The resulting Planck profile is used further on.

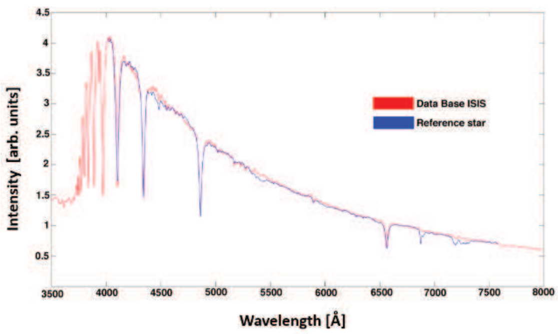


Fig. 4: The example above shows the result with a A2V star (HD162579). The red curve is the reference curve of the ISIS database and the blue curve of the star obtained with the spectrograph. The two curves must be superimposed. (Observers: Olivier Garde, Pascal Le Dû, Thierry Lemoult, Observatoire de St Veran).

Now, the target is processed. The job is selecting the area of interest within the image, from which the final spectrum of the object will be calculated. Two areas containing only the sky background need to be identified to be subtracted from the area of interest containing the object's signal. The goal here is to eliminate all lines of light, interstellar pollution as well as the Earth's atmosphere or even another nebula that could be in the same line of sight as the PN.

 ISSN 2363-5894,

Only the signal related to the object must be considered. This work is relatively easy in the case of a star shaped PN. It becomes harder for a diffuse PN because the different zones to be determined are difficult to be identify. Often, several tests are necessary.

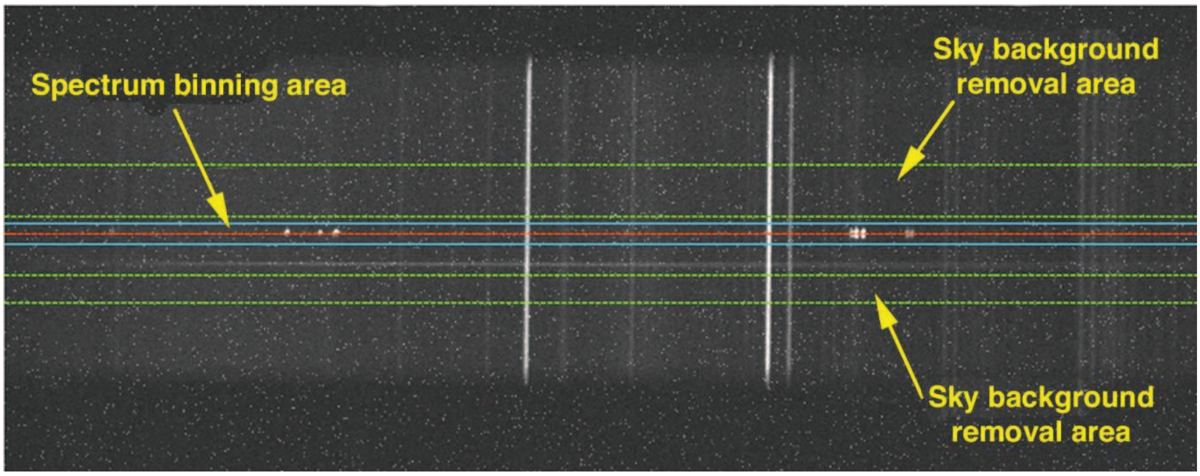


Fig. 5: Example spectrum of a PN under investigation together with background signal. The blue zone contains the object spectrum (emission lines! at the red dashed line). The green boxes determine the areas used for background subtraction.

The example in fig. 5 shows the treatment performed on a star shaped PN candidate, so it appears relatively "easy". The zone delimited in blue lines contains the area of the PN spectrum that will be treated further on. The height is adjusted to contain the entire signal of the PN. It is recommended (Do not hesitate!) to push the thresholds of the histogram for visualization. It is in this zone that the spectrum is calculated (by adding the pixels of each column of the zone).

