20 años Pregrado en **Ingeniería Física**

My first advanced project...
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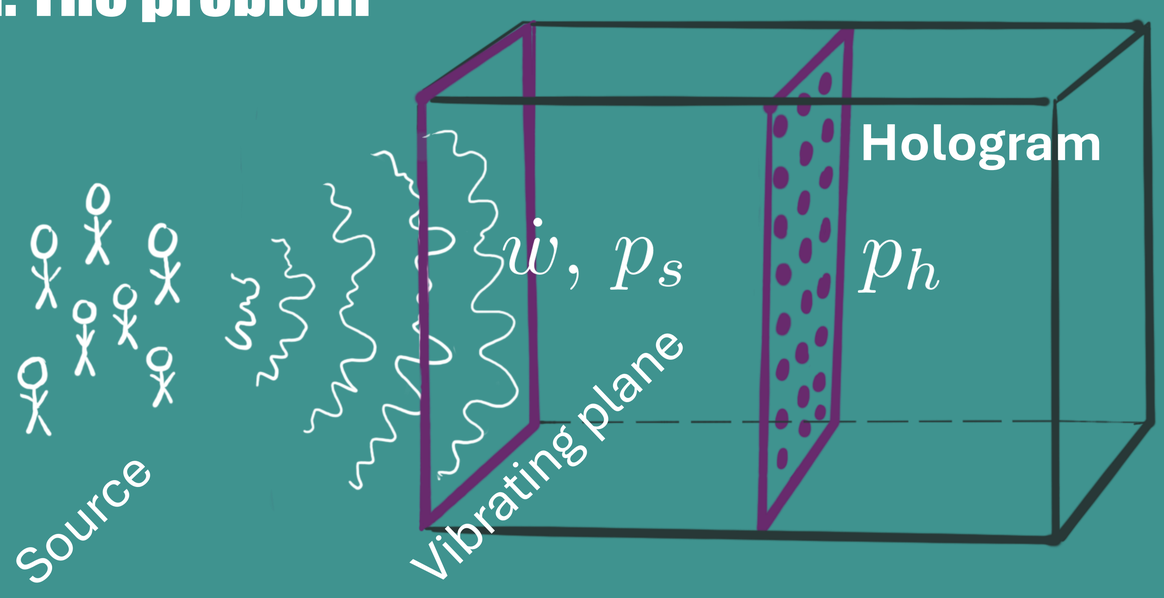
Sound-Based Imaging:

Regularization Approaches in Near-field Acoustic Holography (NAH)

1. The problem



Near-field acoustic holography (NAH) is a method for solving the **inverse problem**: Based on the hologram measurements, how does the plane source look? i.e. **Where are the sources?**

It is important the measurements are close to the source (so that we don't miss anything).

2. Why to use regularization?

The NAH problem is an ill-posed problem, in the Hadamard sense. Small changes in the measurements yield big changes in the source field.

$$\text{Regularization} \implies \text{well-posedness}$$

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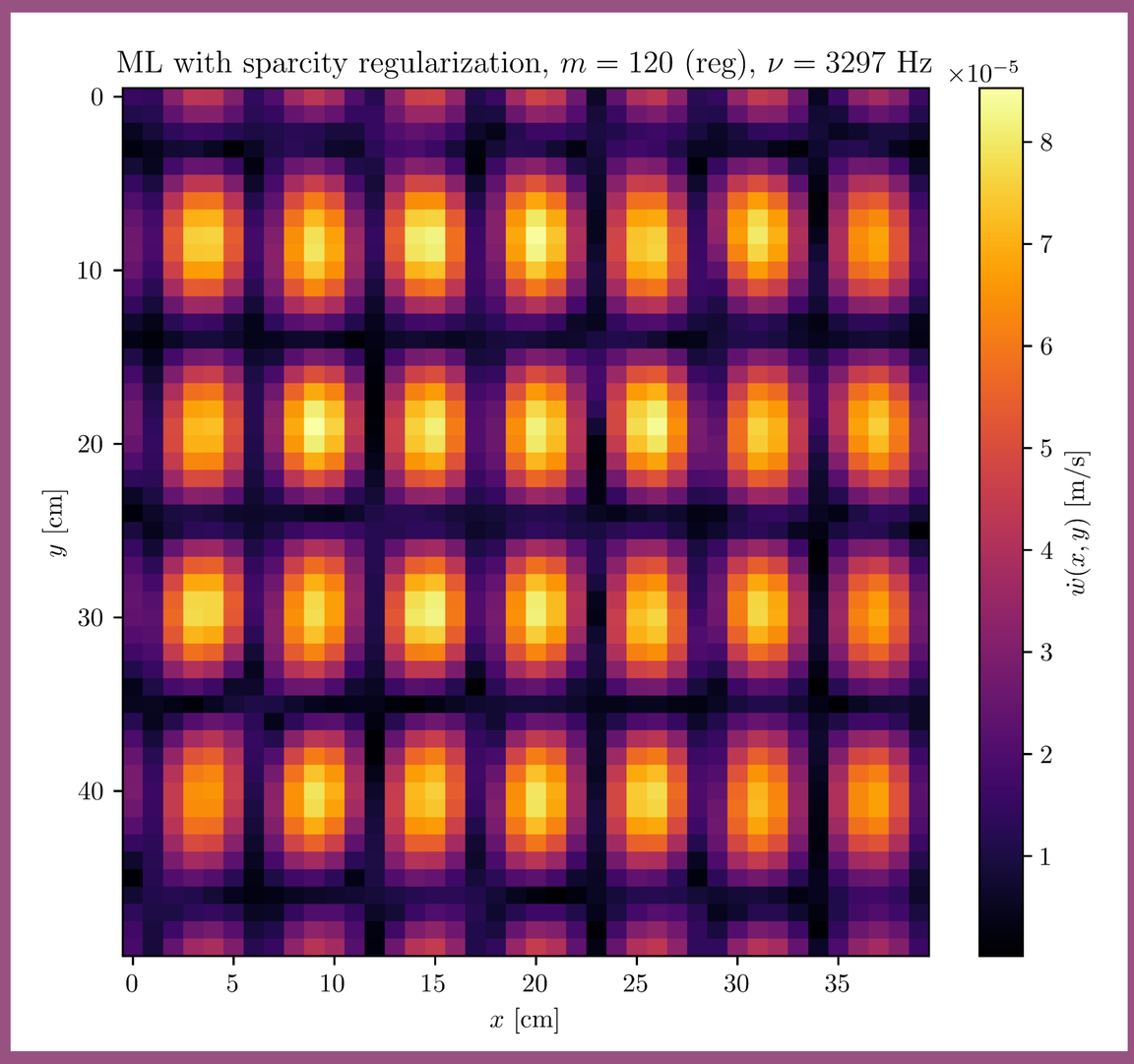
6. What you should take home

