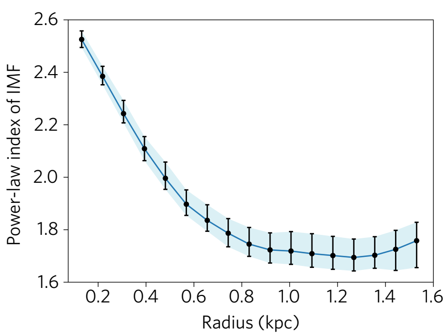
STAR FORMATION

One galaxy, many beginnings

Mon. Not. R. Astron. Soc. (in the press); preprint at https://arxiv.org/abs/1711.05813



Credit: Oxford Univ. Press

The stellar initial mass function (IMF) is an empirical probability function — characteristic of a given population of stars — that describes the distribution of initial masses of stars within that population as they join the main sequence. Given that stellar mass is the fundamental property driving the evolution of stars, knowledge of the IMF is critical for understanding the formation and evolution of galaxies.

It is generally believed that the IMF is universal within the Milky Way. Nevertheless, there has been some evidence that it may be more bottom-heavy in elliptical galaxies — they contain more low-mass stars. Lindsay Oldham and Matthew Auger looked at M87, a very massive elliptical galaxy in the local Universe, and found strong indications that the IMF is different than that of the Milky Way, varying as a function of galactic radius.

The authors used photometric and kinematic data of the central stellar component, globular clusters and satellite galaxies of M87 to calculate M87's mass-to-light ratio on scales between 10 pc and 1 Mpc. They observed a variation of this ratio that cannot be explained by changes in the metallicity, age, dust or star formation history. Instead, Oldham and Auger suggest that changes in the IMF might be to blame. Indeed, a bottom-heavy IMF is required for the central 0.5 kpc of M87 (parametrized by the IMF's power-law index; pictured), while its outer parts show an IMF consistent with the Milky Way. Taken at face value, these results imply that the central part of M87 — and by generalization perhaps of all early-type galaxies — may have formed in fundamentally different physical conditions than the outer regions.

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