Introduction to Bayesian Analysis with R-INLA

- This exercise is designed to illustrate the types of models supported by the INLA framework
- ***scenario: exploratory analysis of a galaxy catalogue***

logistic regression for bar fraction

$$(\text{barred} = 1, \text{unbarred} = 0)_i \sim \text{Bernoulli}(p_i)$$
$$\text{ilogit}\, p_i = \beta_1 \text{mass}_i + \beta_2 \text{SSFR}_i + f(\text{mass}_i, \text{SSFR}_i)$$
$$f(\cdot) \sim \text{Gaussian Process}(\phi), \qquad \phi \sim \pi$$

simple shrinkage estimator for velocity dispersion

$$v_{\text{obs},i} \sim \text{Normal}\left(v_{\text{true},i}, \sigma_i^2\right)$$
$$v_{\text{true},i} \sim \text{Normal}(\mu, \Sigma) \quad \mu, \Sigma \sim \pi$$

local density of the universe in a thin redshift slice

$$\{\text{ra}_i, \text{dec}_i\} \sim \text{Cox Process}\left(cf(\cdot)\right)$$
$$\log f(\cdot) \sim \textit{Gaussian Process}(\phi) \quad \phi, c \sim \pi$$