

# Using GAMA and H-ATLAS Data to Explore the Cold Dust Properties of Early-Type Galaxies



N.K. Agius, A.E. Sansom, C. Popescu

Jeremiah Horrocks Institute  
University of Central Lancashire



Early-Type Galaxies (ETGs) are thought to be a homogeneous class of E and S0 galaxies. They are old and inert, have a high central surface brightness, and cover a wide range of luminosities. ETGs have been classed as smooth, highly concentrated, and spherical systems with a lack of spiral arms and disk components. Their luminosity profiles follow the de Vaucouleurs  $I(r) \sim r^{-1/4}$  law or exhibit high Sersic indices.

ETGs are thought to be quiescent at  $z=0$ , leading to the assumption that they are devoid of both gas and dust. Recent detections of ETGs in the infrared and sub-mm regimes have revealed largely unexpected amounts of gas and dust. Our interests lie in exploring this dusty presence, with the aims of gaining further understanding about the processes which form these ETGs.

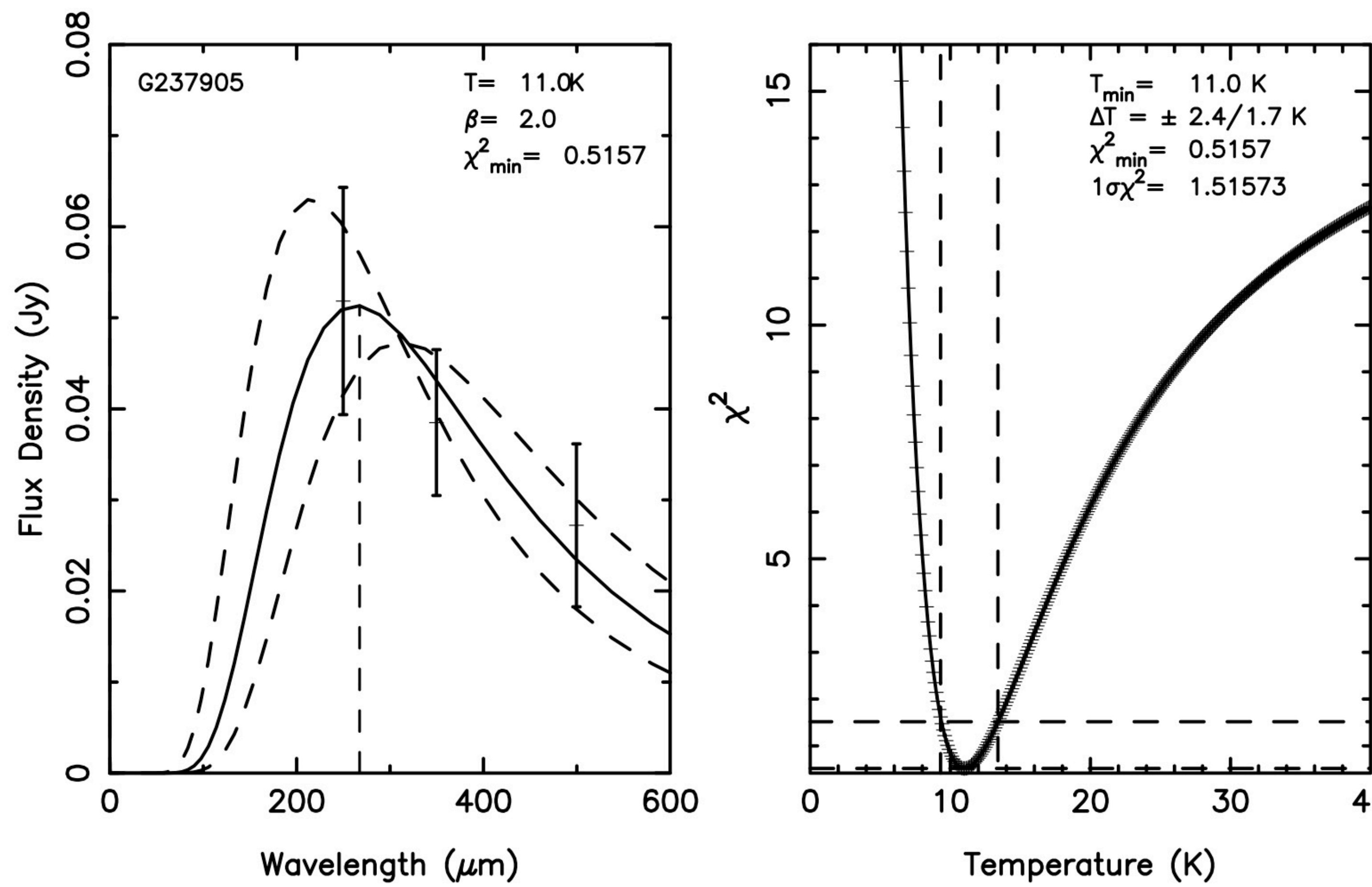
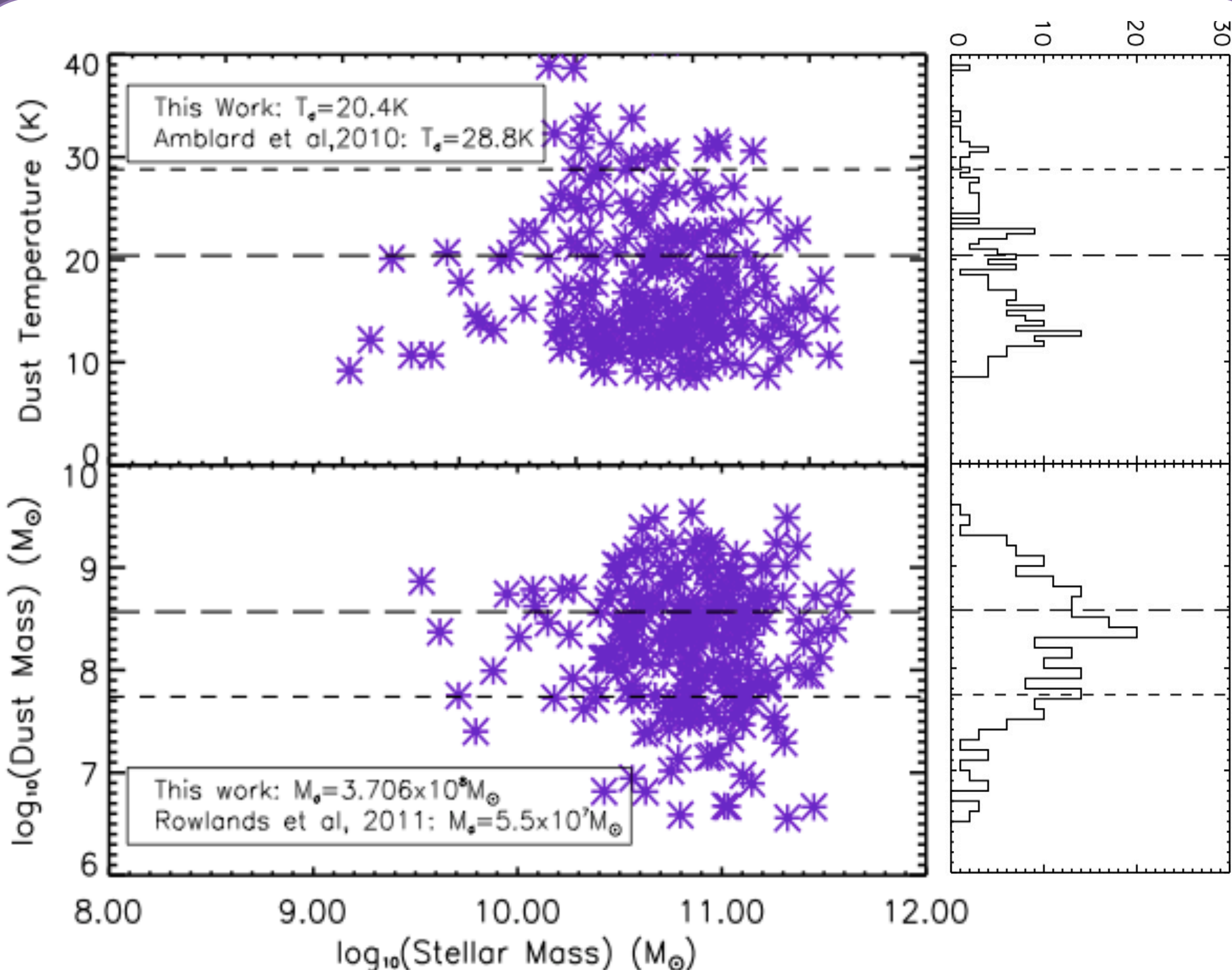


Fig. 2. An example of an isothermal greybody fit to the sub-mm SED (left) and the corresponding  $\chi^2$  fit (right).



