The Nuclear Starburst in NGC 4945

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Abstract. NGC 4945 is with $D \sim 3$–4 Mpc one of the nearest starburst galaxies known and a goldmine for molecular cloud research. A multi-line mm-wave study has been carried out towards its nuclear region with the Swedish-ESO Submillimetre Telescope (SEST). The study covers the frequency range from 82 GHz to 354 GHz and includes 80 transitions of 19 molecules, including rare isotope-bearing species. Applying a Large Velocity Gradient (LVG) code to the data, H$_2$ densities and column densities of 22 molecular species are calculated. Many of these species indicate the presence of a prominent high density interstellar gas component characterized by $n_{H_2} \sim 10^5$ cm$^{-3}$. Abundances of molecular species are calculated and compared with abundances observed toward the starburst galaxies NGC 253 and M 82 and galactic sources. Apparent is an ‘overabundance’ of HNC and CN in the nuclear environment of NGC 4945. NGC 4945 is the second known starburst galaxy with an HNC/HCN abundance ratio $\geq 1$. Carbon, nitrogen, oxygen and sulfur isotope ratios are also determined. The data indicate that high $^{18}O/^{17}O$, low $^{16}O/^{18}O$ and $^{14}N/^{15}N$ and perhaps also low $^{32}S/^{34}S$ ratios (6.4±0.3, 195±45, 105±25 and 13.5±2.5, respectively) are characteristic properties of a starburst environment in an advanced evolutionary stage.