Largest atlas of nuclear galactic rings unveiled

April 29 2010

The largest atlas of nuclear galactic rings has been unveiled. Credit: NASA, ESA, D. Maoz, G. F. Benedict et al.

An international team of astrophysicists has just unveiled the most complete atlas of nuclear rings, enormous star-forming ring-shaped regions that circle certain galactic nuclei. The catalogue, published in the *Monthly Notices of the Royal Astronomical Society*, includes 113 such rings in 107 galaxies.

"AINUR (the Atlas of Images of Nuclear Rings) is the most complete atlas of nuclear rings created to date", Sébastien Comerón, a researcher

at the Institute of Astrophysics of the Canary Islands (IAC), and co-author of the joint study with other scientists from the universities of La Laguna, Oulu (Finland) and Alabama (United States), tells SINC.

The atlas has just been published in the journal Monthly Notices of the Royal Astronomical Society, and covers 113 nuclear rings in 107 different galaxies. Six are dust rings in elliptical galaxies, while the rest (the majority) are star-forming rings in disc galaxies.

The nuclear rings are ring-shaped, star-forming configurations located around galactic nuclei. They range in size on average from between 500 to 3,000 light years, and they are very bright because they contain an abundance of young stars, including some extremely massive ones. This kind of star has a short lifetime but shines very brightly before exploding as a supernova.

To find the rings, the astrophysicists used images from around 500 galaxies observed by the Hubble space telescope, which belongs to NASA and the European Space Agency, as well as using other references. The images were processed using filters, generating various kinds of maps to help identify the rings more easily.

Rings and Lindblad resonances

"The AINUR atlas has also looked for relationships between the properties of the nuclear rings and those of the galaxies in which they are found", says Comerón, "and we have been able to statistically prove that most rings are associated with Lindblad resonances (gravitational shoves that push objects out of certain orbits and into others)".

The astrophysicists have shown that when the rings are in a barred galaxy (within disc galaxies, which have a central cylinder or 'cigar' of stars), the maximum radius that a nuclear ring can attain is 25% of the length of

the bar, and that the maximum radius is inversely proportional to the strength of the bar. This is the behaviour that was predicted for the internal Lindblad resonances, which are determined by the size of the bar and their strength (how elliptical this is). If the bar is small or very elliptical, the resonance orbit becomes small, but if it is large or not very elliptical, the orbits become bigger.

The researchers also found that, contrary to what had been believed until now, a significant proportion of nuclear rings are to be found in non-barred galaxies (around 20%). The resonances needed to form the rings in these galaxies "are probably created by strong spiral arms, weak oval distortions of the disc and some lesser interaction with neighbouring galaxies", the scientists say.

More information: S. Comerón, J. H. Knapen, J. E. Beckman, E. Laurikainen, H. Salo, I. Martínez-Valpuesta y R. J. Buta. "AINUR: Atlas of Images of Nuclear Rings". Monthly Notices of the Royal Astronomical Society 402 (4): 2462-2490, marzo de 2010.

Provided by FECYT - Spanish Foundation for Science and Technology