

Numerical spectral synthesis of soliton and breather gases

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joint work with

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RENCONTRE DU NON LINÉAIRE

Paris, 28th March 2023

Soliton Gas

ensemble of interacting solitons randomly
distributed in velocity, amplitude and positions
[Zakharov, JETP (1971)]

KdV [El, Phys. Lett. A (2003)]

NLS [El & Tovbis, PRE (2020)]

Density of States:

$u(\eta_0, x_0, t)d\eta dx$ is the number of solitons found at t in
 $[\eta_0, \eta_0 + d\eta] \times [x_0, x_0 + dx]$

Algorithm

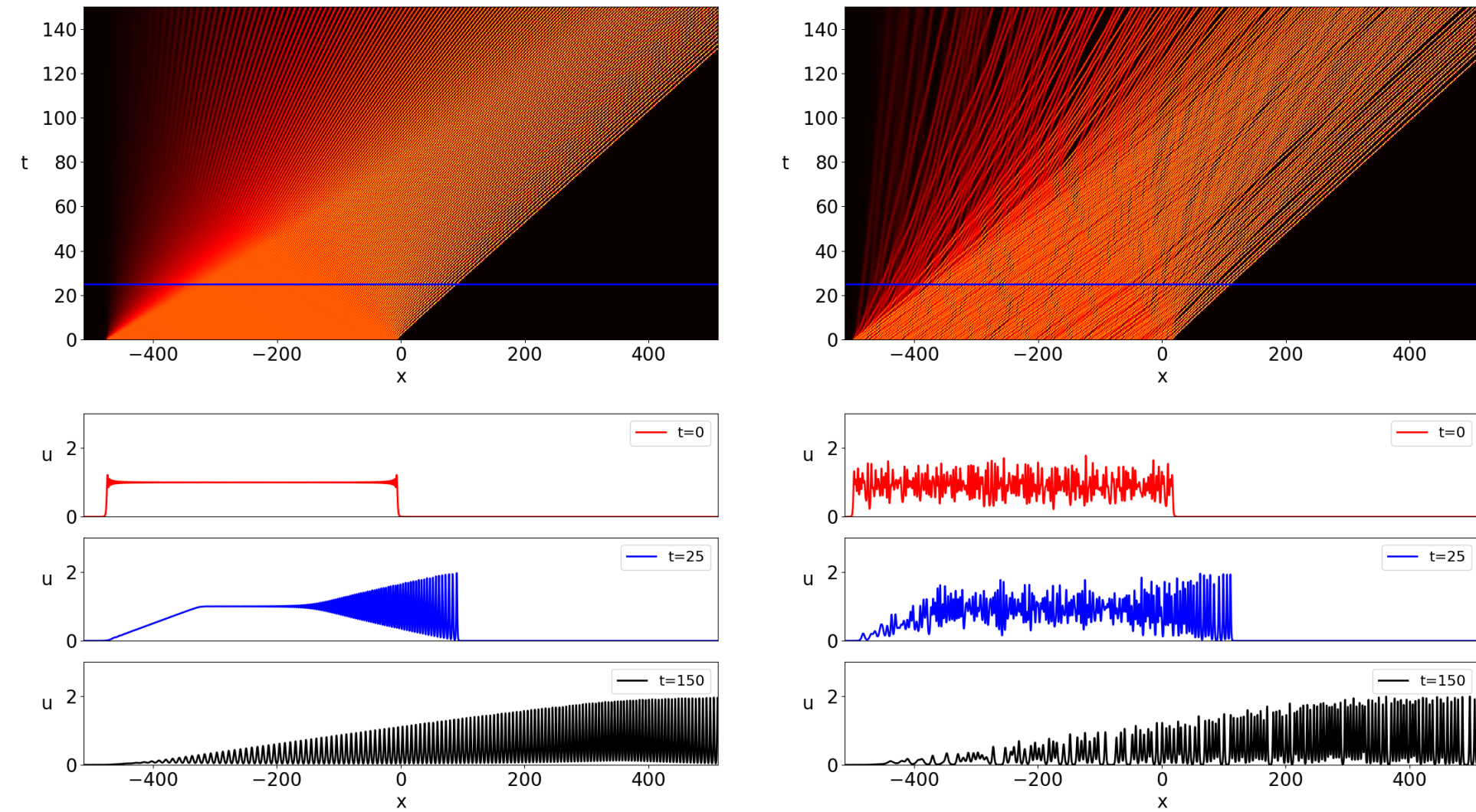
We use an algorithm that relies on the **Darboux Transform**:
an iterative method to generate hierarchy of solutions.

