Imaging and spectroscopy of compact emission nebulae in NGC 6822

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Abstract. We present preliminary results of CTIO 4-m MOSAIC 2 imaging and Magellan and Gemini-South multi-object spectroscopy for NGC 6822. In our on-band off-band ([OIII] 5007, Hα) MOSAIC 2 data of the whole galaxy, we are searching for Planetary Nebula (PN) candidates and measuring their [OIII] 5007 fluxes. So far we have confirmed 13 of the 17 PN candidates reported previously and some other faint candidates. We obtained Magellan and Gemini-South multi-object spectroscopic data to derive simultaneously, the chemical abundances of some HII regions and PNe. The observed objects are distributed in different zones of the galaxy. Our aim is to obtain the chemical abundances of the present ISM (HII regions) and the corresponding values at the time of formation of the PNe. With these data the chemical homogeneity of NGC 6822 will be tested and the abundance pattern given by HII regions and PNe will be used as an observational constrain for computing chemical evolution models to infer the chemical history of NGC 6822.

Keywords. ISM: HII regions, ISM: planetary nebulae, galaxies: abundances, galaxies: evolution

1. Introduction

NGC 6822 is a gas-rich dIrr with clear evidence for recent star formation (it has more than a hundred HII regions; Hodge *et al.* (1988)). Its stellar content extends in a zone of 4×6 kpc, surrounded by a huge HI halo. Recently, Leisy *et al.* (2005) have reported several new PN candidates, increasing the total sample of PNe to 17, most of them in the central zone.

Apparently this galaxy has not been affected by tidal effects from the Milky Way or M 31, as it is located at 495 kpc from our galaxy (moving away at $V_{rad} \sim 44$ km/s) and at 880 kpc from M 31. Therefore, NGC 6822 is particulary suited for chemical evolution studies because, unlike the Magellanic Clouds, it has not lost a significant amount of gas due to tidal effects. In addition its star formation history is well known (Wyder 2001). Modelling its present (HII regions) and near-past (PNe) chemical abundances might allow to decide if outflows towards the intergalactic medium have been produced by this galaxy. This is an open problem in the study of chemical evolution of irregulars, since an important difference has been found between the observed oxygen yield and the oxygen yield predicted by closed-box chemical evolution models. One possible explanation is the possibility of O-rich galactic outflows, another is the presence of dark matter. A well constrained chemical evolution model for NGC 6822 would help to decide on this controversy.

Presently we are analyzing the PN population of NGC 6822 on images with the CTIO wide field camera MOSAIC 2 in [OIII] 5007, Hα and their adjacent continua. We followed the on-band, off-band method to search for emission line objects. Our criteria for the identification of the objects are: compact emission objects with no stellar continuum are identified as PN candidates; compact low-excitation objects with noticeable stellar continuum and extended objects are considered HII regions.

2. Data reduction and analysis

Imaging.- The data have been reduced using the MSCRED IRAF package. The [OIII] 5007, Hα and continuum images were added so we have a 2 hrs image in [OIII] 5007, 1.3 hrs in [OIII]-continuum and 1 hr for Hα and its continuum. The on-band off-band subtracted image shows many compact and extended emission objects. All the point sources presenting emission in both lines and showing no continuum were tagged as PN candidates. We have performed a rough comparative photometry with the IRAF task imexam, to have an idea of what we can expect from the absolute photometry. So far, we have analyzed about 1/6 of the whole galaxy on our very deep images. We have rediscovered 13 PN candidates (of the 17 reported by Leisy *et al.* 2005) and at least 4 unknown faint point sources at large galactocentric distances. These objects should be confirmed as PN candidates in the Hα images and through their excitation degree.

Spectroscopy.- MOS spectroscopic data were acquired on August 11-12, 2005 with the 6.4-m Magellan (Clay) telescope and on Sept. 14, 2005 with the Gemini South (program GS-2005B-Q-56, 5 hrs. in total). Our targets are located in two fields centered at 19:44:56, −14:42:58 (this field includes 4 PN candidates and 7 HII regions), and at 19:44:59, −14:48:08 (southern field including 7 PN candidates and several HII regions) covering the central 15 arcmin of NGC 6822. These data are under reduction and they will be used to constrain our chemical model.

3. Conclusions

We confirmed 13 PN candidates of the 17 reported previously. Some of the not confirmed PNe seem to be extended objects. We are still working on this. A future analysis of our Hα images could help to ascertain this. We have found some faint compact emission objects located at large galactocentric distances. They could coincide with some compact HII regions reported by de Blok & Walter (2005). The nature of these objects needs to be confirmed. Finally, once we get the chemical abundances from HII regions and PNe (spectroscopic data) we will use them as constraints in our chemical model to try to infer the chemical history of the galaxy.

References

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