

## **What does amplify the spirals**

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This symposium provides a unique opportunity to present, as a tribute to Prof. C.C. Lin, new insights on a very old problem in spiral density wave theory: these waves can be strongly unstable, i.e. grow spontaneously in galactic discs, as found as soon as they were discovered. In the simplest model of the Shearing Sheet, their amplification can be reduced to the solution a 2<sup>nd</sup> order ordinary differential equation, whose numerical solution is straightforward; however a full explanation of this amplification, and of the physical processes responsible for it, is still missing.

We will show that in particular the explanations given for the WASER (Mark, 1976) and SWING (Goldreich and Lynden-Bell, 1965; Toomre, 1981) mechanisms both miss certain ingredients. From a purely analytic description we find, hidden in the numerical solution, that both mechanisms must coexist and complement each other to result in the very strong amplification obtained when Toomre's Q parameter gets close to 1.

More precisely we show that, in order to get the very strong amplification (more than one order of magnitude) of a leading spiral wave as it converts to a trailing wave near corotation (the SWING mechanism), it must first have been amplified by the WASER, as a short wave converts into a long wave.