New theory of evolution for spiral galaxy arms

April 21 2011

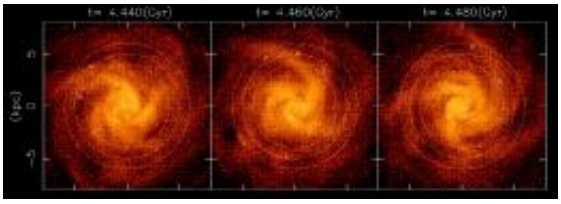

Image Caption: Snapshots of face-on view of a simulated disc galaxy. A Brighter colour indicates higher density. The Image shows two examples of star particles: the red star are travelling at the leading side of the arm, and the blue star are at the trailing side. It can be seen that the blue and red stars interchange their radial distances, with rapid migration within 40 million years. The dotted lines trace circles with radii of 4, 5 and 6 000 parsecs (1 parsec = 31 trillion kilometres), to guide the eye.

(PhysOrg.com) -- A study of spiral patterns found in galaxies like our Milky Way could overturn the theory of how the spiral arm features form and evolve. The results are being presented by postgraduate student, Robert Grand, at the Royal Astronomical Society's National Astronomy Meeting in Llandudno, Wales this week.

Since 1960s, the most widely accepted explanation has been that the spiral arm features move like a Mexican wave in a crowd, passing through a population of stars that then return to their original position. Instead, computer simulations run by Grand and his colleagues at University College London's Mullard Space Science Laboratory (MSSL)

suggest that the stars actually rotate with the arms. In addition, rather than being permanent features the arms are transient, breaking up and new arms forming over a period of about 80-100 million years.

"We have found it impossible to reproduce the traditional theory, but stars move with the spiral pattern in our simulations at the same speed. We simulated the evolution of spiral arms for a galaxy with five million stars over a period of 6 billion years. We found that stars are able to migrate much more efficiently than anyone previously thought. The stars are trapped and move along the arm by their gravitational influence, but we think that eventually the arm breaks up due to the shear forces," said Grand.

In the simulations, Grand found that some stars gradually move outwards and inwards along the spiral arms. Stars travelling at the leading side of the spiral arm slide in towards the centre of the disc, whereas the stars travelling at the trailing side are kicked out to the edges.

"This research has many potential implications for future observational astronomy, like the European Space Agency's next corner stone mission, Gaia, which MSSL is also heavily involved in. As well as helping us understand the evolution of our own galaxy, it may have applications for regions of star formation," said Grand.

Provided by Royal Astronomical Society