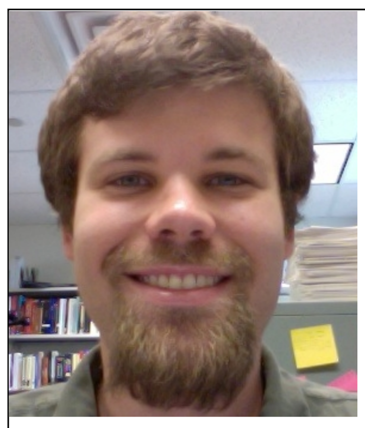

The Origin of the SFR—Density Relation in Galaxy Clusters

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Abstract

Which physical mechanism primarily drives the SFR—density relation remains an important open question in galaxy formation theory. We examine visible and mid-IR photometry of galaxies in 8 low-*z* clusters to measure SFRs and constrain the origin of the SFR—density relation. The distribution of star forming galaxies (SFGs) within the clusters indicates that a significant fraction of SFGs are in transition to passive evolution. This suggests that slow-acting mechanisms like gas starvation provide better explanations for the SFR—density relation than fast-acting processes like ram pressure stripping.

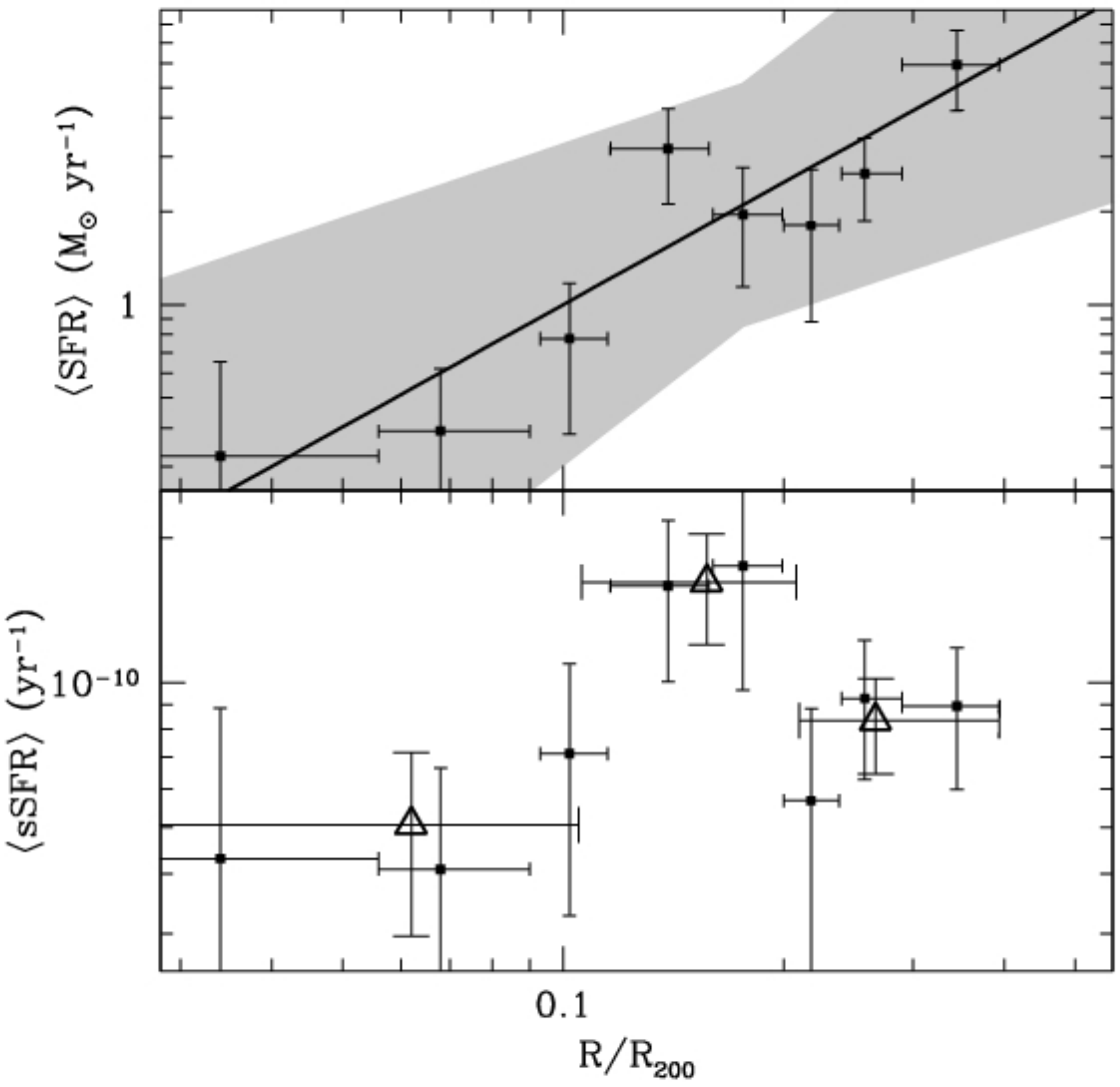

Figure 1: Average SFRs of cluster members as a function of radius. Upper panel shows the SFR averaged over all cluster members in bins of R/R_{200}, and the lower panel shows the specific SFR (sSFR) of SFGs (>3 M_{sun} yr^{-1}). Large triangles show the same data with coarser bins.

