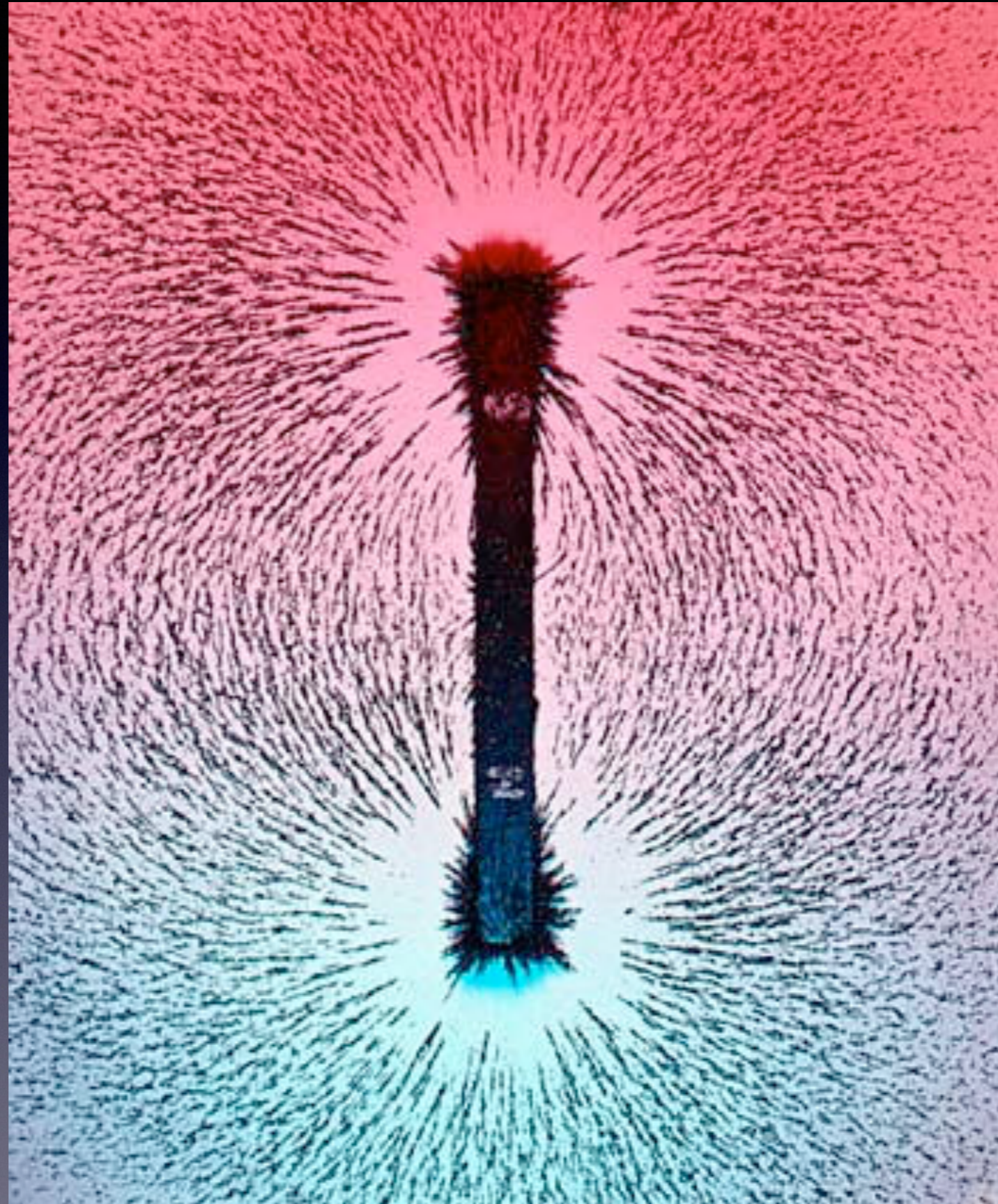


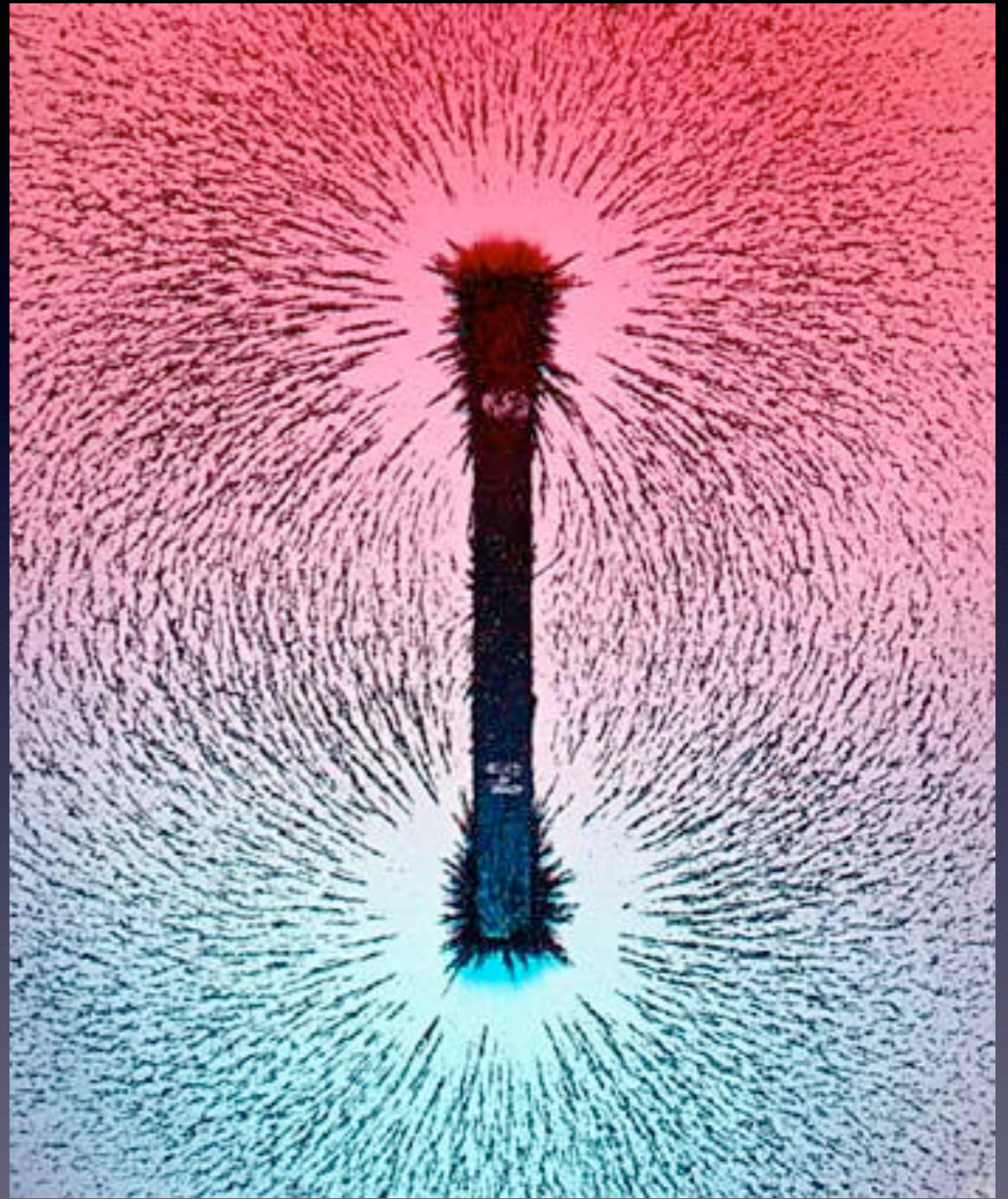
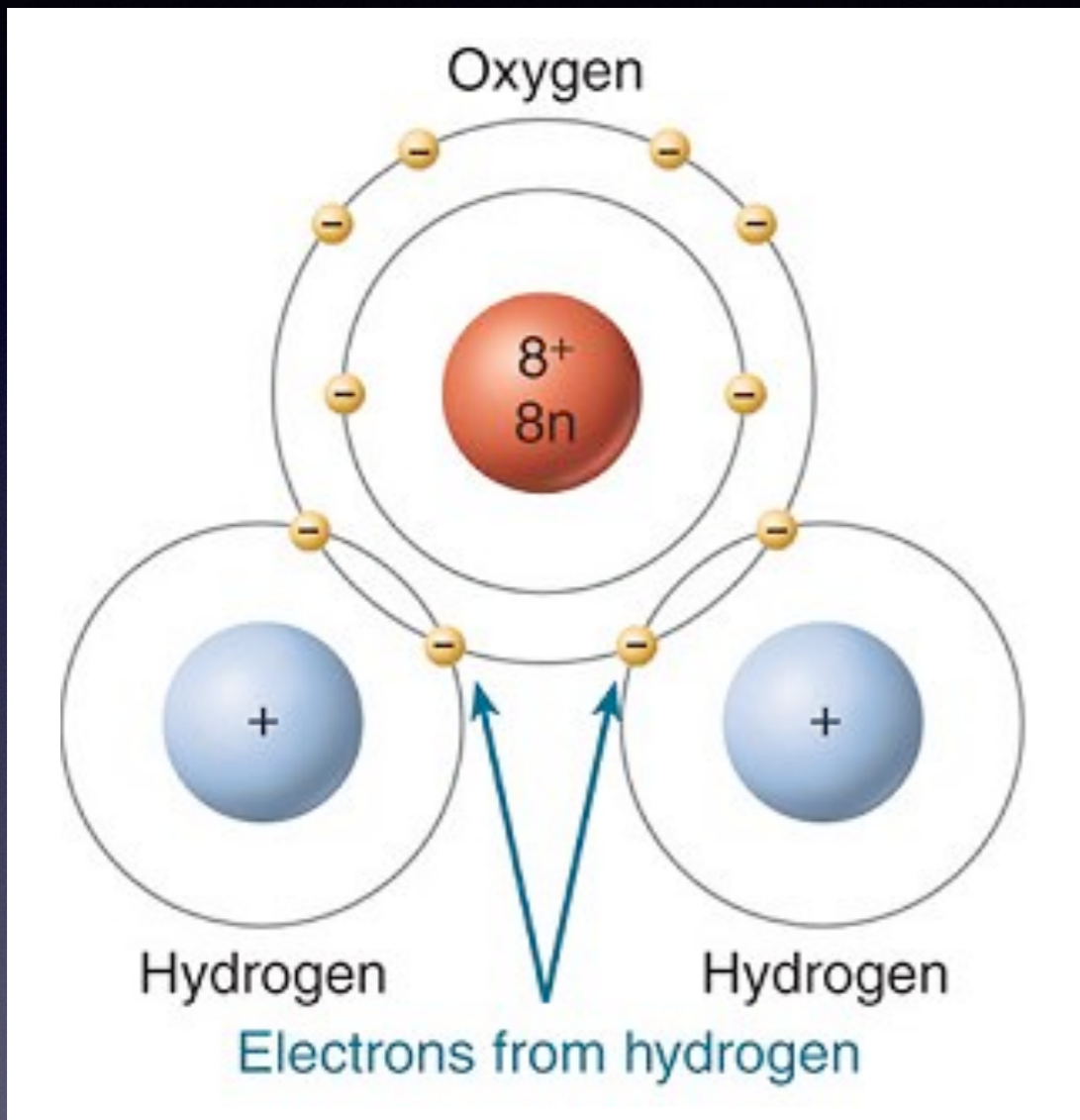
A Non-Physicist's Intro to MRI

