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Title

Author1,[1]⋆ Author2,[2] Author3[2,3]
[1] Institution1
[2] Institution2
[3] Institution3

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ABSTRACT
Single paragraph,not more than 250 words and no references.
Aims.
Methods.
Results.

Key words: keyword1 – keyword2 – keyword3 – keyword4 – keyword5 – keyword6

1 INTRODUCTION

2 OBSERVATIONS AND DATA REDUCTION

2.1 Observations

High-resolution spectroscopic observations were obtained at de 2.1-m telescope of the Observatorio Astrómico Nacional San Pedro Mártir (Baja California, México) in a f/7.5 configuration using the MES-SPM instrument (Manchester Echelle Spectrometer; Meaburn et al. 2003). A total of 56 positions were obtained from seven sets of observations carried out in 2006, 2007, 2010, 2013 and 2015. The number of position acquired in each set of observations, dates, exposition times and airmass during the observations are summarized in Table 1.

For the 2006, 2007a, 2007b and 2010 observations the instrument was equipped with the detector SITE-3 CCD which is an array of 1024×1024 (24μm) pixels giving a spatial resolution of 0.321 arcsec/pix (without considering the binning). On the other hand, the CDD for the 2013a, 2013b and 2015 sets, Marconi-2, was a detector with 2048×2048 square pixel, each 13.5 μm, giving a spatial resolution of 0.176 arcsec/pix (without considering the binning). The slit width was set at 150μ (1.95 arcsec on the sky) throughout the observation and it was oriented in the north-south direction for 2006, 2007a, 2007b and 2010 observations and in the east-west direction for the 2013a, 2013b and 2015 ones.

In order to establish the exact position of the slit in each pointing we took direct slit images of short duration, in which the diffraction grating was replaced by a mirror. Additionally, thorium-argon lamp spectra were taken for wavelength calibration between each slit position.

Finally, taking the seven data sets into account, we get 56 slit-positions in Hα, [N II]6548Å and [N II]6584Å, lines spanning an interval of 217 arcsec in RA and 9 arcsec in DEC. In order to illustrate the spatial distribution of the observations in Fig. 1 we show the 56 slit positions oserved plotted over an Hα image obtained from Da Rio et al. (2009) (see below).

2.2 Data reduction

The spectra were reduced using IRAF[1] by following the standard procedure for 2D spectroscopic observations (bias subtraction, flat-fielding and cosmic rays removal). The wavelength calibration was made using thorium-argon arcs taken between each slit position.

After transforming all the spectra to a common heliocentric velocity frame, we performed a series of further corrections to obtained well calibrated spectra in a self-consistent way.

(i) An astrometric solution was found for each of the spectra using nearby stars. This allowed us to accurately determine the slit position of each exposure.

(ii) In order to compensate the variations in the sky transparency and seeing between exposures we compare our spectra with a deep Hα image of the region obtained from Da Rio et al. (2009) with the Wide Field Imager (WFI) at the 2.2-m MPG/ESO telescope at La Silla. This was done by fitting a low-order Chebyshev polynomial to the spectra to WFI profile ratio. With this we obtained a brightness normalization factor for each spectra, as well as a correction for

⋆ E-mail: mail@mail

[1] The Image Reduction and Analysis Facility IRAF is distributed by the National Optical Astronomy Observatories, which are operated by Association of Universities for Research in Astronomy, Inc., under cooperative agreement with the National Science Foundation.

Table 1. Summary of the data set observed with the spectrograph MES-SPM.

Set name	Dates	# Slits	Orientation	Spatial resolution[(a)] (arcsec pix^{-1})	Cover area (arcmin^2)	Exp. time[(b)] (s)	Airmass[(c)]
2006	2006 Feb 5	11	Vertical	0.624	6×6	300000(3)/600000(8)	1.68
2007a	2007 Jan 10	3	Vertical	0.624	2×6	600000	1.79
2007b	2007 Jan 13	7	Vertical	0.624	14×6	600000	1.30
2010	2010 Jan 15,16,17	17	Vertical	0.624	17×6	450000(1)/600000(16)	1.41
2013a	2013 Feb 16,18,19	11	Horizontal	0.527	100×2	450000(1)/600000(10)	1.52
2013b	2013 Dec 11	5	Horizontal	0.527	114×0.2	600	1.49
2015	2015 Feb 3	2	Horizontal	0.351	88×0.2	600	1-29

[(a)] Final spatial resolution taking the spatial binning into account.

[(b)] 2006, 2010 and 2013a spectra were taken with different exposition times (separated by a bar). Number of position acquired with each exposition time are indicated in brackets. This was taking into account when combining images in the data reduction.

