Spatially resolved star-formation in nearby early-type galaxies

*(based on Kuntschner et al., 2010, MNRAS, **408**, 97)*

Harald Kuntschner[1,*], E. Emsellem[1,2], R. Bacon[2], M. Cappellari[3], R. L. Davies[3], P. T. de Zeeuw[1,4], J. Falcón-Barroso[5], D. Krajnović[1], R. McDermid[6], R. Peletier[7], M. Sarzi[8], K. Shapiro[9], R. van den Bosch[10], G. van de Ven[10]

1: ESO, Germany; 2: Centre de Recherche Astrophysique de Lyon, France; 3: University of Oxford, UK; 4: Sterrewacht Leiden, The Netherlands; 5: IAC, Spain; 6: Gemini North Observatory, USA; 7: Kapteyn Astronomical Institute, The Netherlands; 8: University of Hertfordshire, UK; 9: UC Berkeley, USA; 10: MPI for Astronomy (Heidelberg), Germany

*email: hkuntsch@eso.org

Abstract

We present the spatially resolved stellar population analysis of the absorption line strength maps for 48 nearby early-type galaxies from the SAURON survey. Remarkably, ~40% of the galaxies show signs of a contribution from a young stellar population (see Fig. 1). The most extreme cases of post-starburst galaxies (see Fig. 1a), with SSP-equivalent ages of ≤3 Gyr observed over the full field-of-view covering about the half light radius, are restricted to low mass systems (~2×10^{10}M$_\odot$). Spatially restricted cases of young stellar populations in circumnuclear regions (see Fig. 1b) can almost exclusively be linked to the presence of star-formation in a thin, dusty disk/ring, also seen in the near-UV or mid-IR on top of an older underlying stellar population. The flattened components with disk-like kinematics previously identified in all fast rotators (Krajnović et al. 2008) are shown to be connected to regions of distinct stellar populations (see Fig. 2). These range from the young, still star-forming circumnuclear disks and rings with increased metallicity preferentially found in intermediate-mass fast rotators, to apparently old and more massive structures with extended disk-like kinematics, which are observed to have an increased metallicity and mildly depressed [α/Fe] ratio compared to the main body of the galaxy. Using radially averaged stellar population gradients we find a mass - metallicity-gradient relation where the most massive systems, being slow rotators, exhibit the shallowest metallicity gradients (see Fig 3). This is interpreted as a consequence of the competition between different star-formation and assembly scenarios following a general trend of diminishing gas fractions and more mergers with increasing mass, leading to the most massive systems being devoid of ordered motion and signs of recent star-formation.

Age and metallicity distributions

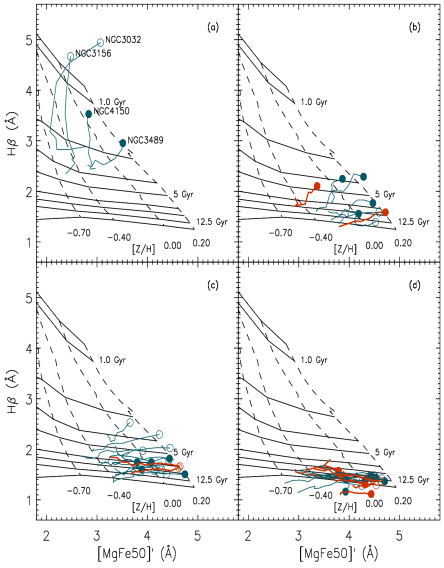

Figure 1: Age/metallicity diagnostic diagrams for the early-type galaxies in the SAURON survey. For each galaxy a radial gradient averaged along isophotes is shown. The center of each galaxy is indicated by a filled circle and open circle for cluster and field galaxies, respectively. The colour indicates whether a galaxy belongs to the fast rotators (blue) or slow rotators (red). Overplotted are stellar population models by Schiavon (2007). (a) Galaxies with an extended, recent star-formation episode; (b) galaxies with signs of a central, spatially constrained, region of younger stellar populations; (c) galaxies with milder but spatially extended signs of a younger stellar population; and (d) galaxies consistent with overall old stellar populations.

Disks in early-type galaxies

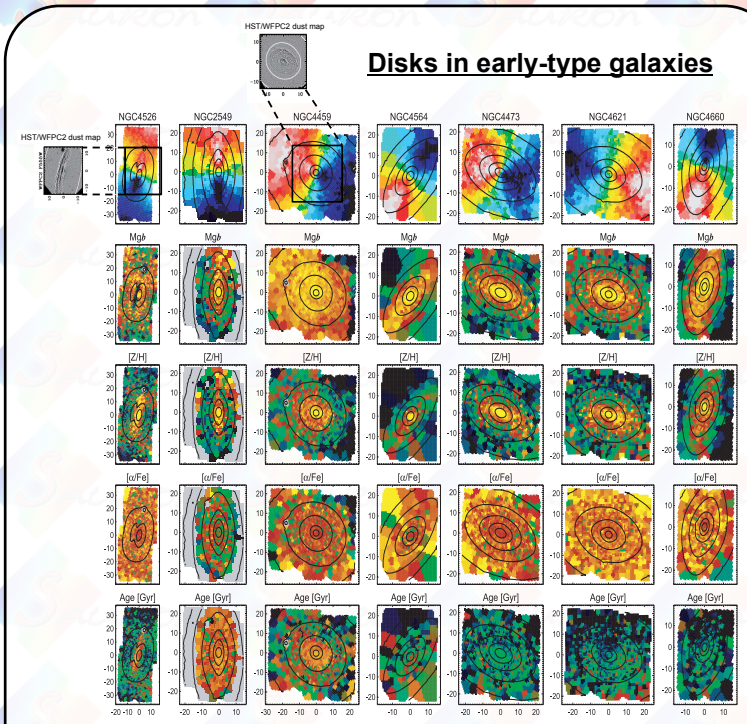

Figure 2: Prominent examples of fast rotators with a distinct, central disk-like component. For each galaxy we show from the top, the stellar velocity field, the Mg*b* line strength map, the metallicity map, the abundance ratio map [α/Fe] and the SSP-equivalent age map. The disk-like components can be clearly seen in the velocity fields and are reflected in enhanced Mg*b* and [Z/H] regions and mild depressions in the [α/Fe] maps. NGC4526 and NGC4459 are examples of currently ongoing residual star-formation in a thin disk (see HST/WFPC2 dust maps).

Metallicity gradient and age *versus* mass

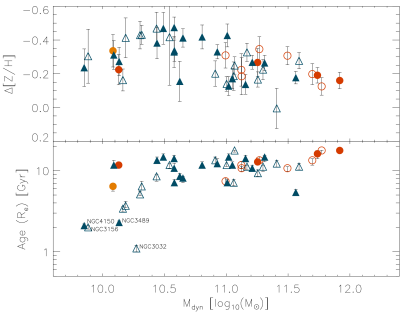

Figure 3: Top: Metallicity gradient *versus* dynamical mass. There is an overall trend for more massive galaxies to have shallower gradients. Bottom: SSP-equivalent age (over 1 R$_e$) *versus* dynamical mass. The youngest systems are at the low-mass end with ≤2×10^{10}M$_\odot$. Fast and slow rotators are shown as blue and red symbols.

References

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Krajnović D. et al., 2008, MNRAS, 390, 93
Schiavon R. P., 2007, ApJS, 171, 146