Dylan Tisdall

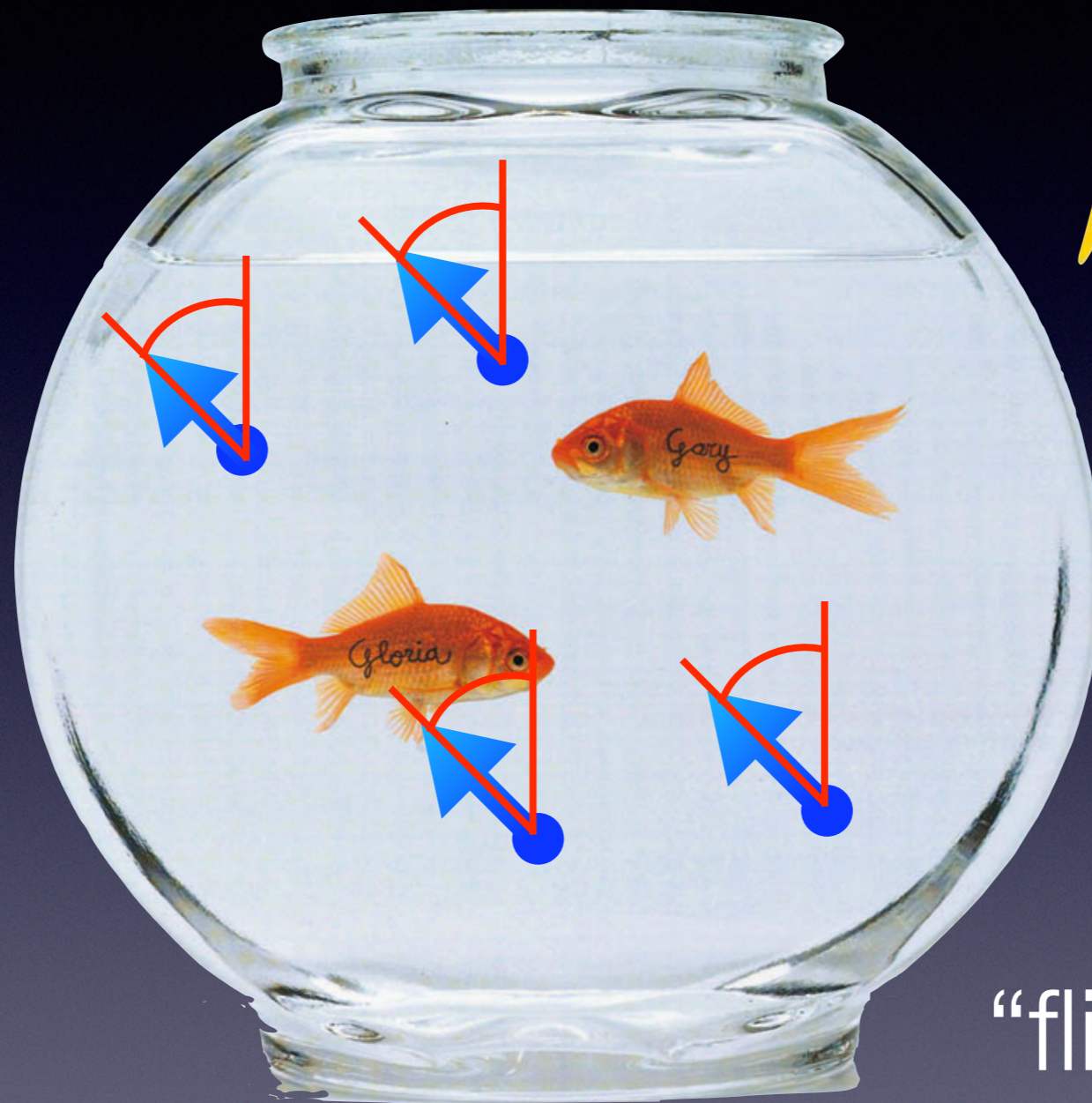




A human head

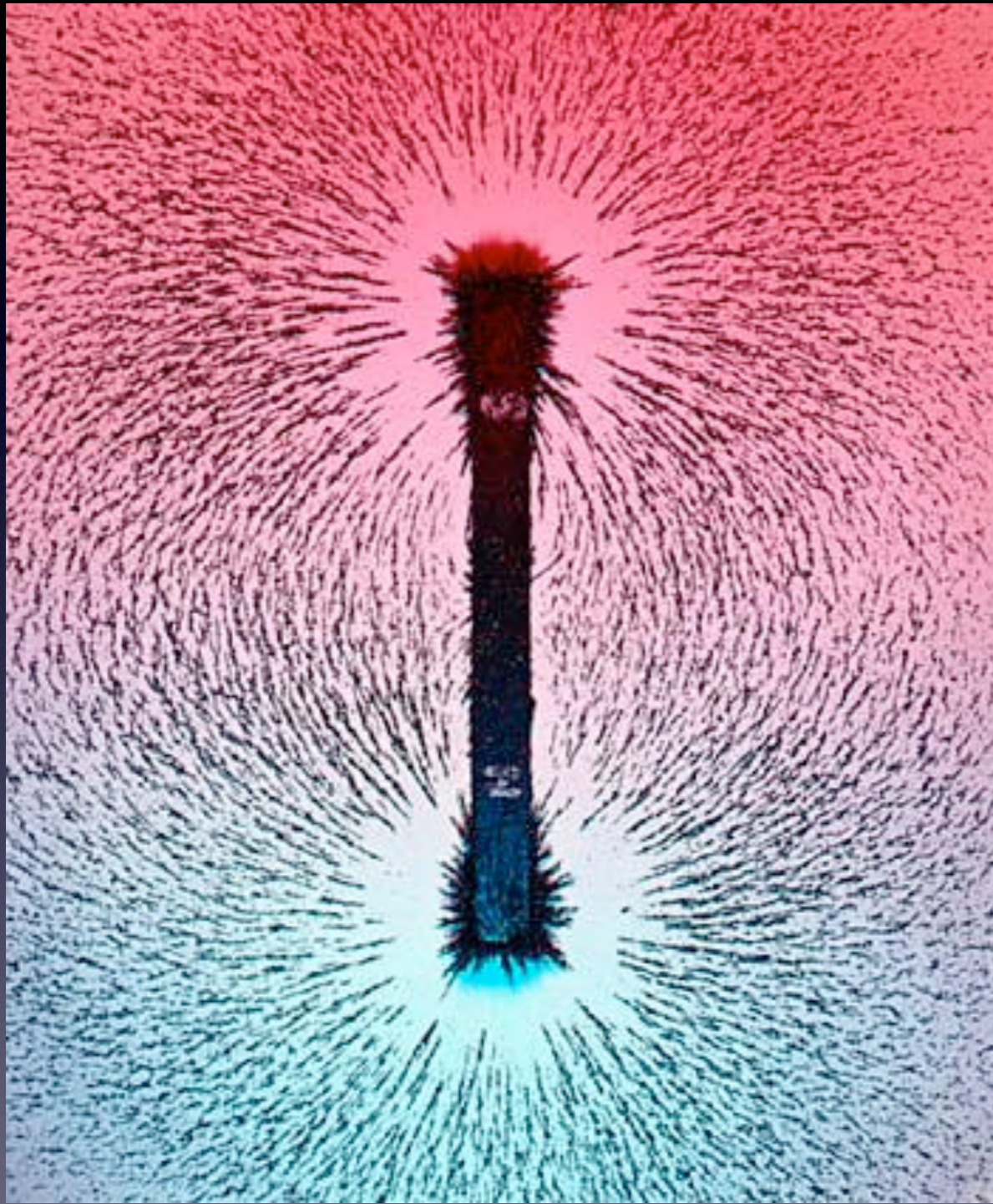


main
magnetic
field

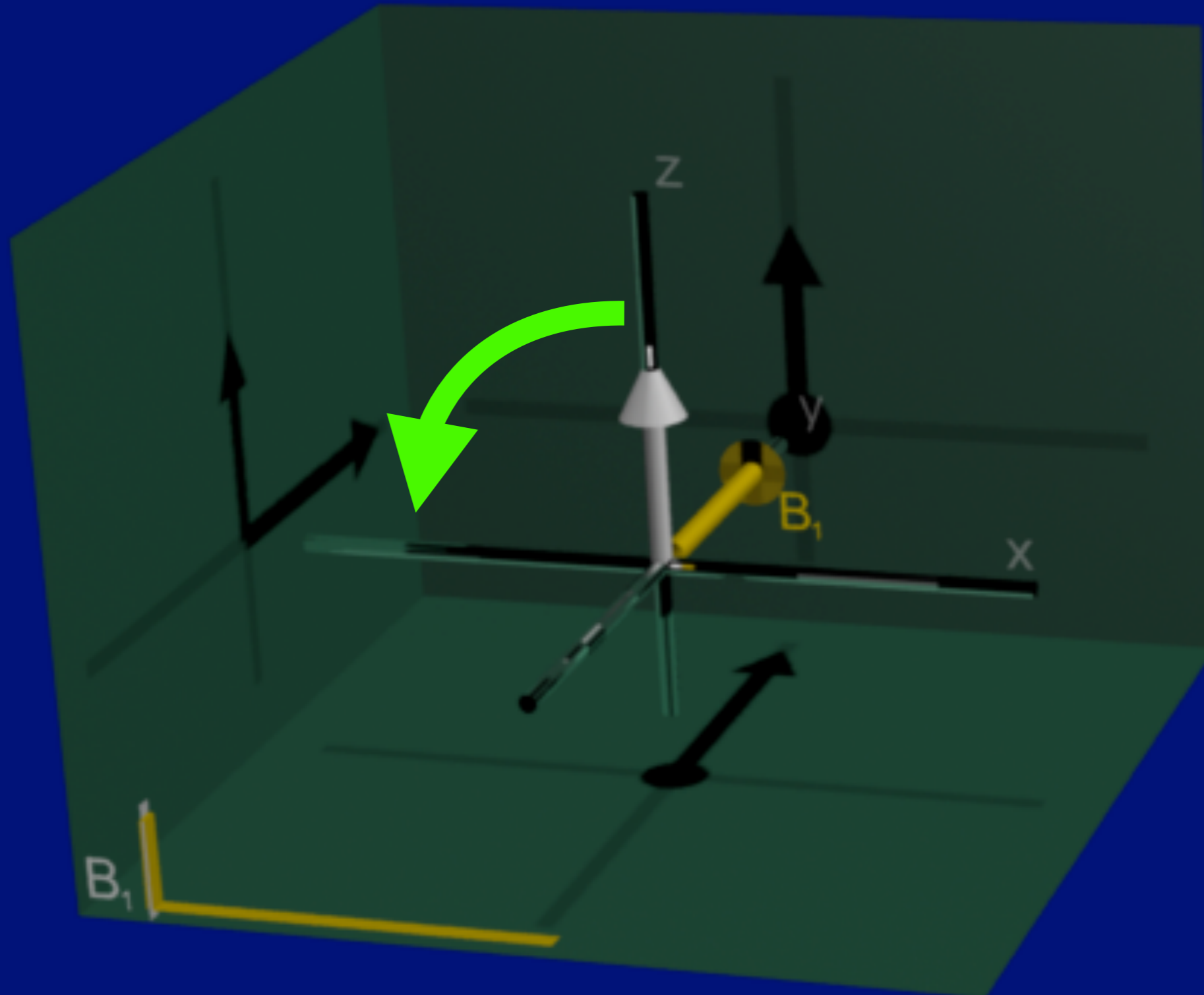


"pulse"

