

Red stars and big bulges: How black holes shape galaxies

April 22 2014, by Robert Massey



Images of a small fraction of the galaxies analysed in the new study. The galaxies are ordered by total mass of stars (rising from bottom to top) and by 'bulge to total stellar mass ratio' (rising from left to right). Galaxies that appear redder have high values for both of these measurements, meaning that the mass of the bulge –and central black hole – determines their colour. Credit: A. Bluck.

(Phys.org) — The universe we can see is made up of billions of galaxies,



each containing anywhere from hundreds of thousands to hundreds of billions of stars. Large numbers of galaxies are elliptical in shape, red and mostly made up of old stars. Another (more familiar) type is the spiral, where arms wind out in a blue thin disk from a central red bulge. On average stars in spiral galaxies tend to be much younger than those in ellipticals.

Now a group of astronomers led by Asa Bluck of the University of Victoria in Canada have found a (relatively) simple relationship between the colour of a galaxy and the size of its bulge – the more massive the bulge the redder the galaxy. The researchers publish their results in the Oxford University Press journal *Monthly Notices of the Royal Astronomical Society*.

As a and his team used data from the Sloan Digital Sky Survey to group together over half a million galaxies of all different colours, shapes, and masses. They then used pattern recognition software to measure the shape of each one, to see how the proportion of red <u>stars</u> in a galaxy varies with its other properties.

They found that the <u>mass</u> in the central bulge (regardless of how big the disk surrounding it may be) is the key to knowing the colour of the whole galaxy. Above a given bulge mass, galaxies are red and have no new young stars.

Almost all galaxies have <u>supermassive black holes</u> at their centres. The mass of the bulge is closely related to the mass of the black hole; the more massive the black hole the more energy is released into the surrounding galaxy in the form of powerful jets and X-ray emission. This can blow away and heat up gas, stopping new stars from forming.

As comments: "A relatively simple result, that large galaxy bulges mean red <u>galaxies</u>, has profound consequences. Big bulges mean big black



holes and these can put an end to star formation."

Provided by Royal Astronomical Society

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