The two green areas are selected at the top and bottom of the spectrum. They do not have star spectra that could disturb the measurement in the area of interest. These sky-background areas are positioned closest to the area of the PN spectrum. Once the treatment is done, we finally obtain a spectrum that can look like this in fig. 6.

We will try to analyze the spectra obtained to determine if it is indeed a Planetary Nebula or another object such as a proto-star, a nova, a galaxy or other object that does not have the spectral signature of a planetary nebula. The example given in fig. 7 is indeed a Seyfert galaxy not yet listed in databases. The spectrum of Pre24 shows nebular lines which are strongly shifted into the red. We can calculate its redshift z to be in this case $z = 0.014$ meaning a velocity of more than 4,300 km/s. We can therefore exclude this candidate clearly as not being a PN.

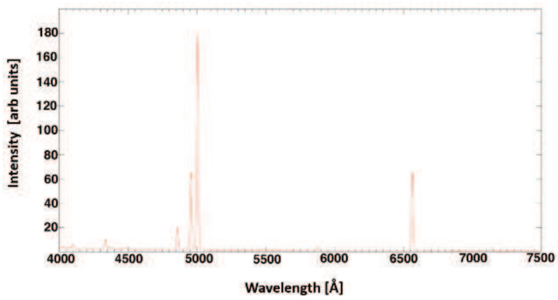


Fig. 6: Example of the KN 66 candidate: one can easily recognize the various nebular lines. T1000, C2PU-Lisa-Atik414EX, 3x900 s, O. Garde, P. Le Dû, P. Dubriel, A. Lopez, 2017-09-20, 19h51m.

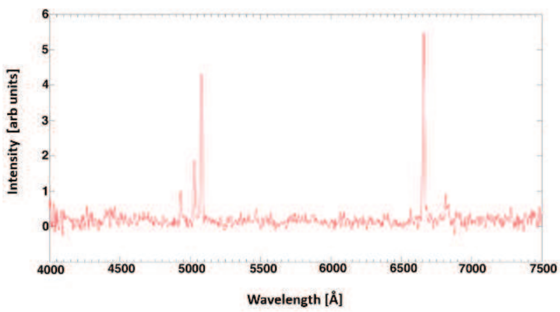


Fig. 7: Pre24 spectrum showing nebular lines with strong red-shift with z = 0.014. T1000 C2PU, Lisa, Atik414EX, 4x900 s, O. Garde, P. Le Dû, P. Dubreuil, A. Lopez, 2017-09-21, 01h16m.

4. Publication of Results and Summary

The collection of spectral data is done by Pascal Le Dû who gathers the various spectra obtained to send them to Quentin Parker and his team of the University of Hong Kong who maintains the HASH planetary nebulae database, ref. 6. A report template can be downloaded from ref. 7.

The filled file can then be sent to ledu@shom.fr containing all spectral data files (.fits, .dat, .log and .xml). The astronomical database is updated on a regular basis with the latest confirmations where the objects pass from the stage "Possible Planetary Nebula" (fig. 8) to the stage of "Planetary Nebula" in full share as on the example in fig. 9.

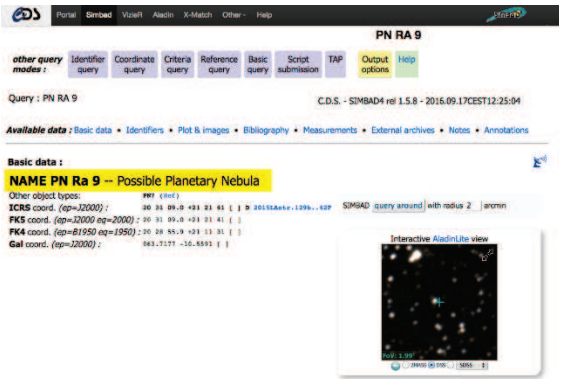


Fig. 8: Example of a target that has not been confirmed yet.