Single temperature Spectral Energy Distributions (SEDs) (example: Fig. 2) have been fit to the observed data, and the resultant cold dust temperature and masses are being used in current diagnostics for this sample. The mean calculated dust temperature is  $20.4 \pm 8K$  (for  $\beta=2.0$ ) and the mean dust mass is  $3.706 \times 10^8 M_{\odot}$ . Overall our sample contains ETGs with high dust masses but, in disagreement with other H-ATLAS literature, intermediate stellar mass galaxies.

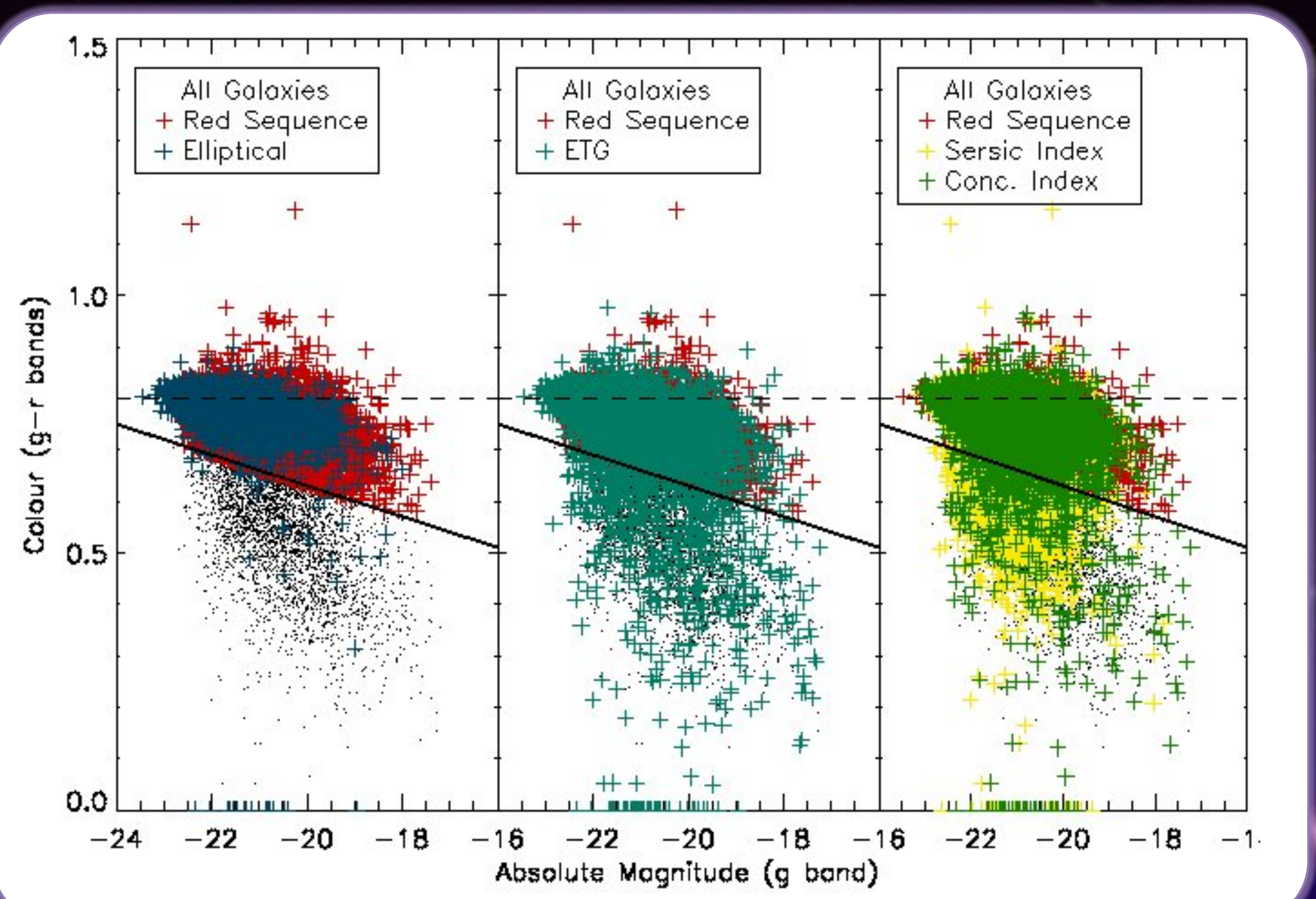
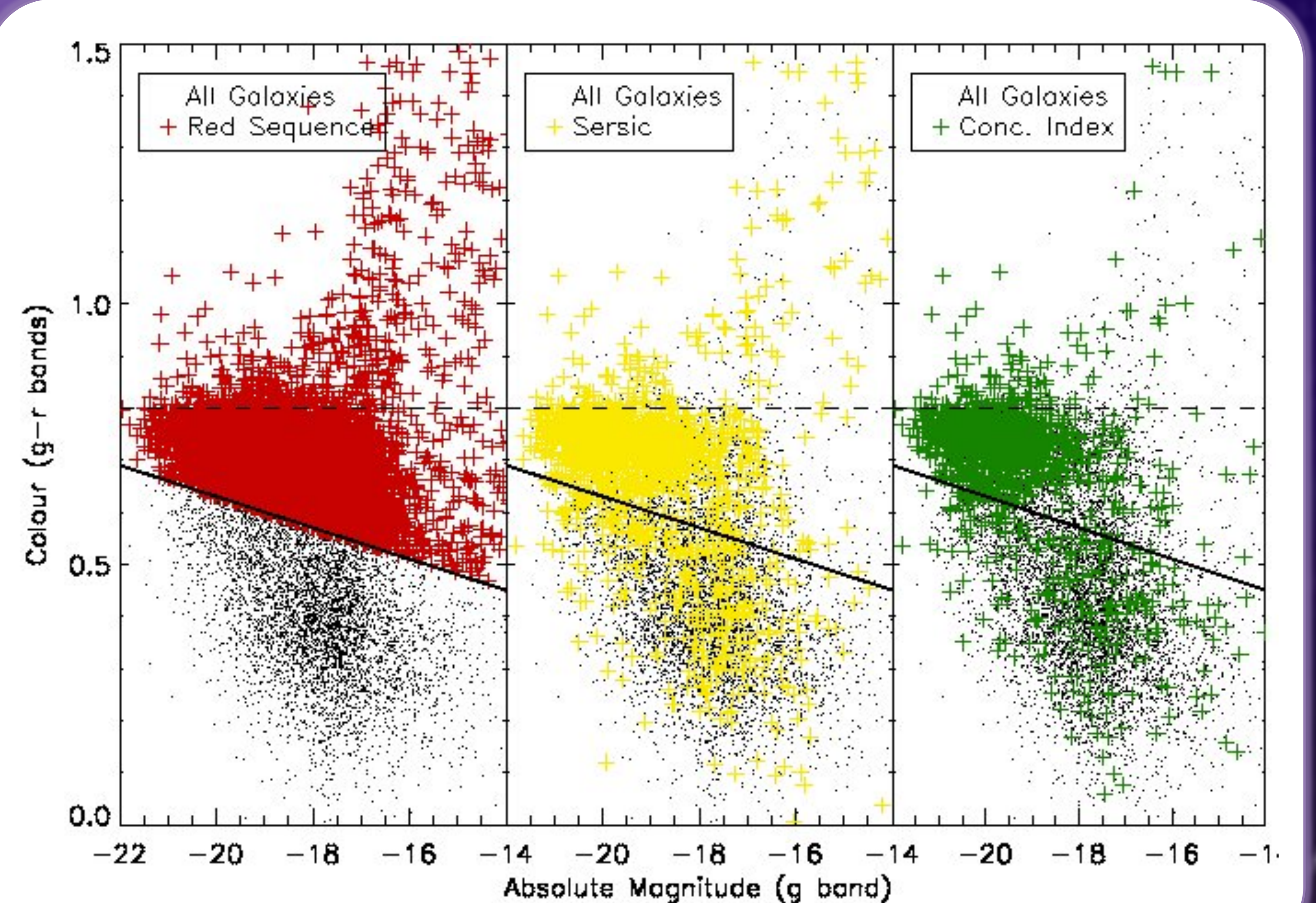


Fig. 1. [Above] The Colour-Magnitude Diagram for our Control Catalogue (Nair & Abraham (2010)). [Below] The same plot for an optically selected GAMA sample. These plots show how Concentration Index is a good proxy for morphology.



By utilising a combination of GAMA multi-wavelength and H-ATLAS FIR/sub-mm data, we were able to create a sample of 239 ETGs. These were defined by a Concentration Index  $\geq 2.86$ , redshift  $z \leq 0.4$ , and independent visual classifications. All further diagnostics were made in comparison with an optically selected sample.

Fig. 3. [Top] The distribution of isothermal dust temperatures for the ETG sample, highlighting our mean temperature and that of Amblard et al, 2010 (for the H-ATLAS sample). [Bottom] The distribution of dust masses fit by isothermal SEDs, emphasizing our mean dust mass and that of Rowlands et al, 2011.