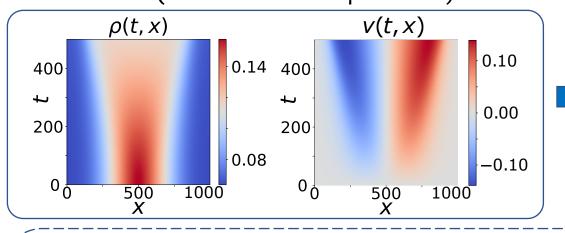
Data (simulations or experiment)



Library of candidate terms

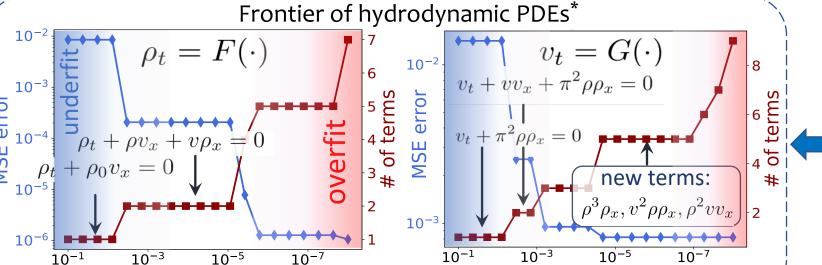
$$\begin{cases} \rho_t = F(\rho, \rho_x, \rho_{xx}, v, v_x, v_{xx}, \rho v_x, v \rho_x, v v_x, \rho \rho_x, \dots) \\ v_t = G(\rho, \rho_x, \rho_{xx}, v, v_x, v_{xx}, \rho v_x, v \rho_x, v v_x, \rho \rho_x, \dots) \end{cases}$$

Global symmetries?



no

Terms preselection



Symbolic regression

- CrossEntropy
- BruteForce search
- STRidge

Objective function $\mathcal{L} = ||\mathbf{U}_t - \Theta(\mathbf{U}) \cdot \xi||_2 + \lambda_0 ||\xi||_0$

Discovered equations:

 λ_0 penalty

Free fermions in 1D* (proved analytically)

 λ_0 penalty

$$v_t+vv_x+\pi^2\rho\rho_x=b_1\rho^3\rho_x+b_2v^2\rho\rho_x+b_3\rho^2vv_x$$
 (tight-binding dispersion)

$$v_t + 5vv_x - v^2(\log \rho)_x + \beta^2 \pi^6 \rho^5 \rho_x = 0$$
 (quartic dispersion)

Strongly-interacting fermions (Fermi-Hubbard)

$$v_t + vv_x + \kappa(U)\rho\rho_x = 0$$

Heisenberg spin chain (high-T domain wall)

$$u_t + auu_x = Du_{xx}, \quad u = \langle S^z(t,x) \rangle$$