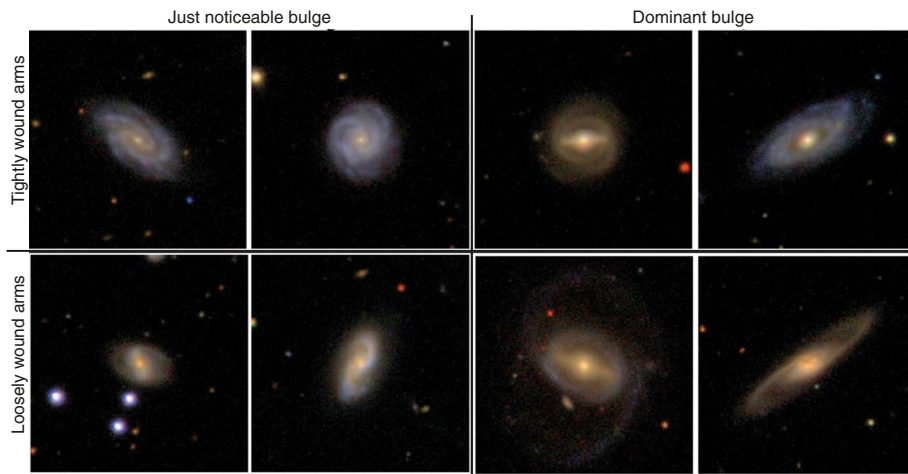


## GALAXIES

## Hubble's tuning fork gets re-tuned

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Credit: Oxford Univ. Press

Spiral galaxies were morphologically classified by Edwin Hubble according to measures of bulge prominence and spiral arm tightness in his famous ‘tuning fork diagram’. However, now a sizeable sample of spiral galaxies classified by Galaxy Zoo citizen scientists has helped to show that there is little, if any, correlation between these two visual characteristics of galaxies.

Karen Masters and collaborators find that galaxies with small bulges have a variety of spiral arm tightness, from tight to loose (see image), whereas those with larger bulges tend to have more tightly wound arms. Perhaps, the authors say, this means that the majority of spiral arms wind up over time, and are not static features — calling into question the role of density waves in the formation of galactic spirals. The researchers do find a correlation: galaxies with evident bars have more loosely wound arms (for a

given bulge size), indicating that bars might slow the winding process.

The galaxy sample comprises ~250,000 Sloan Digital Sky Survey composite images that have been sorted by eye into ‘smooth’ (elliptical galaxies) and ‘featured’ (spiral galaxies) classes, and further refined to remove ‘odd’ galaxies, ending up with a selection of ‘normal’ spirals, of which ~5,000 were used as a basis for the bulge size and spiral arm winding investigation. There have been several previous indications that Hubble’s correlation does not hold for spiral galaxies and several observations that failed to find the expected signature of density waves. The size of the Galaxy Zoo sample adds strong statistical support to these previous results.

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