Unraveling the Enigma of Super Jupiter Formation:
Insights from Observations

Super Jupiter formation mechanisms, including core accretion and gravitational instabilities in protoplanetary disks, and stellar-like mechanisms in molecular clouds, remain subjects of exploration. Over a decade, the carbon-to-oxygen ratio emerged as a crucial parameter that promised to provide information about the location of the gas and solids' accretion. Currently, we know that the interpretation is more complex than initially thought. Under this framework, we examine a homogenous sample of 24 low-mass (mass < 50 Jupiter masses) companions and isolated objects homogeneously observed at medium-resolution on the K-band (resolution ~5000) with SINFONI at the VLT, aiming to prove formation tracers. We uniformly measured the carbon-to-oxygen ratios and metallicities of the sample using ForMoSA, a Bayesian forward modeling Python package. We conducted preliminary statistical assessments to analyze these values concerning each target's age, mass, temperature, gravity, and semi-major axis. This comprehensive approach, linked to population synthesis simulations, probes the boundaries of planetary-mass formation mechanisms for this super-Jupiter population, offering valuable insights into their formation histories.