[(c)] Mean value during the observations.

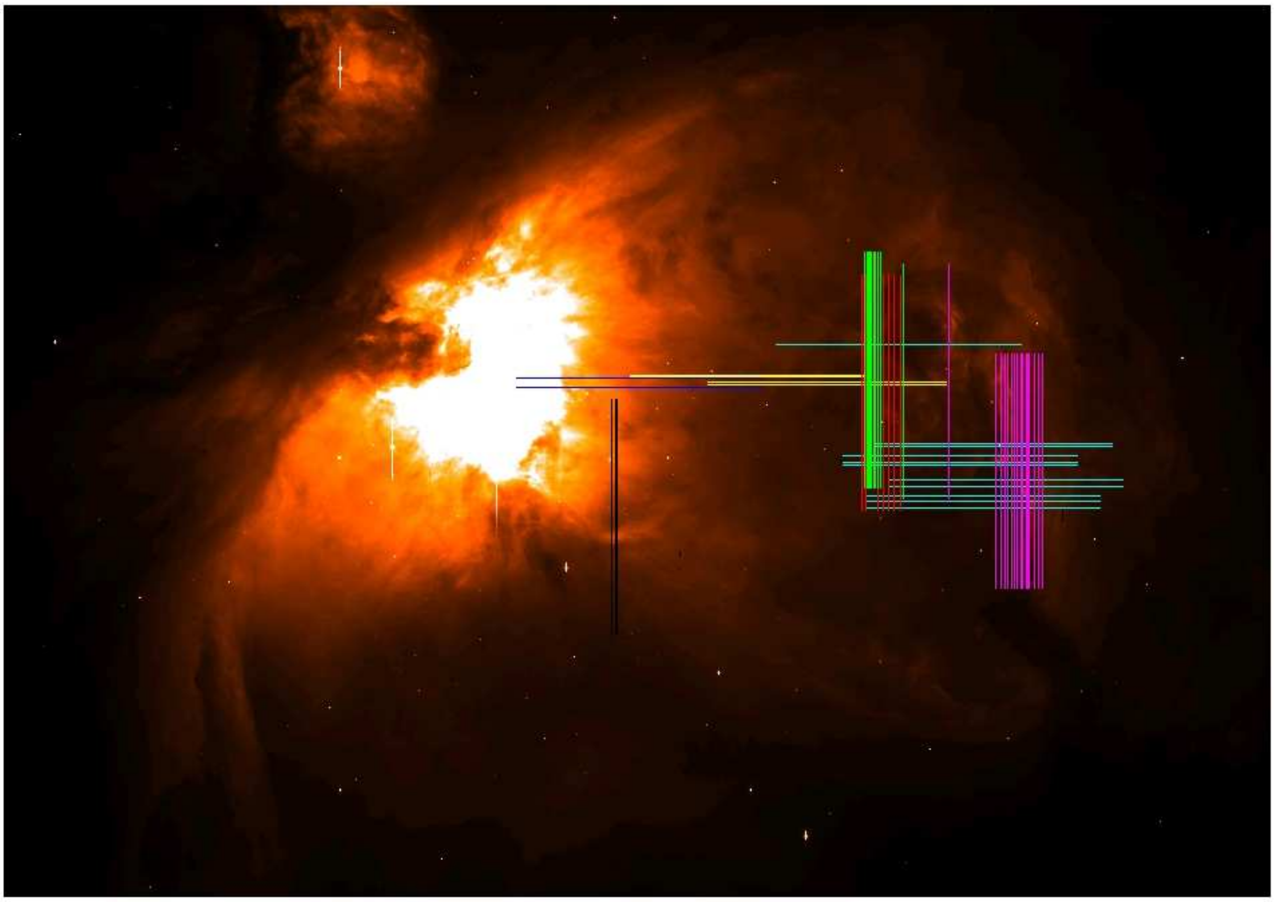

Figure 1. Hα image of the western region of the Orion nebula (Da Rio et al. 2009) showing the positions of the MES-SPM observations. Data sets corresponding to 2006, 2007a, 2007b, 2010, 2013a, 2013b and 2015 are represented in green, black, red, magenta, cyan, yellow and blue, respectively. North is up and east left.

flux gradients along the slits. This comparison also allowed us to flux-calibrate our spectra, using the spectrophotometry provided by O'Dell & Harris (2010) in common regions. Figure 2 shows a three-panel plot with the flux calibration for one of the positions.

(iii) Continuum emission was removed by fitting a two-dimensional Chebyshev function. For each exposure a background section was selected including only line-free regions of the spectrum (we use an excluded velocity window of -10 to +40 km s^{-1}in heliocentric velocity around the line core). In addition we use an intensity threshold to distinguish high velocity knots from noise.

