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IR SPECTROSCOPY IN HIGH REDSHIFT QSOS

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At the moment, one of the big issues in astronomy is the determination of the metallicity of QSOs at different redshifts. This is a powerful tool to probe star-forming activity and evolution in galactic nuclei at different epochs of the universe.

It has been found that to z<1 the Narrow Line Region (NLR) of QSOs tends to disappear at high luminosities. At z>2 most luminous QSOs are also characterized by the total absence of the NLR. However, high z QSOs have been found with strong [O III] emission; which probably indicates the population of high-redshift QSOs is divided into two distinct groups — one group contains objects with strong [O III] λ5007 lines, and the other group shows no [O III] λ5007 lines.

A possible explanation is that the host of QSOs with strong [O III] are experiencing powerful starburst activity and that the large amount of dense gas associated to the starburst enhances the emission of [O III]. If these QSOs are characterized by vigorous star formation, then they should increase the FIR emission due to warm dust heated by the starburst.

On the other hand, one would expect that the more sub-mm/mm luminous QSOs would also be the more metal-rich (especially in N) QSOs, because they were more recently enriched by supernovae.

The goal of this work is to check this hypothesis by using sub-mm/mm observations to detect the FIR emission associated with the starburst hosted in the circumnuclear region of these QSOs. We also will correlate the sub-mm/mm emission with other QSO properties, such as the metallicity.

We are going to use several lines to estimate the metallicity, depending on the available spectra (optical or IR). We can use the N V/C IV ratio or (Si IV + O IV)/C IV. In addition, we can calculate the black hole mass from the width of the Hβ, C IV or Mg II lines.

We obtained NIR spectra for a sample of QSOs already observed in the mm band. The 4 objects have redshifts z $\sim$ 2.5 and are among the most luminous sub-mm/mm QSOs. The NIR spectroscopic observations were made at the TNG in Spain, equipped with the NICS and the JK grism (Baffa et al. 2001) (see Figure 1).

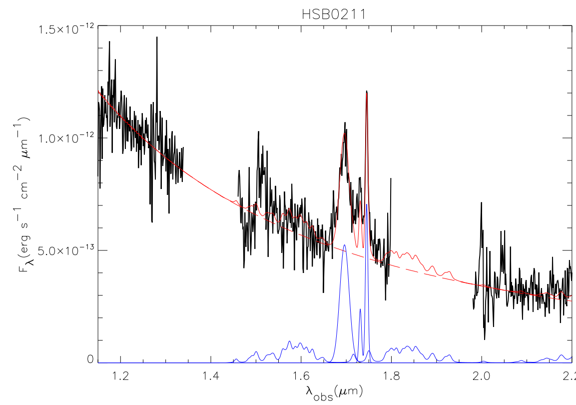

Fig. 1. NIR spectrum of the HSB0211+1858 QSO at z$\sim$2.5. It clearly shows intense [O III] emission.

We obtained mm observations with MAMBO at IRAM for another set of 6 objects. This sample was previously observed in the NIR by Dietrich et al.(2002), who provided us with the spectra for our analysis.

In order to have a statistically significant sample, we have compiled from the literature a list of 212 QSOs, observed at sub-mm and mm wavelengths (Omont et al. 2003, 2001; Priddey et al. 2003; Carilli et al. 2002; Isaak et al. 2002).

We have already analyzed our IR spectra, and we are presently working with the spectra available from the SDSS database (41 objects) in order to obtain the metallicity, black hole mass and the accretion rate. We expect to be able to find/reject a correlation with the sub-mm/mm emission.

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