Mapping the invisible:

Gravity as a Lens to Reveal Dark Matter

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Image of the Bullet Cluster, a pair of colliding galaxy clusters

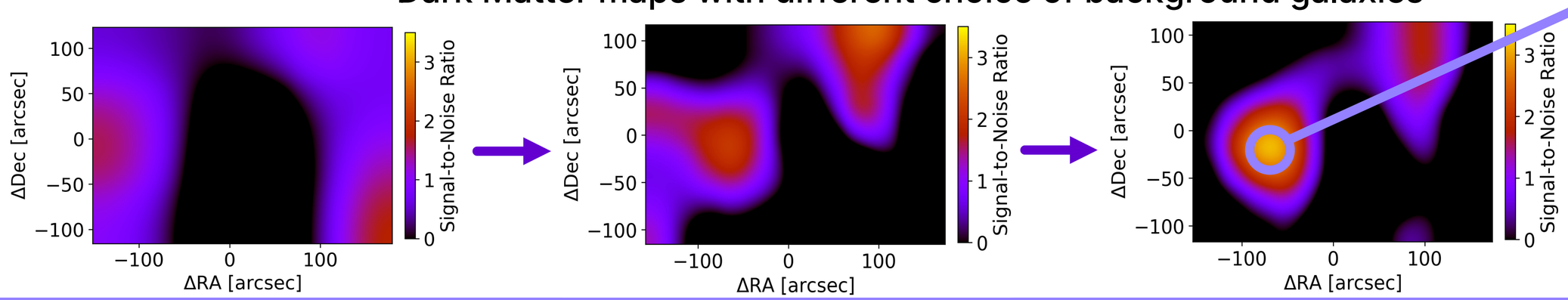
There's a lot more mass in this picture than what you can see

The hidden mass distorts the shape of background galaxies.
By measuring these distortions, we can map the hidden mass, called Dark Matter!
Dark Matter makes up about 85% of the matter in the Bullet Cluster, and even the Universe.

Which background galaxies should we choose?

We have to select a set of background galaxies to measure the distortions on. Usually, this set is chosen manually, and is changed until a coherent image appears. This process is ***slow*** and ***subjective***.