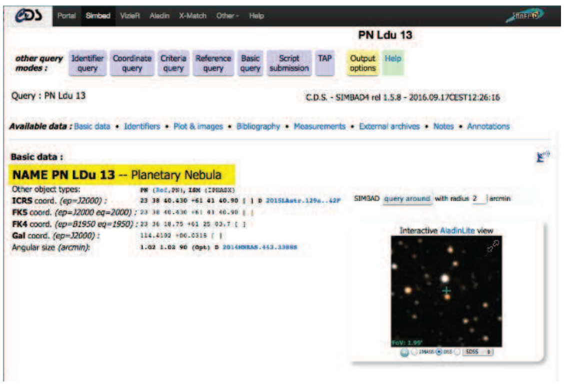


Fig. 9: Example of a Planetary Nebula that has been confirmed by amateur spectroscopy.

At this date, many planetary nebulae have been confirmed in spectroscopy by amateurs. But there is still considerable work to be done on all current and future candidates.

References

[1] http://vizier.u-strasbg.fr/viz-bin/VizieR?-source=J/other/LAstr/114.54
[2] http://www.shelyak.com
[3] http://aladin.u-strasbg.fr
[4] http://www.astronomie-amateur.fr/Documents%20Spectro/ReferenceStarFinder.xlsm
[5] http://www.astrosurf.com/buil/isis-software.html
[6] http://hashpn.space/
[7] http://www.cielocean.fr/uploads/images/FichiersPDF/ExempleFicheSpectro.doc

More references:

- Planetary Nebula Confirmation Mission Report to St Veran Observatory: http://o.garde.free.fr/RapportMissionCALAI-2016BD.pdf
- Planetary Nebula Confirmation Mission Report to the OCA on the Calern Observatory: http://o.garde.free.fr/RapportMissionCalern2017.pdf
- Website of Pascal Le Dû: http://www.cielocean.fr
- Discovery of new faint northern galactic PN: http://www.cielocean.fr/uploads/images/FichiersPDF/RMxAA..48-2_aacker.pdf
- Article in french about Pascal Le Dû observations: http://www.cielocean.fr/uploads/images/FichiersPDF/ASM87_SpectroGa1.pdf
- The APN VII congress poster in Hong Kong: http://www.cielocean.fr/uploads/images/FichiersPDF/Poster_APN%20VII%20v1-1.pdf
- The issues of the french magazine l'Astronomie relating the confirmations of planetary nebulae: # 91 February 2016, # 102 February 2017 and # 114 March 2018:
- https://www.saf-lastronomie.com/revue/
- The French magazine Ciel et Espace # 558 March/April 2018: https://boutique.cieletespace.fr/liseuse/preview/558/view.html#!/avedocument0/pdf/1/1/1

Olivier Garde, member of ARAS and CALA, has been practicing amateur astronomy since an age of 12. He obtained a University diploma of Astronomy and Astrophysics of Paris XI in 1996 in parallel with his studies in acoustics to become a sound engineer. In 2002 he began to take an interest in spectroscopy and realized his very first spectra. For more than 15 years, he collaborates regularly on Pro / Am programs in spectroscopy, owns an observatory in the south east of France equipped with low- and high-resolution spectrographs (LISA, LHIRES III, eShel, WhoppShel, SBIG SGS) and also participates in missions in various observatories (Observatory of St Véran, OCA Calern, Observatory of Haute Provence). He is an active member of the French Association of Astronomy (AFA). In 2017, he joined the spectrum validator team of the BESS Be Stars spectra database at the Meudon Observatory. In 2018 he became technical consultant of Shelyak instrument company while continuing the management of his audiovisual production company.
He also owns an observatory in the South East of France close to the Alps equipped with numerous low- and high-resolution spectrographs (LISA, LHIRES III, eShel, WhoppShel, SBIG SGS).