The Leverhulme Trust

Awards in Focus

Do bars kill galaxies?

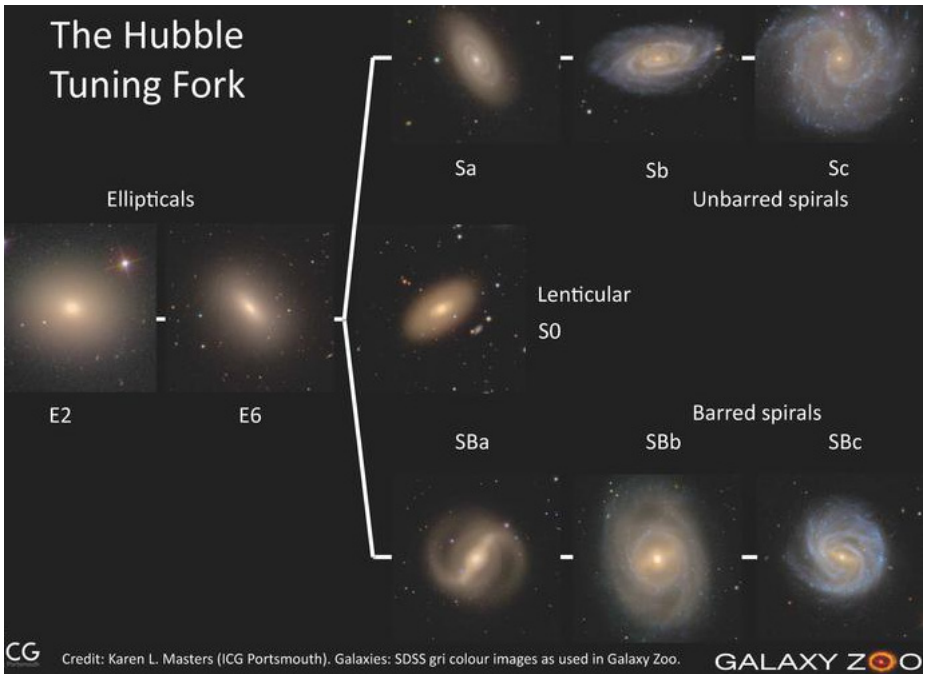
A galaxy is a collection of many millions of stars. Through a telescope they show an amazing variety of shapes, and the first step astronomers often take in understanding them is to classify them. Probably the best-known classification scheme is the Hubble Tuning Fork, which splits galaxies into ellipticals, and spirals (either with or without a bar).

Hubble developed his sequence based purely on how the galaxies looked, but his classification has lasted in part because astronomers soon realised the sequence places galaxies in order of the amount of new stars they are forming. Most elliptical galaxies are red, because they are not forming new stars so contain only old, red stars; while most spiral galaxies are blue because their light is dominated by a few very young, and bright blue stars.

Astronomers now have catalogues containing many millions of galaxies – far more than Hubble could have ever imagined - and more than we can hope to visually classify ourselves. Because of this the Galaxy Zoo project was started – an internet based tool which asks members of the public to help classify galaxies based on their shape (www.galaxyzoo.org). Galaxy Zoo has been enormously popular (over 400,000 people have now signed up for an account) and has provided classifications for almost a million nearby galaxies.

We know that blue star-forming spiral galaxies must turn into massive red and "dead" elliptical galaxies over cosmic time, but the details of how this happens are still unclear. One of the most interesting findings in Galaxy Zoo has been red spirals – spiral galaxies which are as red and dead as typical elliptical galaxies, so appear to provide a link between the two types.

Using the detailed Galaxy Zoo classifications, I recently lead a study, which showed that red spiral galaxies are more likely to host a bar than their blue counterparts. We are now studying



Top: The Hubble Tuning Fork illustrated by the SDSS gri colour composite images used in Galaxy Zoo. Credit: SDSS/Galaxy Zoo.

Bottom: a blue unbarred spiral (l), a red barred spiral (m) and a red elliptical (r). Image credit: SDSS gri colour composites.

if bars could be responsible for the cessation of star formation in spirals (i.e. killing them), or if they are a side effect of other external processes which shut off star formation.

In computer models of galaxies, bars continuously self-destruct and re-form as they move material around in the disc. Atomic hydrogen gas (the fuel for future star formation) may be important in this process - if there is no gas in the galaxy the bar may be able to linger longer. And without gas, a spiral galaxy will also quickly stop forming stars and turn red.

So, what I'm currently working on is a census of the atomic hydrogen gas in the red and barred spirals, along with trying to look for clues to determine what process might be responsible for removing the gas from these galaxies.

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Karen was awarded an Early Career Fellowship grant in 2010.