"flip angle"



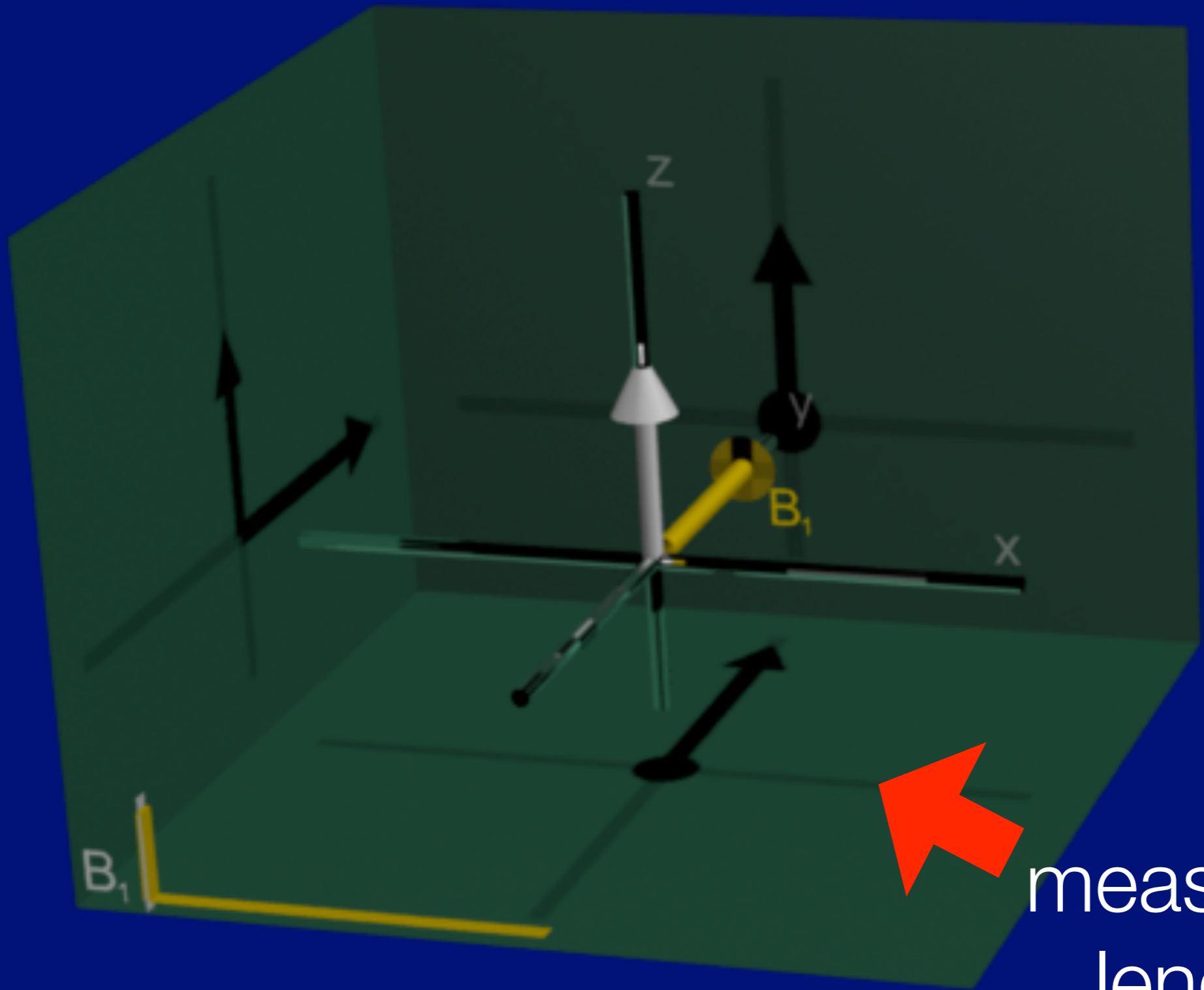
precession



The **rate of precession**
changes **linearly** with the
strength of the **magnetic field**

main
magnetic
field





measured
length

“rotating frame of reference”

