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Extragalactic molecular line surveys: the starburst galaxy NGC 253

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Abstract. Fig. 1 shows the first spectral line survey towards an extragalactic source, the starburst galaxy NGC 253. The scan, carried out at the IRAM 30 m telescope, covers ∼86% of the observable 2 mm atmospheric window from 129.1 to 175.2 GHz. A total of ∼ 100 spectral features have been identified as transitions from 25 different molecular species. Ten out of these 25 molecules have been detected for the first time towards a starbust galaxy. NO, NS, SO_2, H_2S and H_2CS were reported by Martín et al.(2003), Martín et al.(2005) while C_2S, CH_2NH, NH_2CN, $HOCO^+$ and C_3H are tentatively detected in the survey. These new detections implies an increase of ∼ 40% in the 27 molecular species previosly detected outside the galaxy (Mauersberger & Henkel(1993), Mauersberger et al.(1995), Sage & Ziurys(1995), Heikkilä et al.(1999).) Additionaly, DNC and N_2D^+, two deuterated species never obseved in the extragalactic ISM, are tentatively identified.

The molecular abundances derived for each species in NGC 253 have been compared with five Galactic sources known to be prototypes of different types of chemistry. The chemical complexity of NGC 253 resembles closely that observed towards prototypical Galactic Center molecular clouds (Sgr B2(OH) in, thought to be mainly dominated by low velocity shocks Martín-Pintado et al.(2001). This comparison certainly indicates that the chemistry of the molecular environment within the nuclear region of NGC 253 and that in Galactic Center molecular clouds are driven by similar physical processes.

Also a comparison has been performed with five selected prominent galaxies which clearly shows up the chemical differenciation between nuclei of galaxies. The chemical complexity of IC 342, and also that of NGC 4945 except for the observed lack of SiO, clearly resemble that of NGC 253. On the other hand, it is remarkable the different chemical complexity observed between the starburst nuclei within NGC 253 and M 82. This difference has been interpreted in terms of the nuclear starburst in M 82 being in a more evolved stage, dominated by photodissociation regions (PDRs) (García-Burillo et al.(2002)). This idea is fully supported by the similarity of the chemical complexity of M 82 and the Orion Bar, taken as prototype of PDR.

Keywords. surveys, ISM: molecules, galaxies: abundances, galaxies: individual (NGC 253), galaxies: ISM, galaxies: nuclei, galaxies: starburst, radio lines: galaxies

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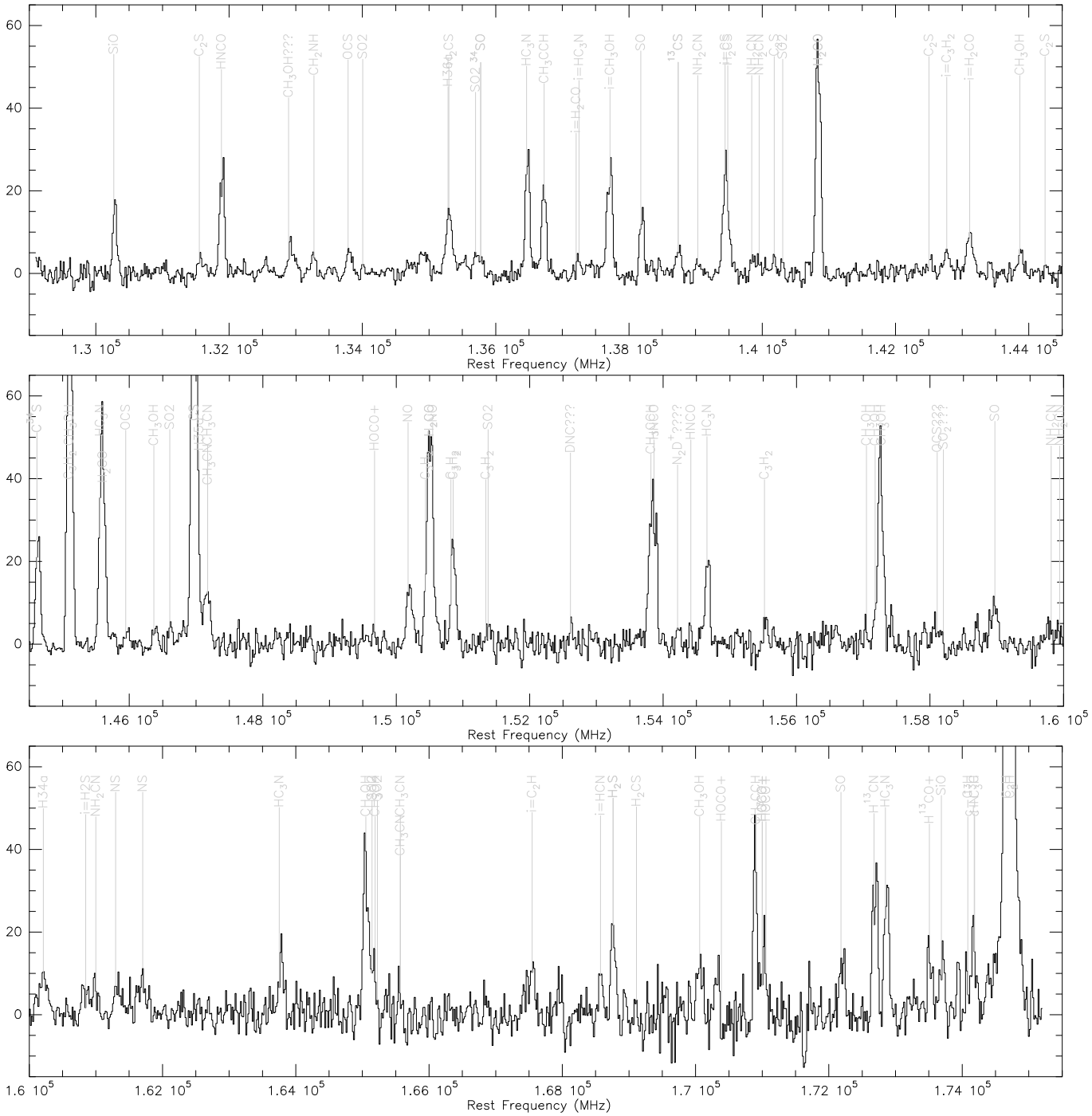

Figure 1. Complete 2 mm frequency scan towards the starburst galaxy NGC 253.