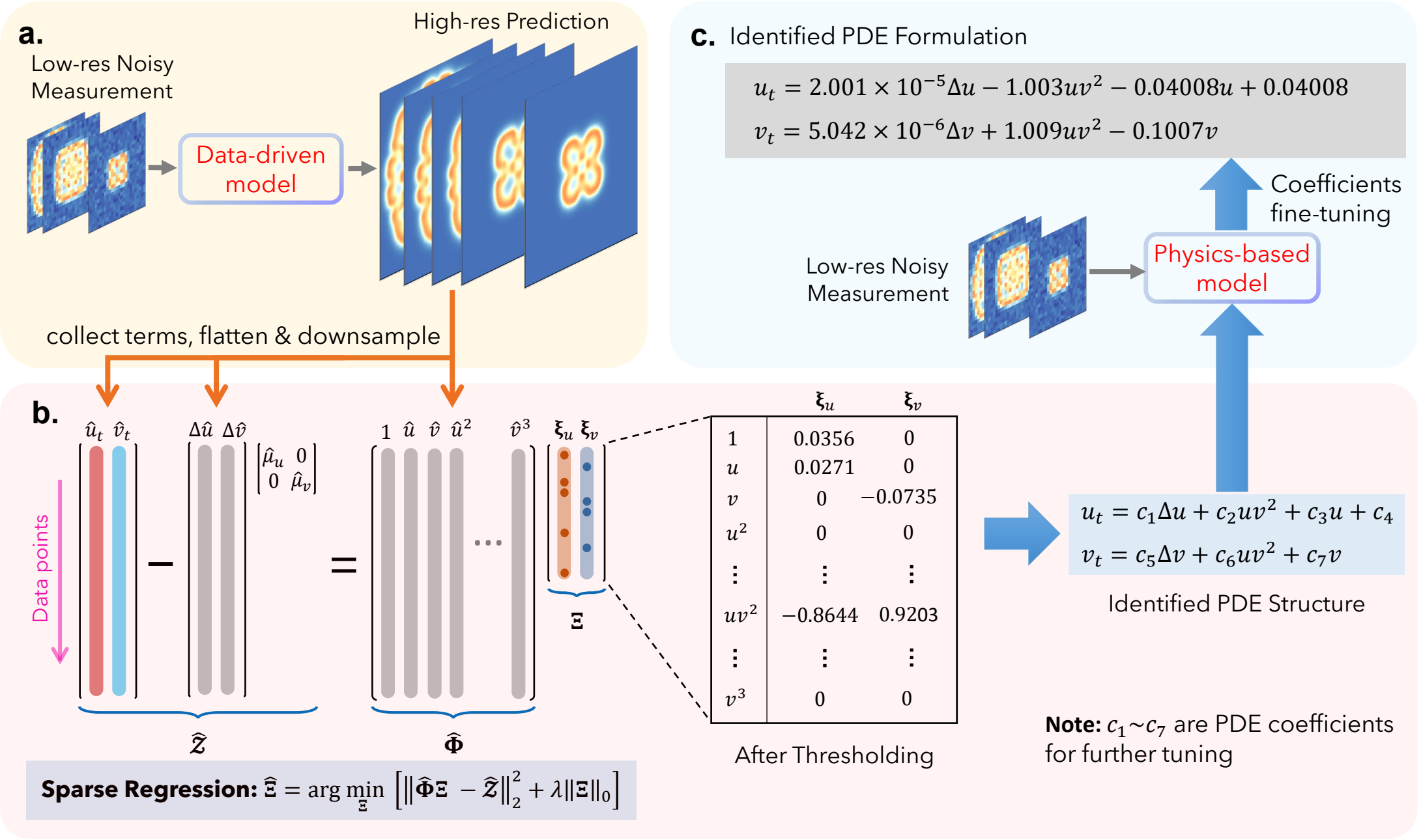
a.
Low-res Noisy Measurement
Data-driven model
High-res Prediction
collect terms, flatten & downsample
b.
Data points
$\hat{u}_t$ $\hat{v}_t$
$\Delta\hat{u}$ $\Delta\hat{v}$
$\begin{bmatrix}\hat{\mu}_u & 0\\ 0 & \hat{\mu}_v\end{bmatrix}$
1 $\hat{u}$ $\hat{v}$ $\hat{u}^2$ $\hat{v}^3$
ξ_u ξ_v
$\hat{\mathcal{Z}}$
$\hat{\Phi}$
Ξ
$\hat{\Xi} = \arg\min_{\Xi} \left[\|\hat{\Phi}\Xi - \hat{\mathcal{Z}}\|_2^2 + \lambda\|\Xi\|_0\right]$
Sparse Regression:
After Thresholding
ξ_u ξ_v
1 0.0356 0
u 0.0271 0
v 0 −0.0735
u^2 0 0
uv^2 −0.8644 0.9203
v^3 0 0
$u_t = c_1\Delta u + c_2 uv^2 + c_3 u + c_4$
$v_t = c_5\Delta v + c_6 uv^2 + c_7 v$
Identified PDE Structure
Note: $c_1 \sim c_7$ are PDE coefficients for further tuning
c. Identified PDE Formulation
$u_t = 2.001 \times 10^{-5}\Delta u - 1.003uv^2 - 0.04008u + 0.04008$
$v_t = 5.042 \times 10^{-6}\Delta v + 1.009uv^2 - 0.1007v$
Coefficients fine-tuning
Low-res Noisy Measurement
Physics-based model