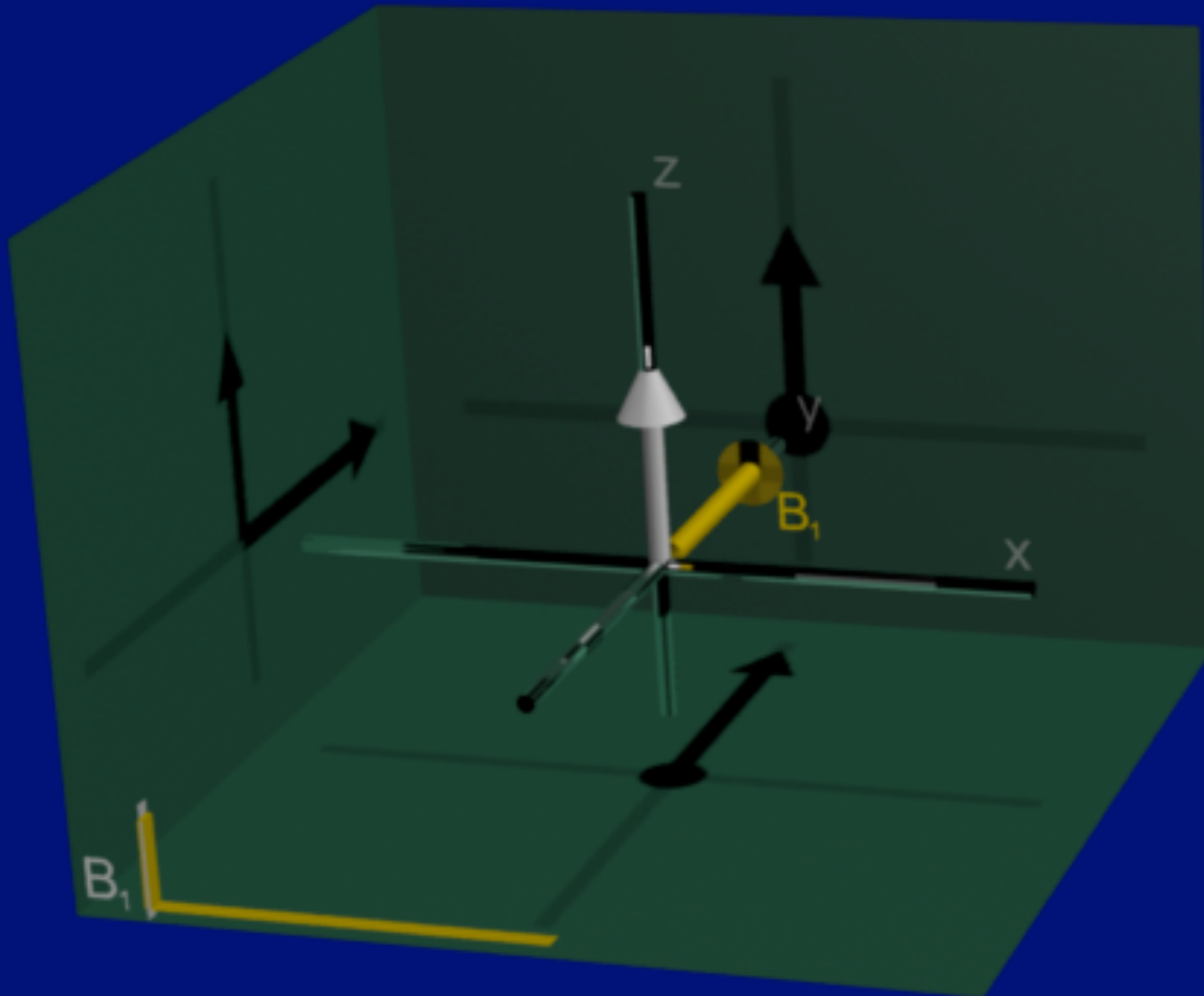


relaxation

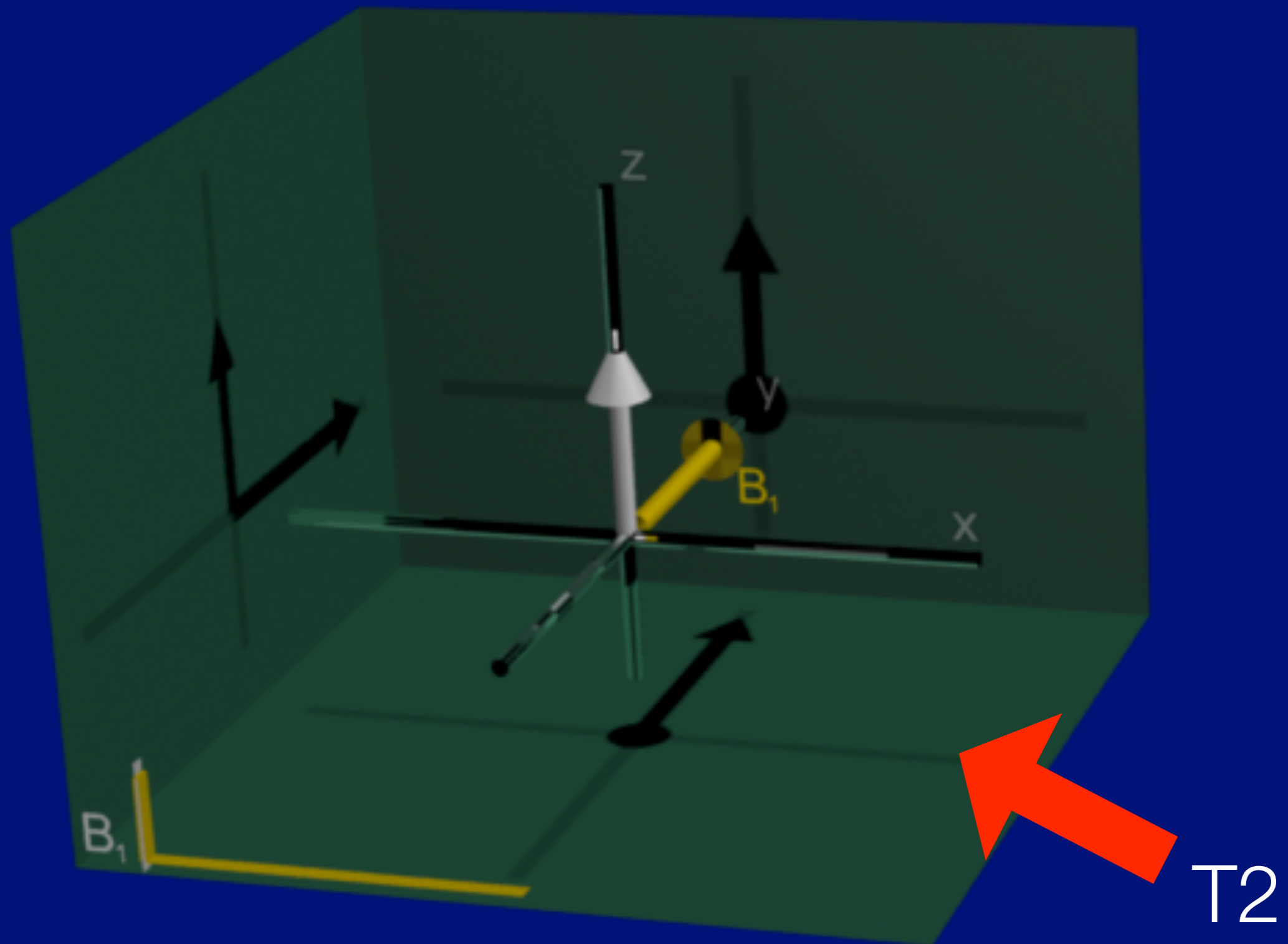


main
magnetic
field

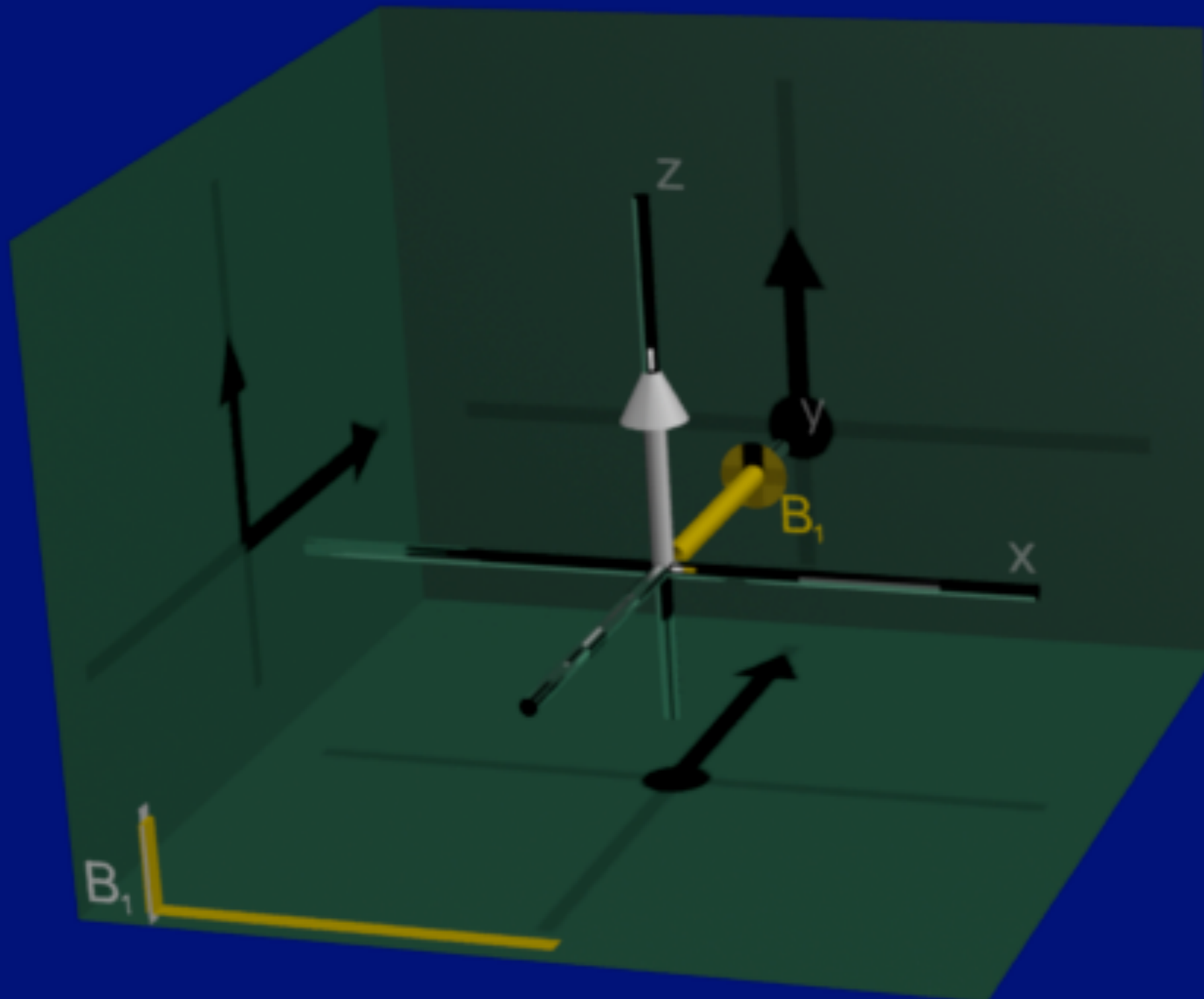
T2 is dephasing



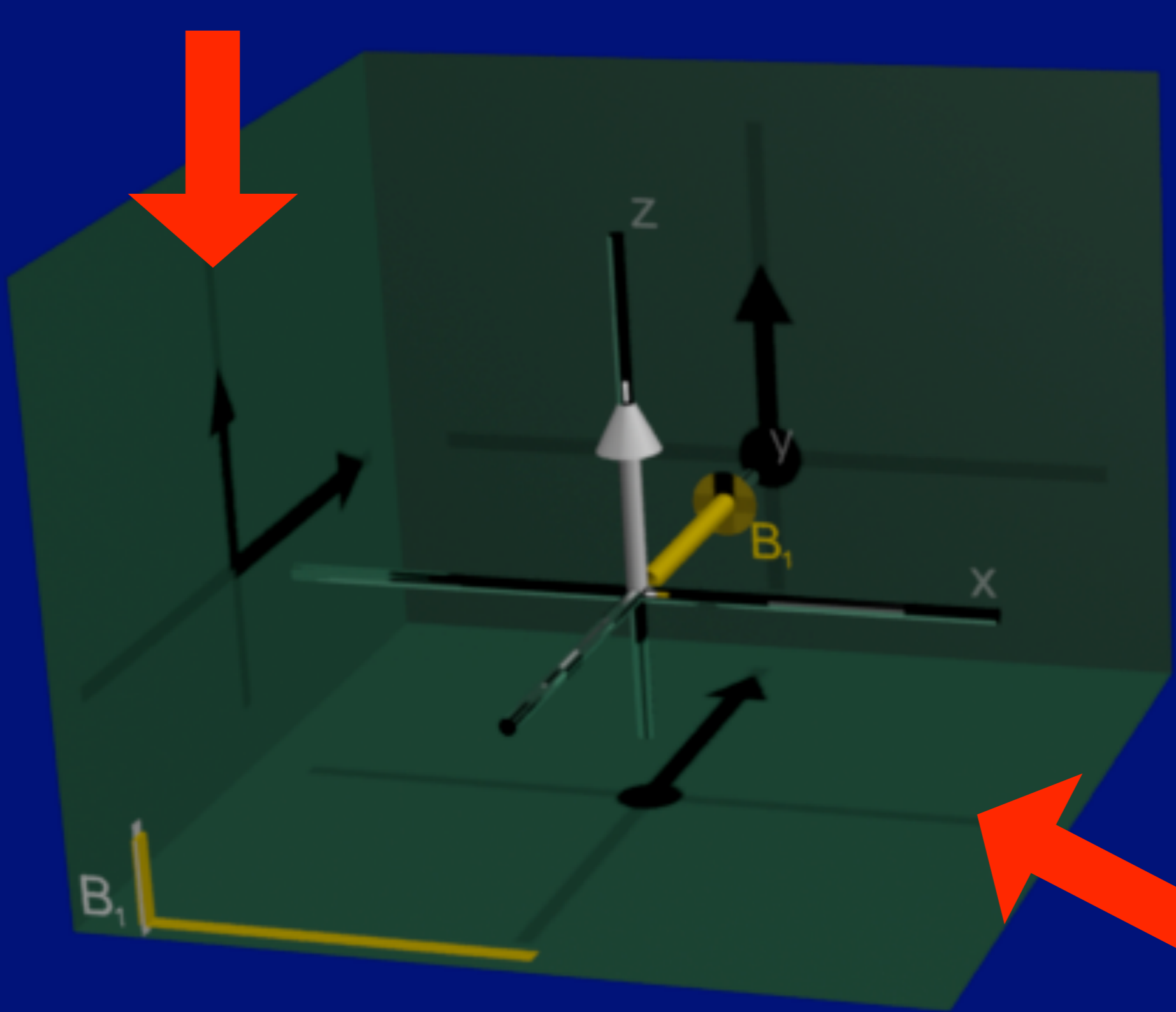
dephasing looks like “less signal”