$$\begin{array}{ccc} \varphi(x, t) & & \hat{\varphi}(x, t) \\ J & \xrightarrow{\quad D \quad} & \hat{J} \end{array}$$

Implementation of **multiprecision libraries**
[Gelash and Agafontsev, PRE (2018)]

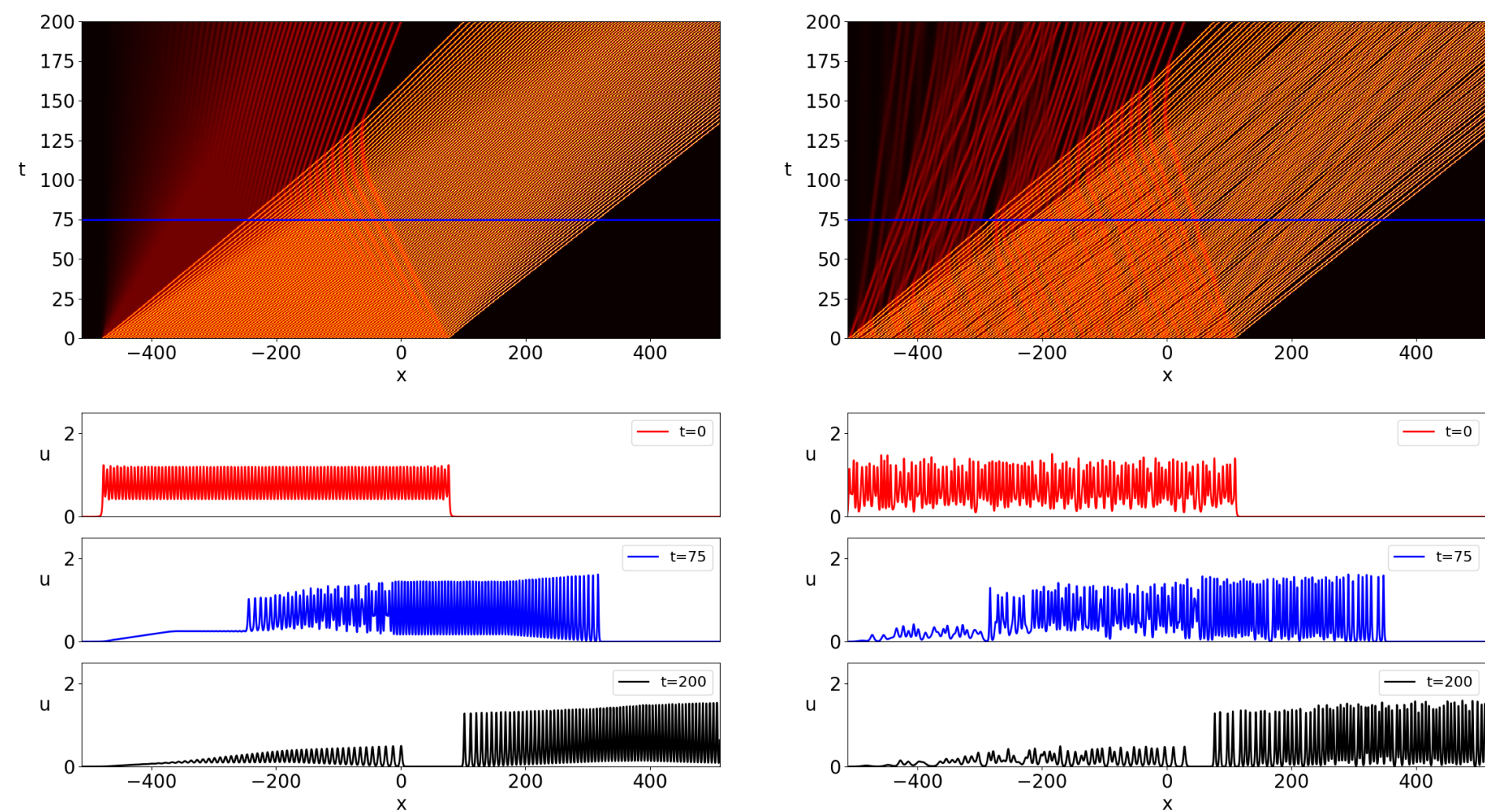
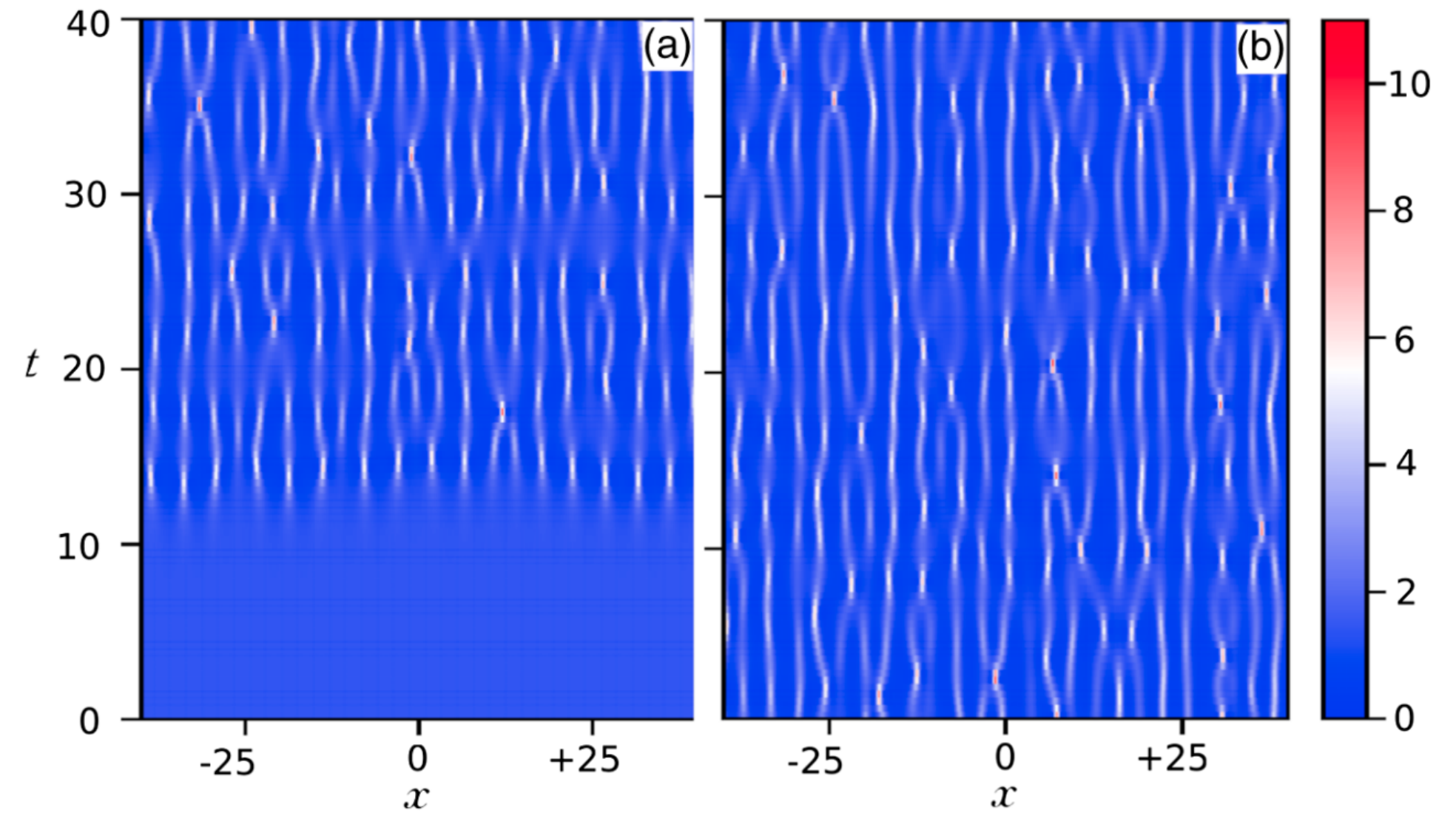
KdV

Genus 0



NLS

Modulation Instability



Genus 1

Breather Gas