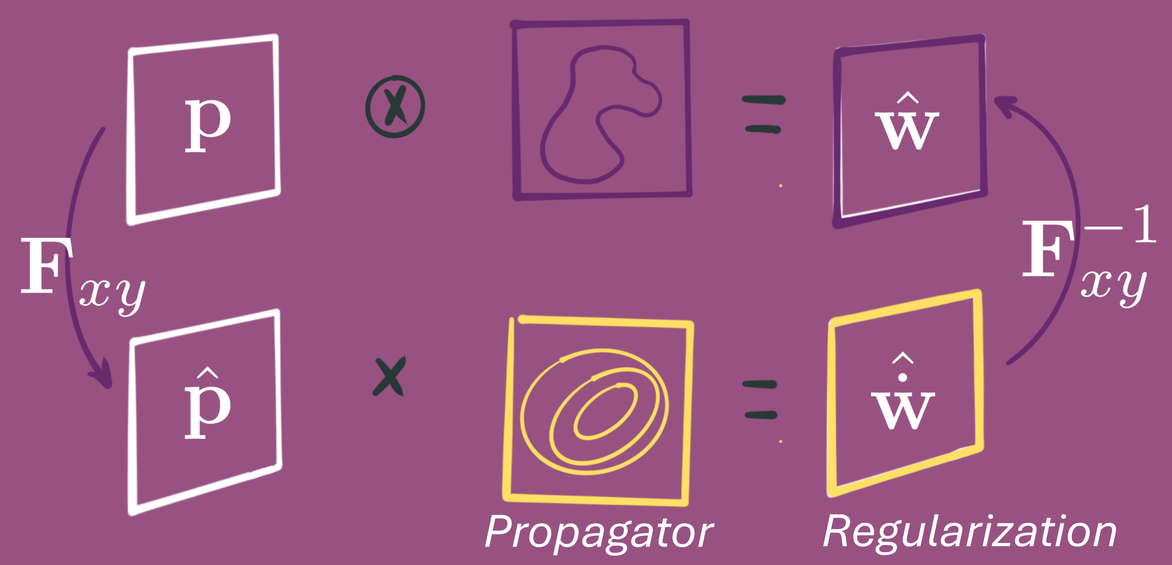
Not only can we see with our eyes, we can also ***see*** sound. NAH is an **inverse**, **ill-posed** problem that requires **regularization** which tries to find sound sources based on forward measurements.

Also, you just saw some really cool pixelated figures.

5. The results



4. The algorithm



3. The Regularization Methods

Tikhonov: $\hat{\dot{\mathbf{w}}} = \min_{\mathbf{w}} \|\mathbf{p} - \mathbf{H}\dot{\mathbf{w}}\|_2^2 + \lambda \|\mathbf{L}\dot{\mathbf{w}}\|_2^2$

Sparcity: $\mathbf{x} = \sum_{j \in J} \alpha_j \mathbf{d}_\mathbf{j}\,, \quad |J| \ll M$

ML: Finding λ for maximizing contrast

Green's Functions: $\delta E = 0$