T1 and T2 relaxation



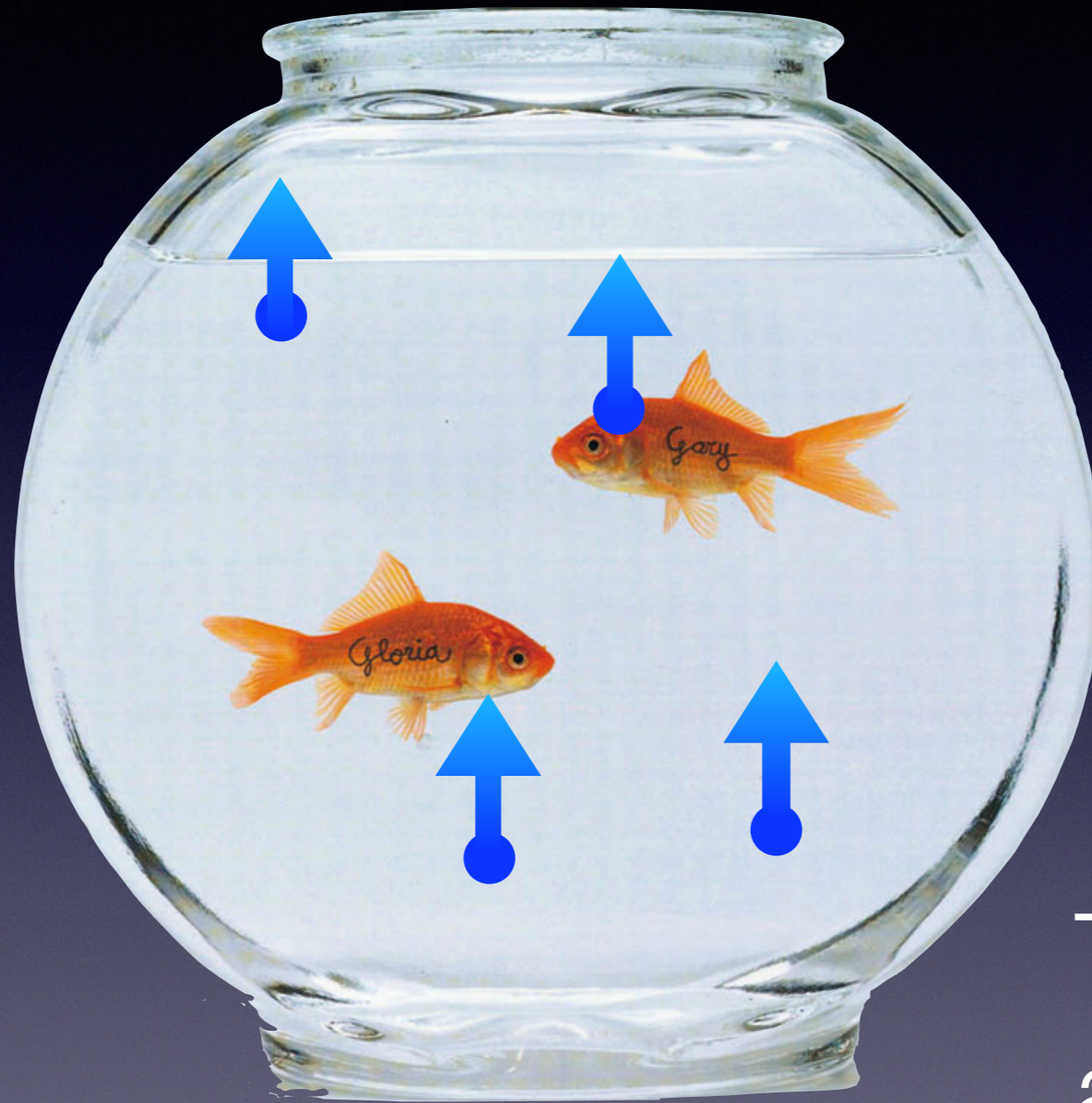
T1



T2

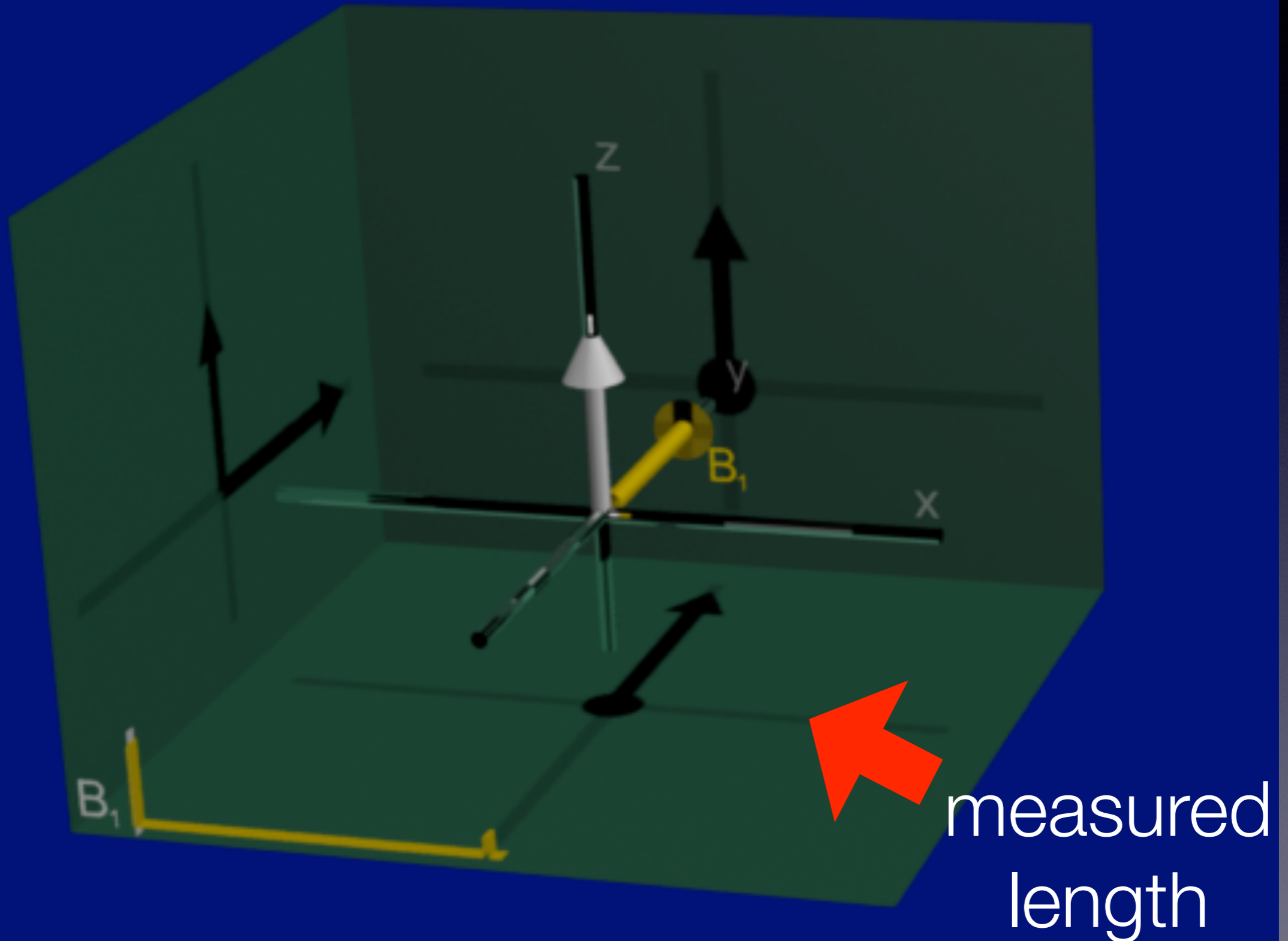


main
magnetic
field



The fish
are what
make it
interesting....

inversion recovery

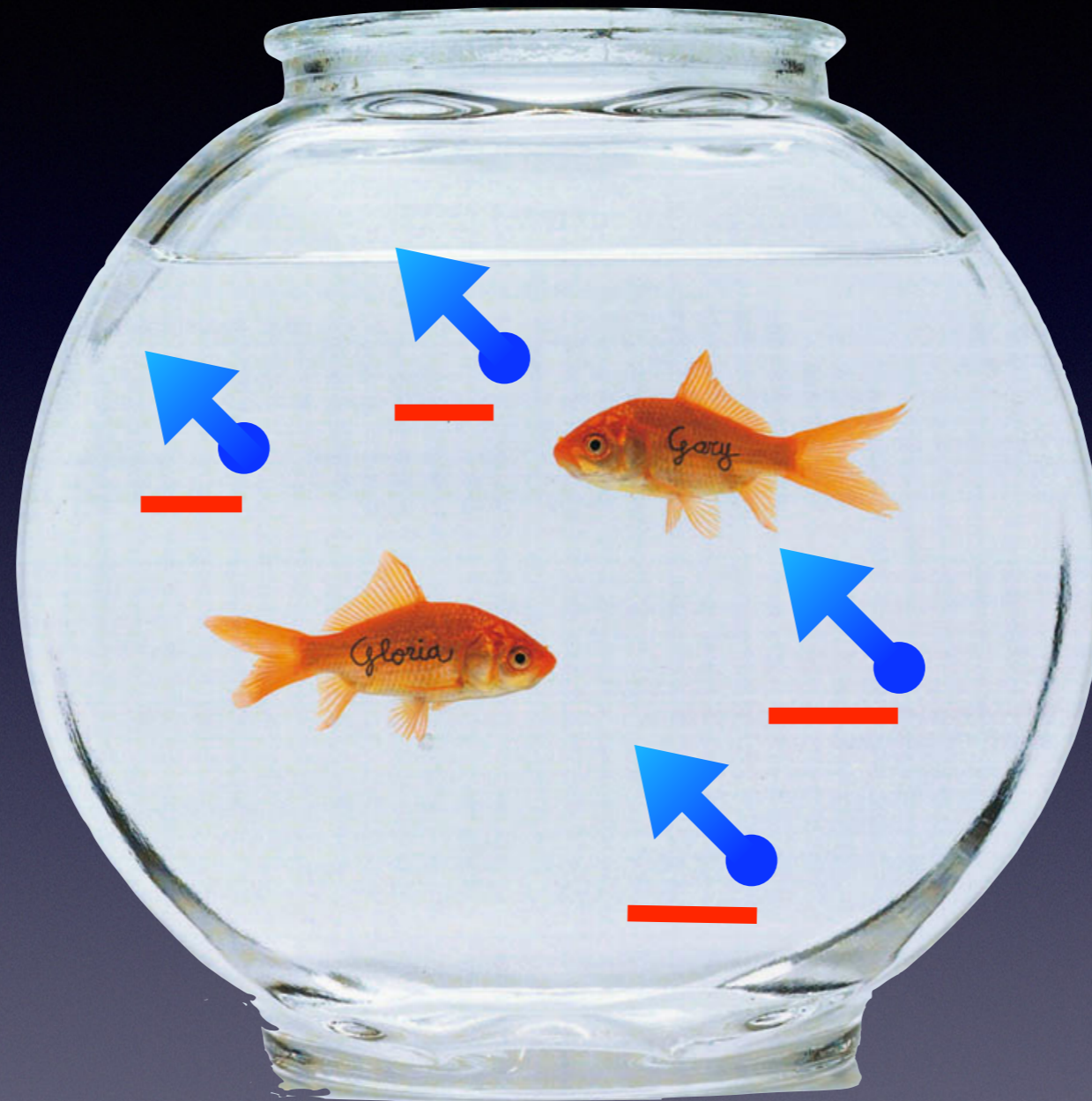


Using **inversion recovery** we
can **weight** our measurements
for tissues with **specific T1**

How do we get
spatial information?

