

# The Third National Workshop on the SKA Project - The Italian Route to the SKAO Revolution



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## Cold gas in nearby radio galaxies

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The SKA precursors and pathfinders (e.g. MeerKAT, ASKAP) opened a new era of investigation of neutral atomic (HI) gas studies in nearby galaxies. The possibility of reaching high spatial ( $\sim 10 - 30''$ ) and spectral resolution ( $\sim 4 - 20 \text{ km s}^{-1}$ ) with short ( $\sim 10$  hrs) observations, combined with a large field of view ( $\sim 1^\circ$ ), now enables us to investigate the presence of low-column density ( $< 5 \times 10^{19} \text{ cm}^{-2}$ ) HI in all types of galaxies in different environments, from isolated objects to groups and clusters. For example, observing low-column density HI from the macro (hundreds of kpc) to the micro scale (a few kpc) in active galactic nuclei (AGNs) allows us to trace not only signatures of AGN-feedback (i.e. gaseous outflows) but also phenomena of cold gas accretion.

In this talk, I will show how using both neutral hydrogen and high spatial resolution observation of the radio continuum emission of AGNs we can connect the presence of HI with the history of the nuclear activity occurred in the galaxy. I will present the results from different recent deep HI observations ( $< 5 \times 10^{19} \text{ cm}^{-2}$ ) from the Australia Telescope Compact Array and MeerKAT projects (i.e. Meerkat Fornax Survey, Mhongoose, open-time) of a handful of nearby AGNs ( $D_L < 50$  Mpc) representative of different radio powers and optical luminosities. I will focus on the role of the neutral hydrogen in the accretion and feeding of the nuclear activity. These results demonstrate how HI observations allow us to distinguish between 'external' accreting phenomena (i.e. mergers and interactions) and 'internal' phenomena (i.e. cold chaotic accretion, secular events). I will highlight the crucial synergy with high resolution molecular and ionised gas observations to understand what mechanisms regulate the life-cycle of radio AGNs.

### Research area

HI galaxy science

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