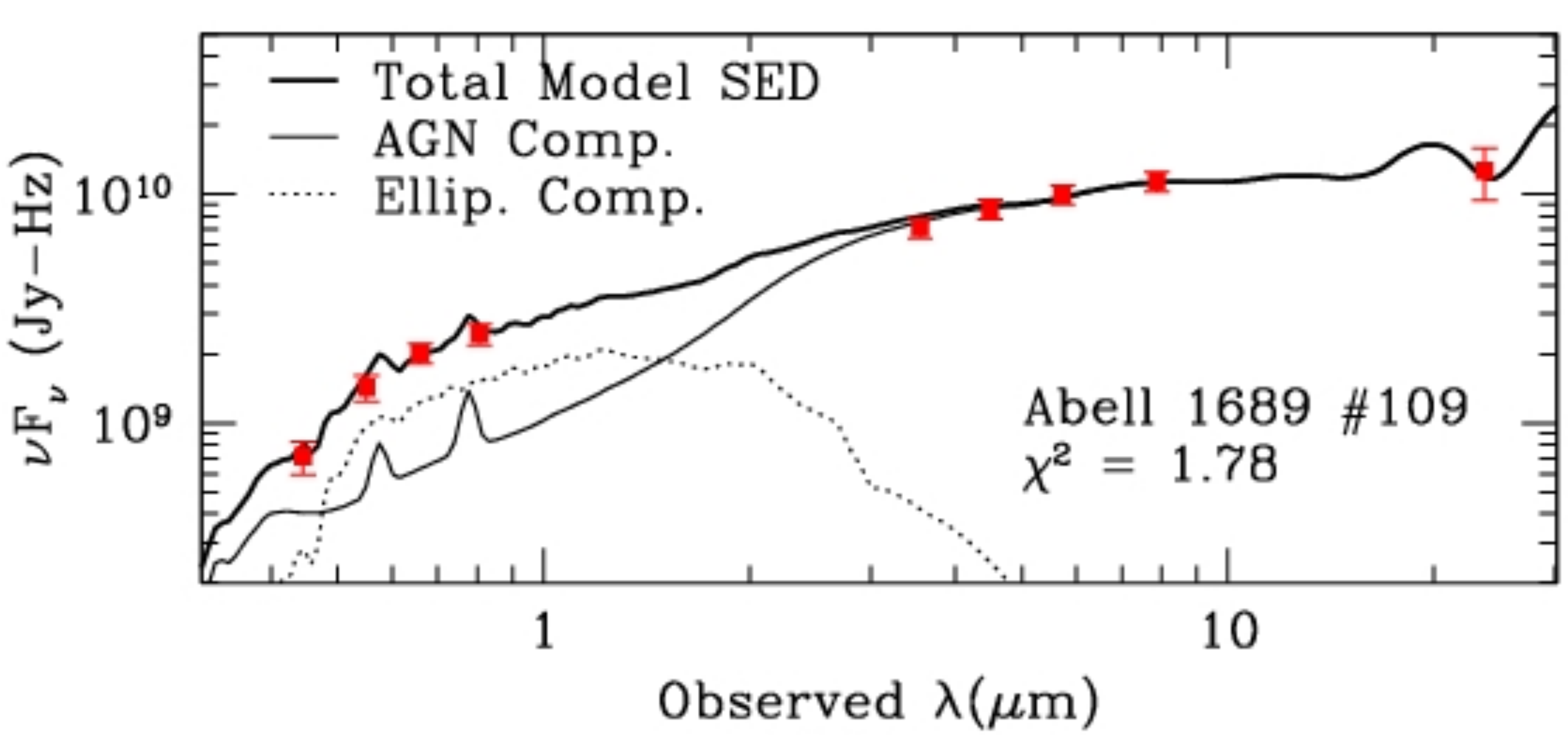

Figure 3: Example of a model SED. This object shows the power-law SED characteristic of AGN in the IR. Normal SFGs are characterized by strong PAH emission features.

Methods

We fit model spectral energy distributions (SEDs) to each cluster member. We use these SEDs to identify AGN (Figure 3) and determine *K*-corrections, from which we then infer stellar masses and SFRs.