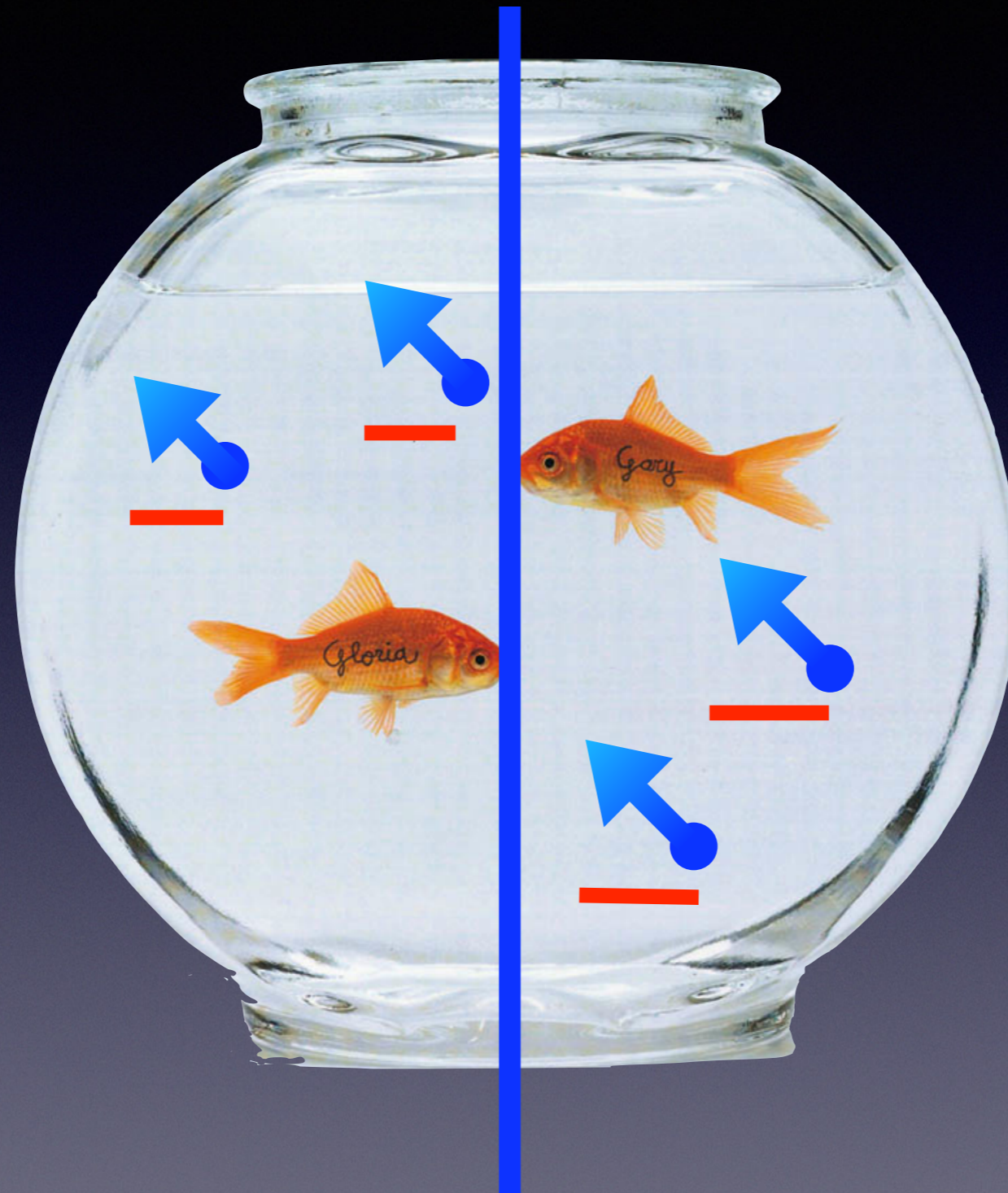
what do we measure?


main
magnetic
field



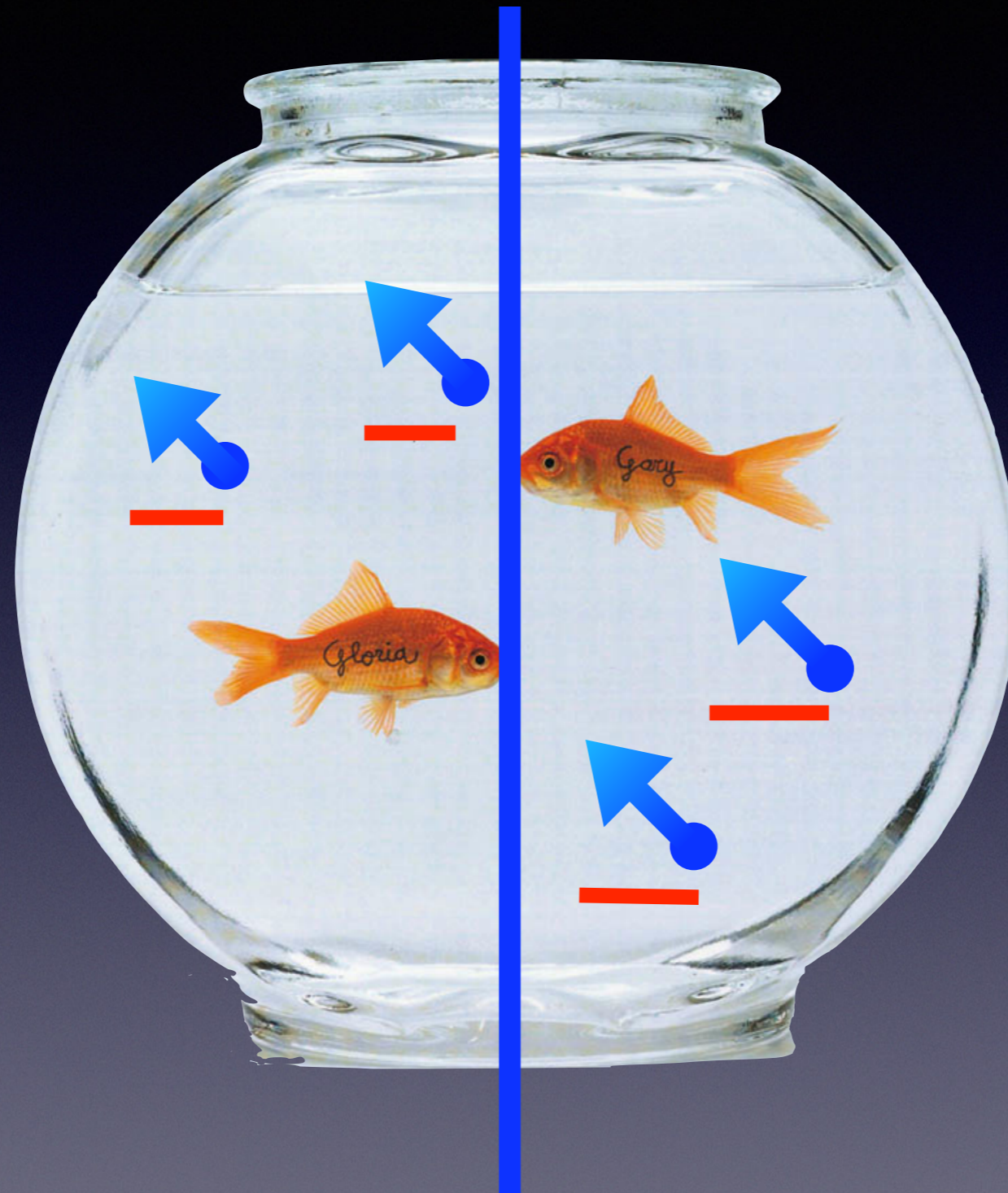
add up the red lines

two voxels (left and right)



take one measurement (sum)

two voxels (left and right)