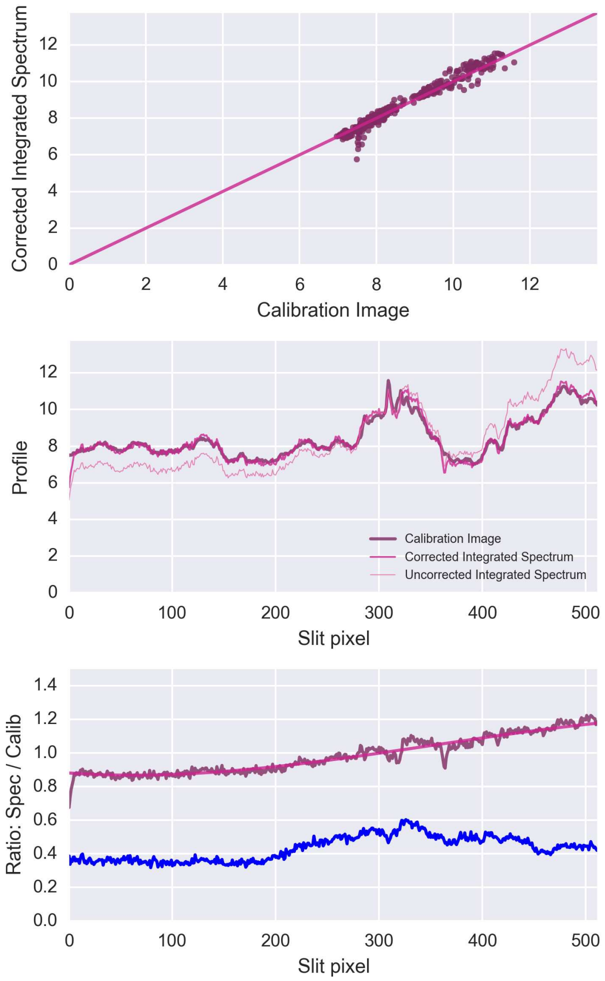

Figure 2. Example of flux-calibration of one of the 2006 spectra. Top panel: calibrated spectrum profile plotted against calibration WFI image profile. Medium panel: corrected, uncorrected and calibration WFI spectra profiles along the slit. Bottom panel: spectrum-WFI ratio corrected (pink colour), uncorrected (blue colour) plotted along the slit. The Chebyshev polynomial function used for calibration is also represented in OTHER colour. **(Problems with colours description)**.

The resultant calibrated two-dimensional spectra are shown in Fig. 3.

3 ISOVELOCITY MAPS

In order to better reveal the spatio-kinematical patterns in the object, the slit spectra were combined and interpolated to produce isovelocity channel maps. To that end, we carried out the following steps.

First, we built an orthogonal RA-DEC grid placing all the slits onto there by looping over slits profiles extracted in a given wavelength (helocentric velocity) window. On those grid pixels in which two or more slits fall, the intensity was estimated as the mean weighted by the slit quality. Grid pixels where no slit falls leave transparent.

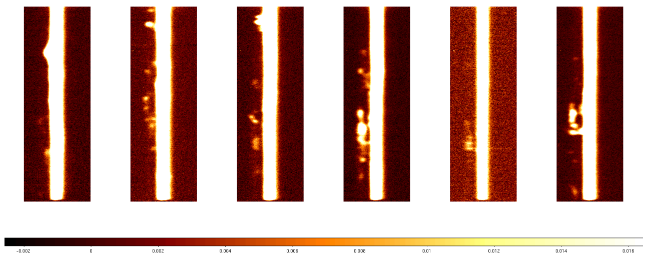

Figure 3. Calibrated two-dimensional slit spectra in Hα for six representative slit positions.

Due to observational differences between each set of observations (i.e. spatial resolution and seeing) we generated multi-resolution maps in order to not degrade the quality of better spectra. To do that, we build several isovelocity maps onto grids with binning of 2 (better resolution), 4, 8, 16 and 32 (worst resolution).

Finally, all the grids were combined to obtain multigrid smoothed channel maps with a spatial resolution ranging from 0.5 to 15.1 arcsec pix^{-1}. The resulting isovelocity channel maps for Hα and [N II]6584Å are shown in Fig. 4.

Pensar cuales mostrar Velocity windows: Widebands (+0+60,-60+0,-120-60), Red(+30+50,+10+30,-10+10), Near-red(+50+70,+70+90,+90+110), Far-red(+110+130,+130+150,+150+170), Blue(-30-10,-50-30,-70-50) and Far-blue(-90-70,-110-90,-130-110).