To determine average galaxy properties, we need completeness corrections. These are determined empirically, and include both spectroscopic and photometric components. These corrections are combined to determine the averaged properties shown in Figures 1 & 2.

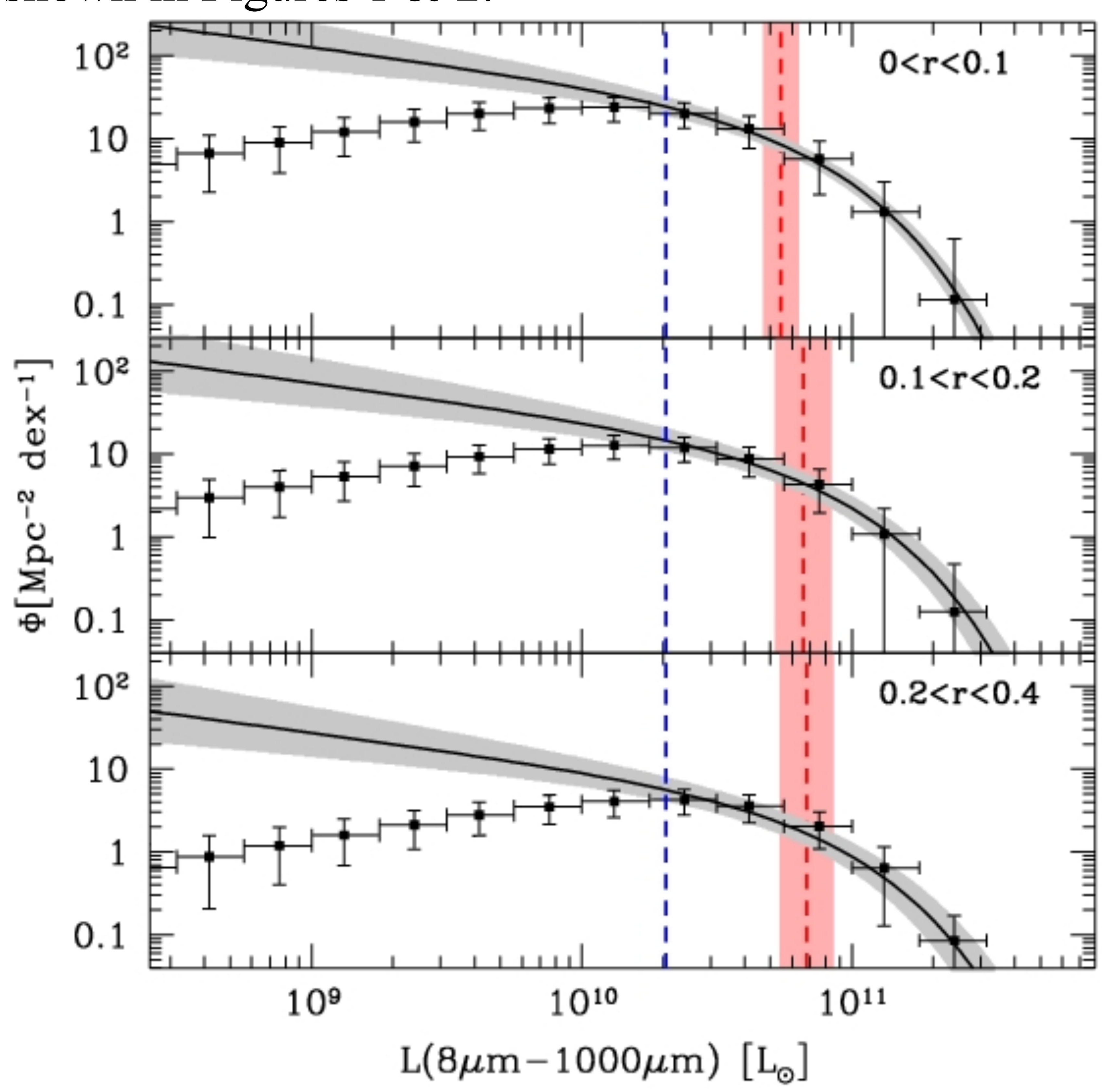

Figure 2: Total IR luminosity functions, binned by $r=R/R_{200}$. Blue, dashed lines show the completeness limit for a normal, spiral galaxy. Red dashed lines show L^* for each luminosity function.

Results

We find evidence for an increase in the SFRs of individual galaxies toward the outskirts of galaxy clusters, which suggests the presence of a significant population of galaxies in transition from star-forming to passive, and this population is larger near the projected center of the cluster. The population is large enough to alter the average properties of the SFG sample, so its lifetime must be comparable to the age of the cluster, and the process responsible for truncating star formation must be slow.