X-RAY AND IR EMISSION OF THE YOUNG STELLAR POPULATION OF THE ORION B MOLECULAR CLOUD

M. A. López-García,1 B. Stelzer,2 I. Pillitteri, J. López-Santiago1 & E. De Castro1
1 Universidad Complutense de Madrid, Dept. de Astrofisica, Facultad C.C. Fisicas, Madrid, Spain.
2 INAF – Osservatorio Astronomico di Palermo, Palermo, Italy.

Abstract
Multiwavelength surveys are the key to explore the mechanisms of star formation. We focused on the Orion B region, a multicore star forming region with more than 1000 young stellar objects in different stages of formation. We are carrying out a multiwavelength study for a significant part of the Orion B molecular cloud, based on 9 XMM-Newton archival observations, infrared (Spitzer, WISE, and 2MASS) and Optical (XMM Optical Monitor and UCAC4) photometry data. This work is focused on the classification and characterization of young stellar objects and the inhomogeneity along the cloud. After filtering for the background sources, we classify the sample into 332 Class III, 141 Class II and 11 Class I/O and a dozen of brown dwarf candidates based on their infrared/optical properties. We explore the differences along the cloud and the stellar population distribution. We find 5 different regions where Class I/O and Class II objects are located, coincident with the centre of NGC2023, NGC2024, NGC2068, NGC2071 and around V1647-Ori. In addition, we are currently carrying out an optical follow-up of the BD (brown dwarfs) candidates.

Infrared Properties
For the infrared analysis, we used the Spitzer data and 2MASS catalogue discussed in Mogezht et al. (2012). The authors classified the source of the catalogue as stars with IR excess,Class II, or protostars, Class I/O. We checked this classification and then we used color-color and color-magnitude diagrams to improve the characterization.

X-ray Analysis
Using the Science Analysis Software (SAS) task expfilt we fitted the event list and created the GTI (Good Time Interval) files. We create one master source list for all available data in Orion B, with a total of 604 sources.

Spectra were analyzed for X-ray sources with more than 100 net count, in each instrument. The source must be detected on at least one of the individual EPIC detector. Under this restriction, 45 of the total 604 source spectra were analyzed. The spectral fitting was computed using XSPEC version 12.7.1. For the fit we used 1T or 2T models, for all stars we fixed the abundance to Z/Z⊙ = 0.3.

We use the 45 stars for which spectral analysis could be performed to determine a conversion factor (CF) between the observed count-rate and flux (absorbed flux).

X-RAY CORONAL PROPERTIES

• Class III
  \[ K_{\text{corr}} = 3.48 \text{ keV} \]

• Class II
  \[ K_{\text{corr}} = 2.04 \text{ keV} \]

• Class I/O
  \[ K_{\text{corr}} = 2.03 \text{ keV} \]

We used the flux derived from the CF to obtain X-ray luminosities (calculated with a fixed distance of d = 450 pc for all sources). We created the X-ray luminosity function using the Kaplan-Meier estimator and compare with the CDUP data (Getman et. al. 2005) between our limits. We censored data from our maximum and minimum flux, i.e. from 30 to 315 [in log10(\text{erg cm}^{-2})] for CDUP and Orion B data. CDUP, Orion B, and the curves for Class II and Class III are similar. The main difference between the curves are at high luminosities when CDUP is slightly above.

Conclusions
We have carried out an analysis of the X-ray and infrared properties of the Orion B region. From 9 archived XMM-Newton observations we classified 332 Class III, 141 Class II and 11 Class I.

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Fig. 2. XMM-Newton image mosaic of Orion B. The image is in the band: 0.3-7.5 keV.

Fig. 3. RGB Image
• Blue: X-ray
• Red: Optical
• Green: WISE (W1 in 3.4 μm)

Fig 3. Details: Red points are Class O/I, green points Class II, green triangles are transitional disks, black points Class III, black diamonds are strong reddening Class III.

Table 1. Details of EPICs observations

References
• Mogezht et al. 2012, AJ, 144, 192

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