Dark Matter maps with different choice of background galaxies

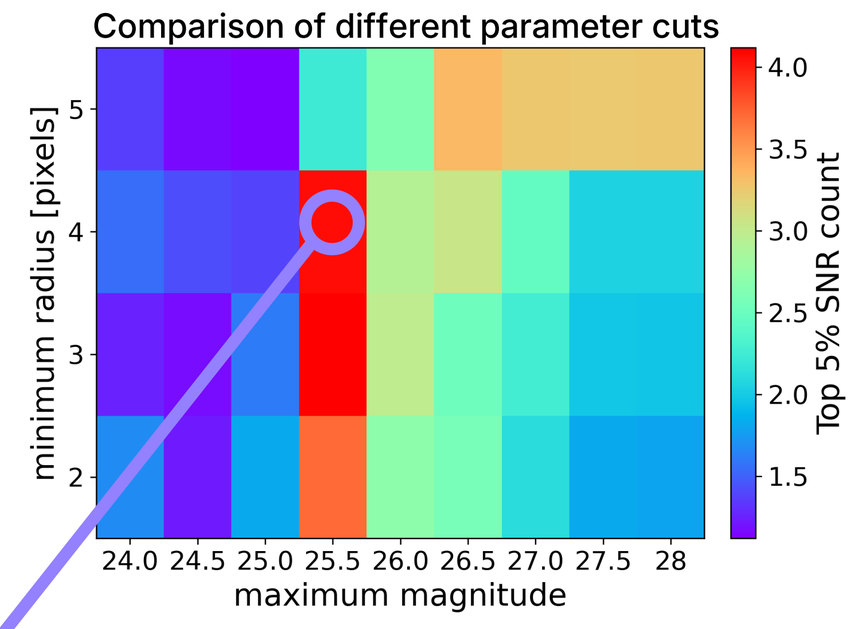


We want to maximize such high signal-to-noise areas

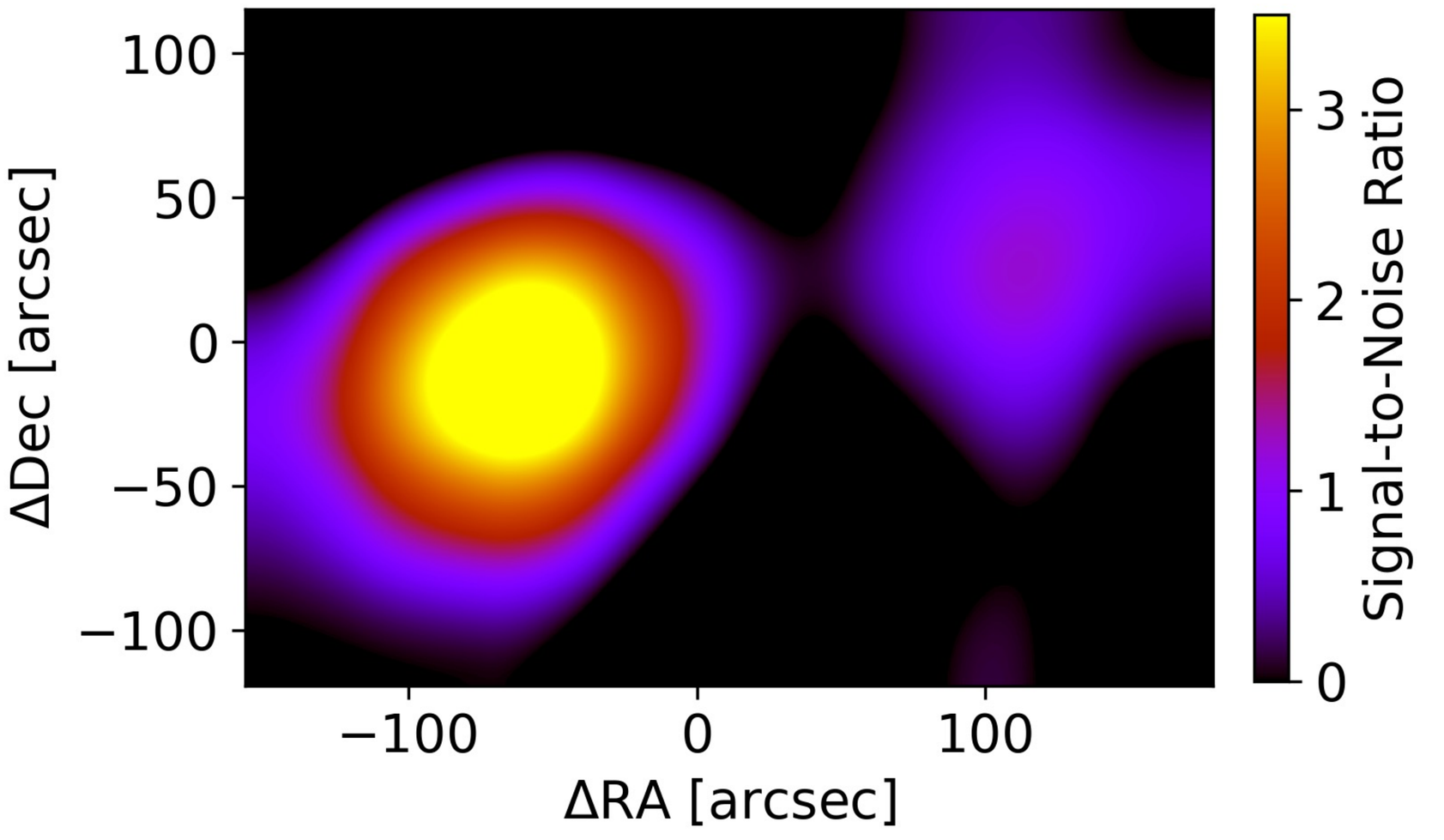
No need to guess!

This project automates the optimization of the dark matter map.

We first eliminate background galaxies that are too faint or too small. Then, we make maps using different sets of them and compare the results to choose the map that has the highest signal-to-noise ratio, without having to guess it!



Dark Matter map with an optimized choice of background galaxies



Results

The final map (left) has an improved quality of about 65% compared to the initial guess!

What Next?

- A Smarter Search
- Investigating on more parameters and other filters
- Different clusters

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