Spectroscopy of the bright optical counterparts of X-ray sources in the direction of M 31

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Abstract

Recent surveys of the Local Group spiral Galaxy M 31 with XMM Newton telescope yielded a large number of X-ray sources. As part of the effort to identify and classify the objects responsible for this X-ray emission, using the 1.3m Skinakas Telescope in Crete (Greece) I have obtained optical spectra of the brightest optical counterparts of some of the X-ray sources previously identified by Pietsch et al. (2005, *A&A* **434**, 483). The observations have been scheduled into three observing runs: on September 12-15 and 26-30,2007 and in October 5-7,2007. Most of these objects were foreground star candidates. The purpose of the present study has been to confirm this classification and to explore the compatibility between the optical spectral classification and the observed X-ray properties of the sources. I have obtained optical spectra for 23 optical counterparts of X-ray sources identified by XMM Newton in the direction of M 31. The data have been reduced using the astronomical analysis software IRAF. The spectral classification of the objects has been achieved by comparison with standard stars spectra observed with the same instrumental setup used to obtain the targets spectra. I deduced the spectral class both inspecting the spectra visually and using informatic procedures. The same classification process has been carried out on the standard stars in order to check the reliability of the method. As a further test I reproduced the expected correlation between color and spectral type of normal stars using the results obtained for the standars and for the objects. The outcome of the classification confirmed that all of the sources are foreground stars in direction of M 31, of spectral types between F and M. Marking the difference between the identified spectral types, I plotted various hardness ratios versus the logarithm of the ratio of the X-ray flux to the optical flux, $log(f_x/f_{opt})$. The different spectral classes in the sample do not show any significant difference, since they occupy the same area in the hardness ratios-$log(f_x/f_{opt})$ planes. Further work is required to explain the behaviour of a couple of G type stars which show a relative higher hardness ratio.