3.1 Kinematic features

Descripcion de las caracteristicas observadas en los mapas de isovelocidades

4 BLUE-KNOTS ANALYSIS

4.1 Identification

4.2 Gaussian fitting

5 CONCLUSIONS

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The Acknowledgements section is not numbered. Here you can thank helpful colleagues, acknowledge funding agencies, telescopes and facilities used etc. Try to keep it short.

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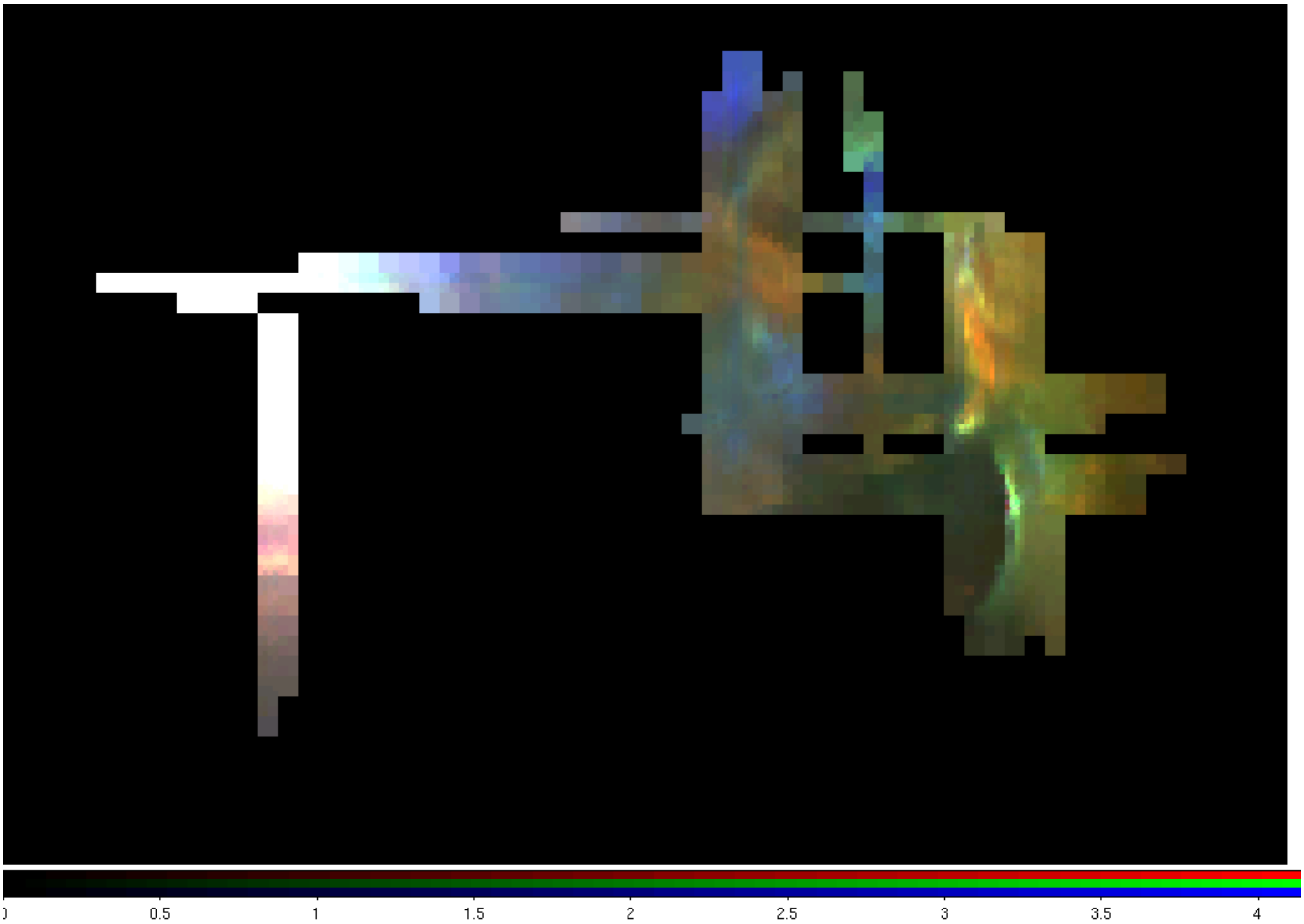

Figure 4. RGB composition image of the western region of the Orion nebula obtained from the isovelocity maps. Red correspond to the channel maps with heliocentric velocity between +30 and +50 $\mathrm{km\,s^{-1}}$, blue between +10 and +30 $\mathrm{km\,s^{-1}}$and green between -10 and +10 $\mathrm{km\,s^{-1}}$.