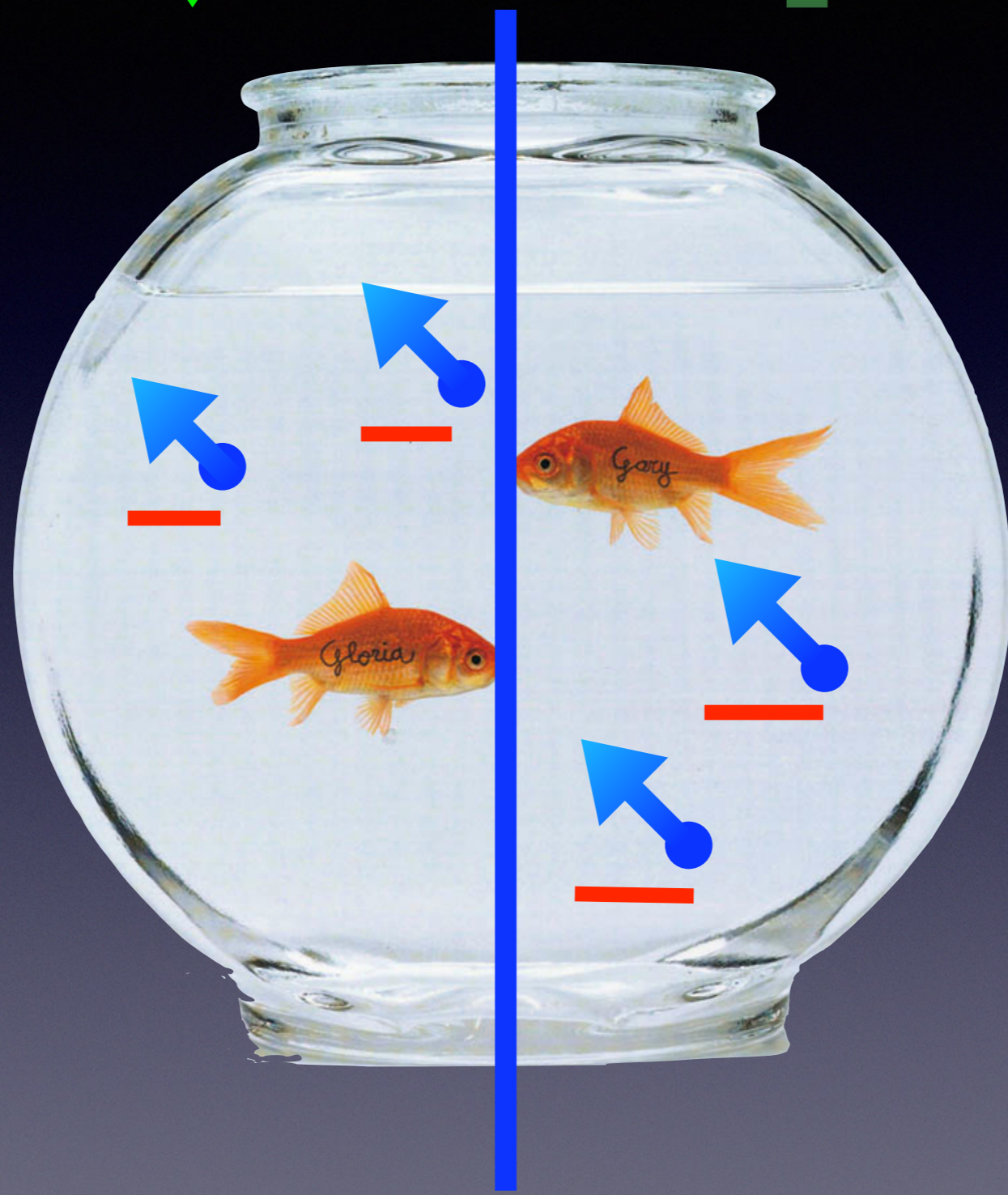


apply a different magnetic field to each half

gradient



main
magnetic
field

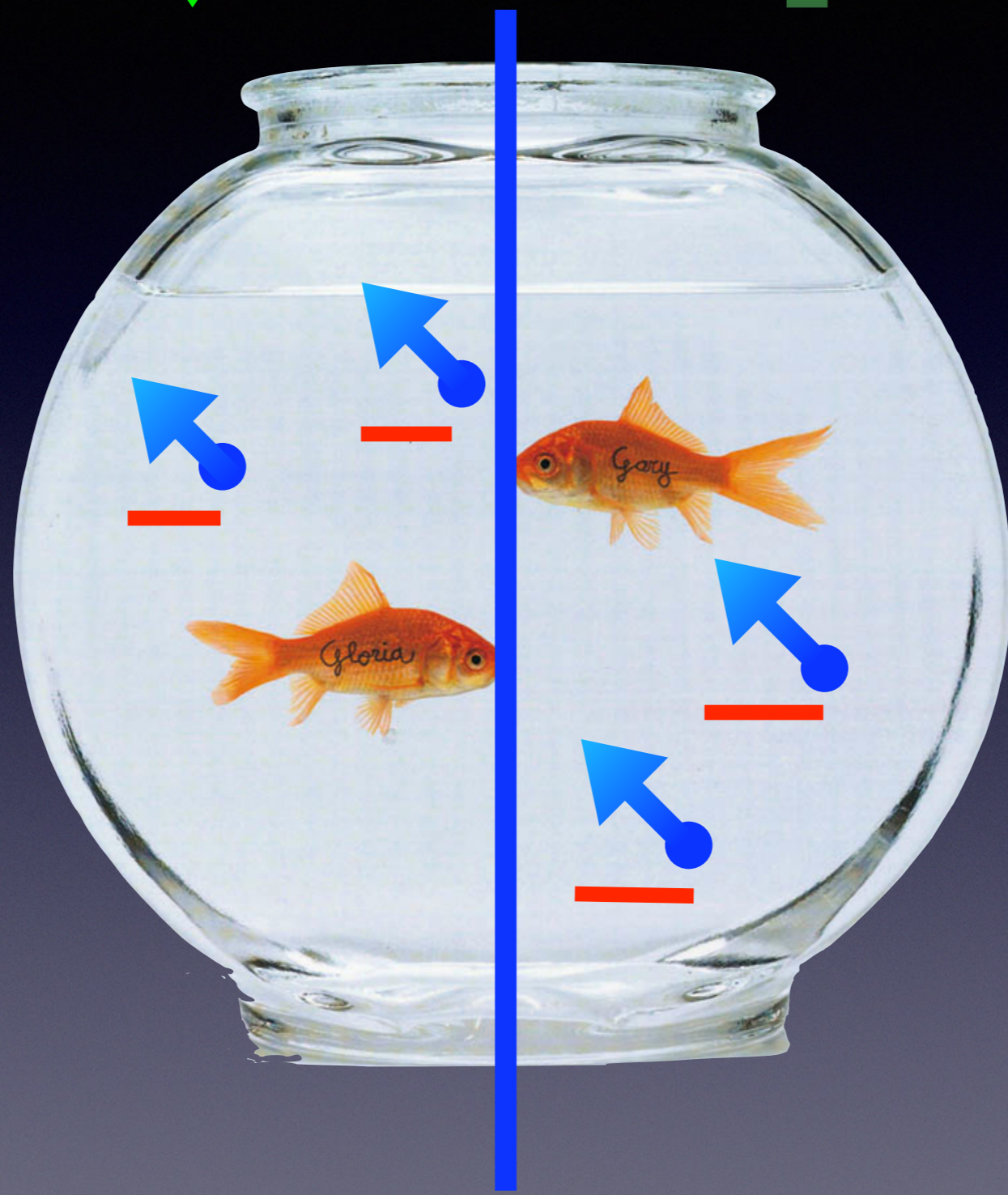


apply a different magnetic field to each half

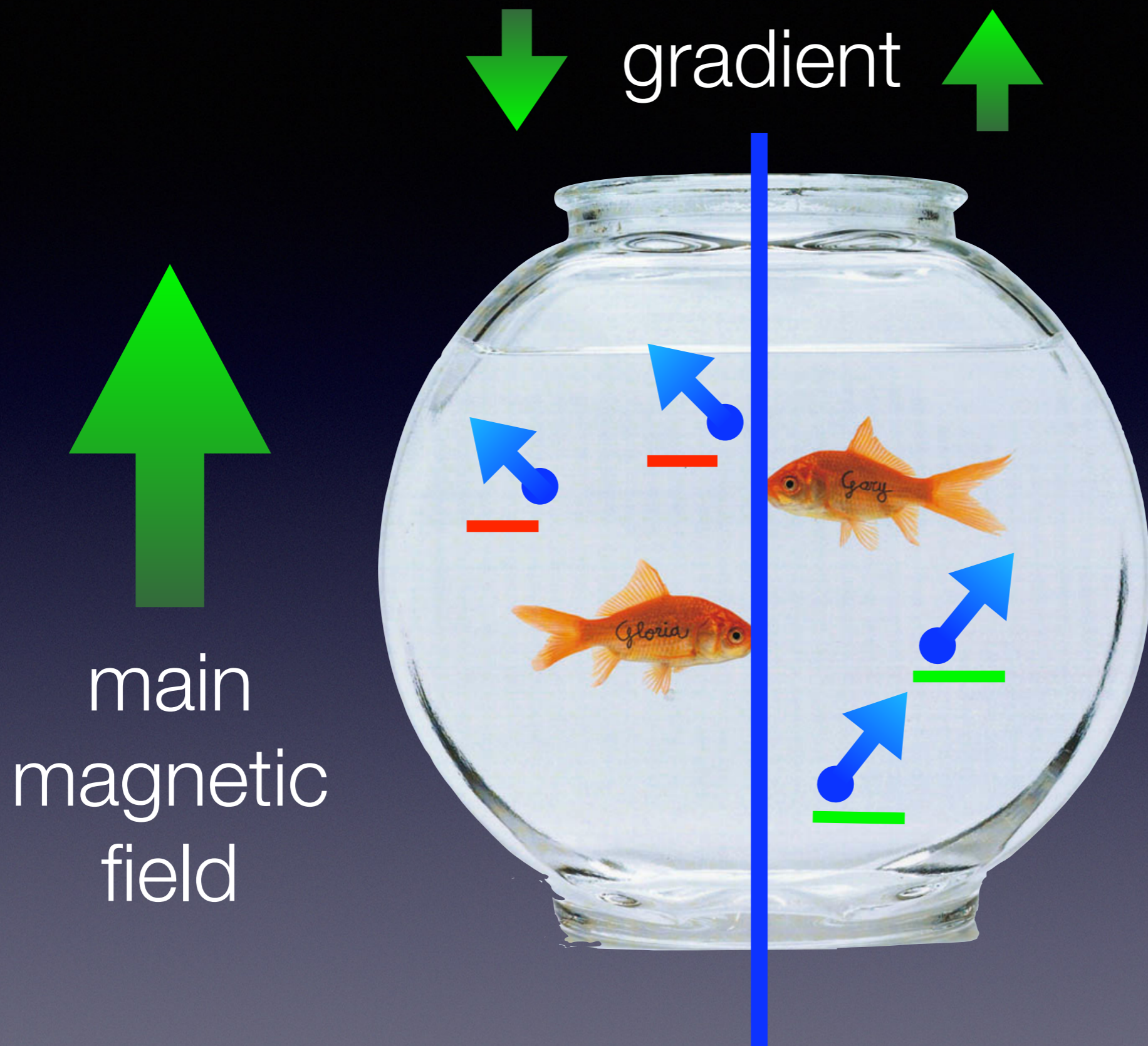
gradient



main magnetic field



rate of precession is different in each voxel

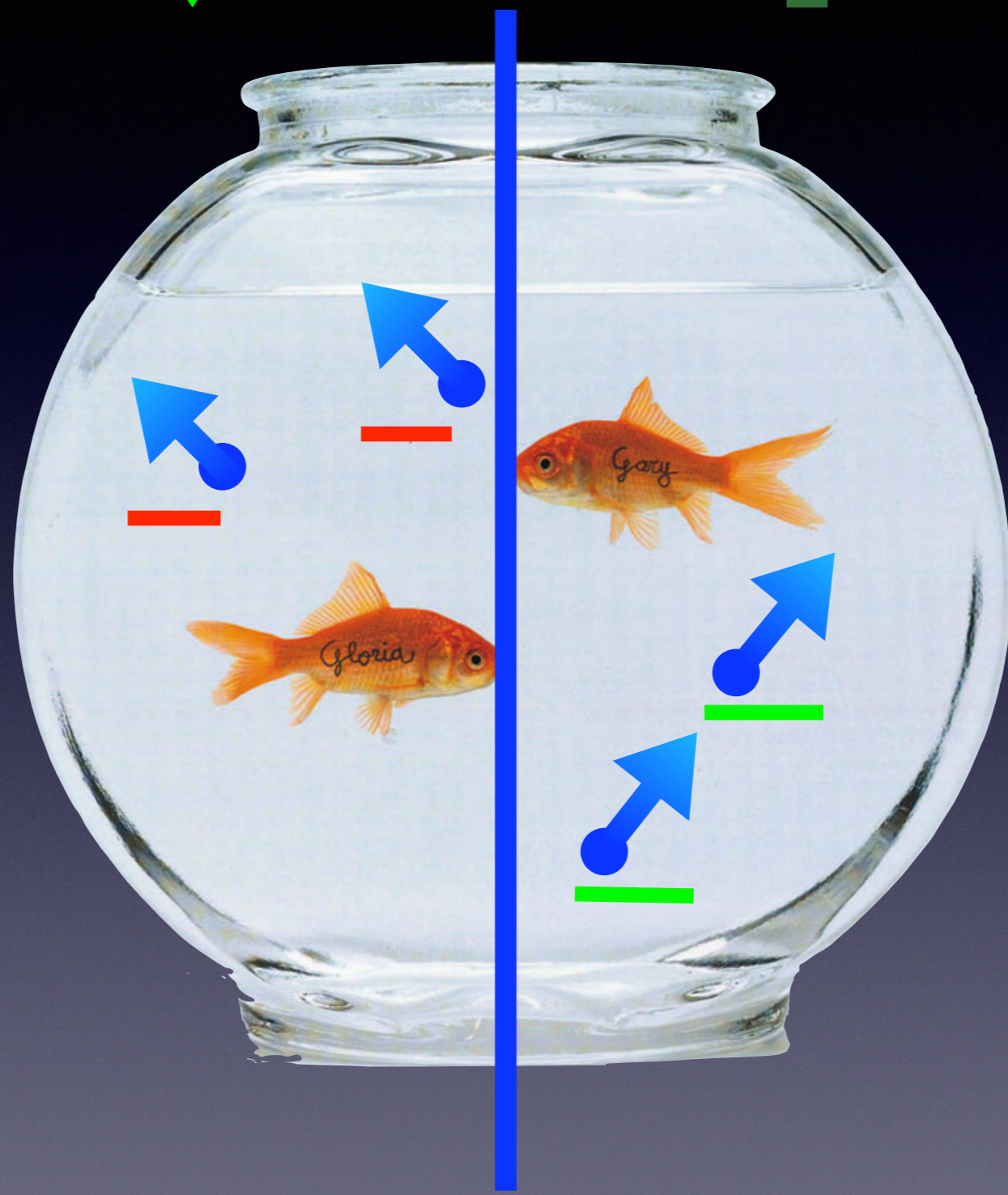


rate of precession is different in each voxel

gradient



main magnetic field



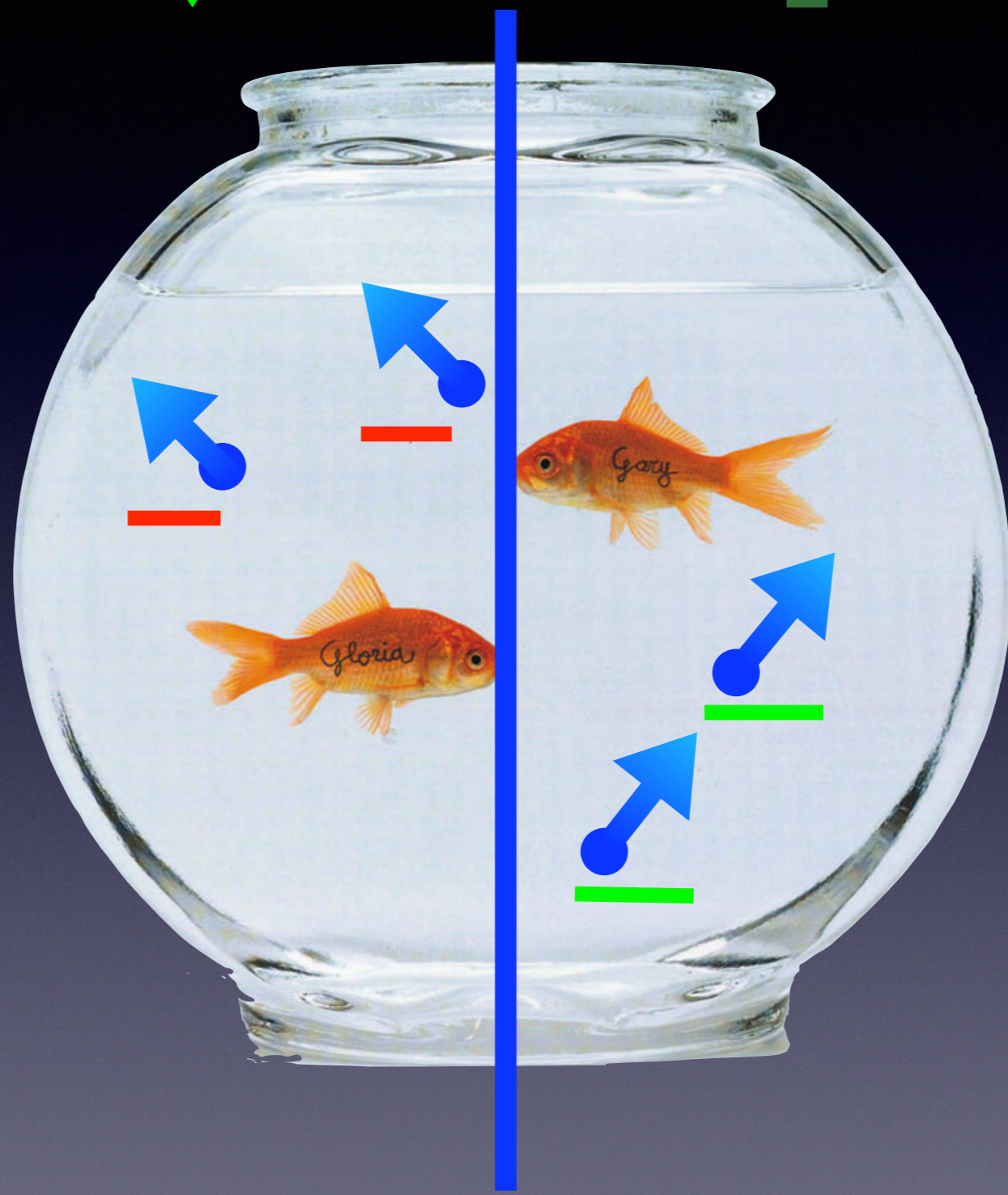
the voxels are out of phase

rate of precession is different in each voxel

gradient



main magnetic field



the voxels are out of phase

take second measurement (sum)

1st measurement: left + right

