Line emission and absorption dominating the optically thin spectrum in Arp 220 at 40pc resolution with ALMA

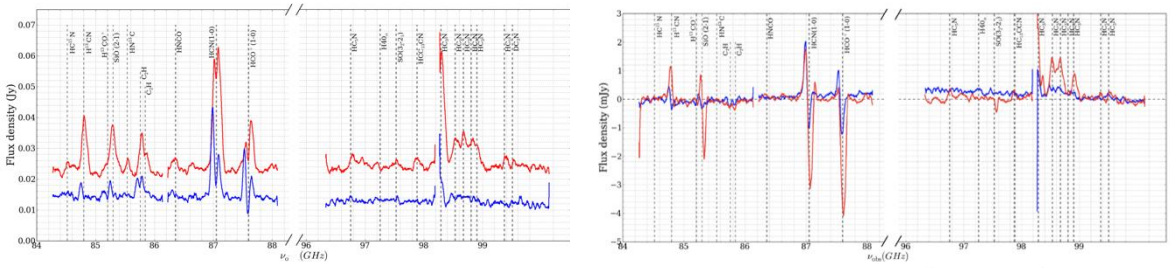
Loreto Barcos-Muñoz[1], Susanne Aalto[2], Sergio Martin[3], et al.

[1] *National Radio Astronomy Observatory, North American ALMA Science Center, 520 Edgemont Rd, Charlottesville, VA, USA 22903*

[2]*Department of Space, Earth and Environment, Chalmers University of Technology, Onsala Observatory, SE-439*

[3]*European Southern Observatory, Joint ALMA Observatory, Alonso de Córdova 3107, Vitacura, Santiago 763-0355, Chile*

Arp 220 is one of the most extreme starbursts in the local universe. It is a late stage merger, highly obscured and compact, with $N_{H2}>10^{26}$ cm^{-2} [e.g., 1] toward the western nucleus, being optically thin only between 5 to 100 GHz [e.g., 2]. The extreme conditions present in the central kpc of this merger makes it an ideal environment to test complex chemistry of the ISM. We will show the spectra of Arp 220 between 84 ~ 100 GHz detected at 0.1" (40 pc) resolution with ALMA. The wealth of line emission detected toward both nuclei (Figure 1 – Top Left) at this high angular resolution gives a hint of the molecular richness of the ISM in this system. However, the high angular resolution in such dense environment reveals high absorption of the lines (Figure 1 – Top Right) which complicates the interpretation of the observations, and makes the central region of the nuclei almost inaccessible. High vibrational lines of HC_3N may provide a way out to this problem. Finally, we will show a few indicators of outflow emission including HNCO, SiO(2-1), and HCN/HCO+ ratio map. The latter shows enhanced HCN emission along the outflow detected in the western nucleus [e.g., 3] and gives a hint of the location of the outflow in the eastern nucleus (Figure 1 – Bottom).



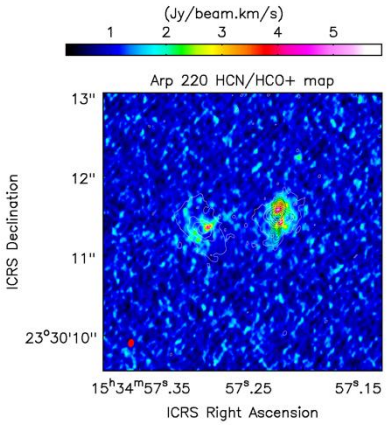


Figure 1 – (Top): Integrated profile from East (blue) and West (red) nucleus (Left) and from the central beam (0.1" aperture) (Right). We clearly detect a wealth of line emission that are heavily absorbed in the center. PCygni profiles are observed in both nuclei. (Bottom): HCN/HCO+ map with outflow contours (black) and the 3σ contour in white. We observe enhancement of HCN emission along the outflow.

References (Cambria 10 pt, bold face, aligned to the left)

[1] Scoville, N., et al., ApJ, 836, 66 (2017)

[2] Barcos-Muñoz, L. et al., ApJ, 799, 10 (2015)

[3] Barcos-Muñoz, L. et al., ApJL, 853, 28 (2018)