PhD student: Amirnezam Amiri
Thesis title: Physical conditions of ionized gas outflows
Tutors: Prof. Alessandro Marconi - Dr. Giovanni Cresci

Galactic outflows, either driven by starburst regions or active galactic nuclei (AGNs), are thought to play a crucial role in galaxy formation and evolution. In fact, they have great influence on both the IGM and the ISM of their host galaxies, regulating the quenching of the star formation activity, the metal content of galaxies, and so on.

However, a comprehensive picture of the physical condition of such outflows is still far to be obtained. The new generation of IFU spectrographs is recently providing unprecedented datasets to obtain detailed maps of ionization conditions, metal enrichment, kinematics of the gas entrained in such outflows, but a robust modeling of such new datasets is still missing.

In my thesis, I will tackle these problems by modeling the physical conditions of the outflowing gas and its kinematics. I will develop a set of photoionization models to reproduces the observed properties of the outflows detected in the framework of the MAGNUM survey (e.g. Cresci+15, Venturi+17, Mingozzi+19), that is targeting nearby (D<50 Mpc) active galaxies. This approach will provide a unique tool to test the outflow physical conditions. In particular, we will consider several different ionizing sources for the gas in the outflow, in order to reproduce the original observed data. Furthermore, we will consider multiple clouds with different physical conditions, to solve the problems affecting the currently adopted single cloud models. I will then develop a full kinematical model of the outflowing gas to reproduce its structure and geometry, taking into account the complex, multi-cloud nature of the gaseous structure in the outflow. This will allow me to derive robust measurements of the mass outflow rate and of the geometry of the outflowing gas, at variance with the simple models adopted so far, which consider a medium with uniform density and filling factor.

This combined approach will provide an unprecedented detailed modeling of the physical and kinematical condition in AGN-driven outflows, that will be a benchmark for forthcoming studies at higher redshift.