

Spirals in galaxies

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Abstract. The venerable problem of what causes the spiral features in disk galaxies is nearing a solution. In previous work, we have shown that transient spirals in simulations result from the superposition of a few coherent waves that have many properties of modes. The new achievement presented here is a clear demonstration that the evolution of one unstable mode leads to scattering at Lindblad resonances, and the depopulation of phase space at such resonances creates a “groove” that is the cause of a new unstable mode. Thus we now understand that the cause of spiral patterns in simulations is a recurrent cycle of groove modes. In other work, we have used *Gaia* DR2 data, converted to action-angle variables, to identify resonant scattering features in the Solar neighborhood that closely resemble those seen in the simulations, suggesting that the mechanism that causes spirals in simulations may also be at work in the Milky Way.

Keywords. galaxies: kinematics and dynamics

This 20 minute talk summarized the principal results from [Sellwood & Carlberg \(2019\)](#), and the 6-page introduction to that paper presents a review of the current status of the topic.

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Reference

Sellwood, J. A. & Carlberg, R. G. 2019, *MNRAS*, 489, 116