Extreme extragalactic star formation at high angular resolution with laser guide star adaptive optics

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Star formation can occur at an extremely intense rate when two galaxies collide. The major gravitational potential perturbations induced by the interaction usually drag gas and dust together to form a myriad of massive, dense and compact Super Stellar Clusters (SSC) enshrouded in dust cocoons, radiating most of their power in the IR wavelengths. This overall process has a crucial role in the structural and chemical evolution of galaxies. The typical burst duration being of the order of 10 Myr the study of this process requires high angular resolution, as the average distance of a typical sample of ULIRGs is of the order of 150Mpc. Considering a typical diameter for a SSC of 50 pc, its angular size at this distance is 70 mas. This corresponds to the resolution achievable with Adaptive Optics (AO) on 8-10m telescopes in the near-IR. It is also comparable to the resolution achieved by the HST is the visible. From the ground, Laser Guide Star (LGS) AO is mandatory since practically none of these objects is bright enough or close enough to a bright star to serve as the reference for the AO system. In this paper, we present the preliminary results of a survey of rather close ULIRGs lead with various LGS assisted AO techniques (single conjugate, multi-conjugate and multi-object AO) in combination with already available HST visible data. This multi-spectral approach allows us to derive SED and color-color diagrams of SSCs which are compared to tracks provided by galaxy evolution models such as Galev, where the parameters are tuned to simulate a recent starburst. From these preliminary results, we present a first analysis in terms of individual SSC characteristics and link to the host system properties (burst location and propagation history, relationship with central AGN when applicable, etc ..) Moreover, this pilot program is also used to assess the performance achievable with future AO systems on the European ELT.