2nd measurement: left - right

add them: 2 x left

1st measurement: left + right

2nd measurement: left - right

subtract them: 2 x right

Real sequences sum together
fractional amounts from all the
voxels.

Real sequences sum together fractional amounts from all the voxels.

The fractions are changed using the x-, y-, or z-gradients.

Real sequences sum together fractional amounts from all the voxels.

The fractions are changed using the x-, y-, or z-gradients.

The voxels are “unmixed” from all the measurements using an Inverse Fourier Transform.

A Pulse Sequence

1. “Prepare” (invert, flip)

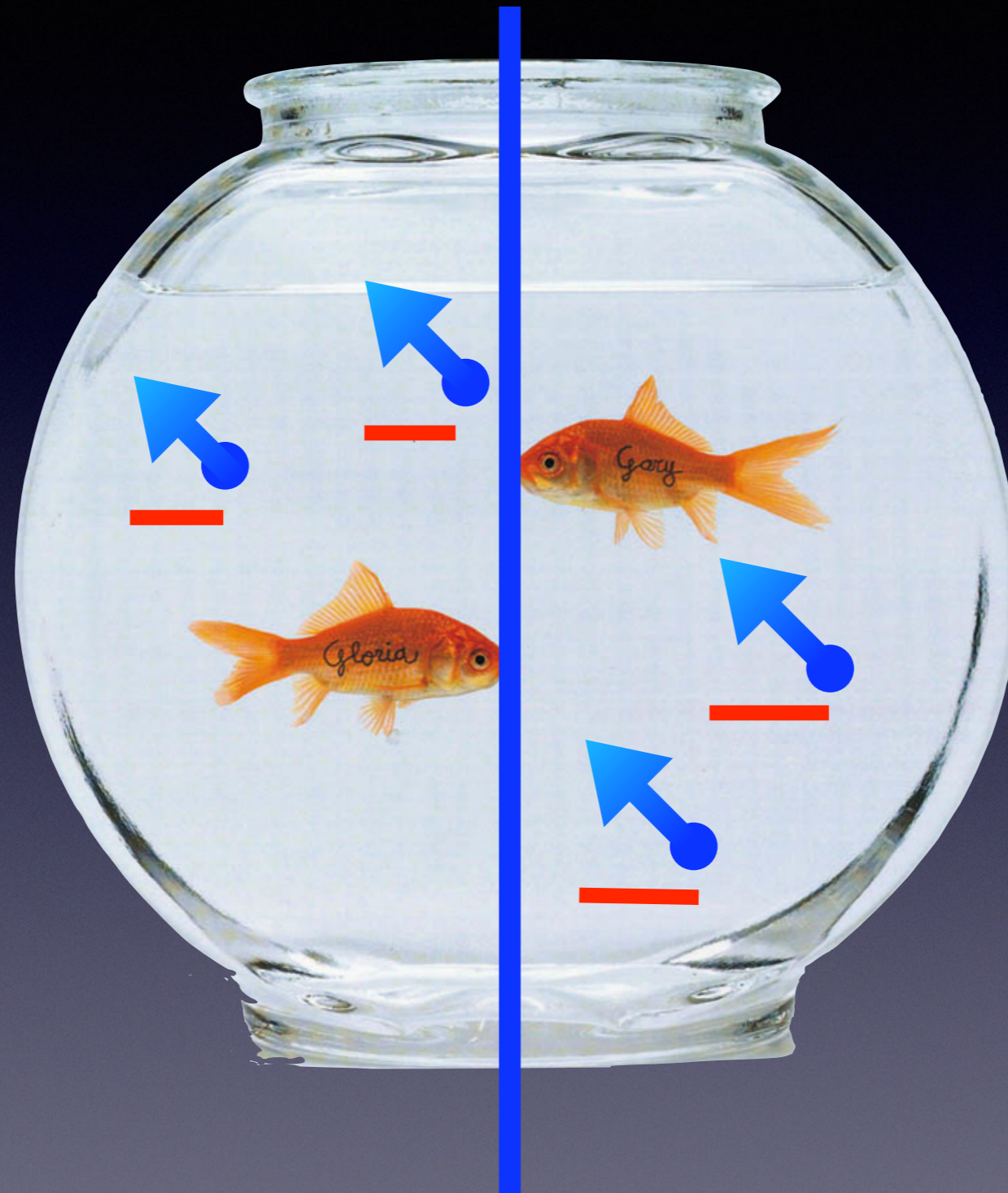
2. Localize (Gradients)

3. Measure repeat

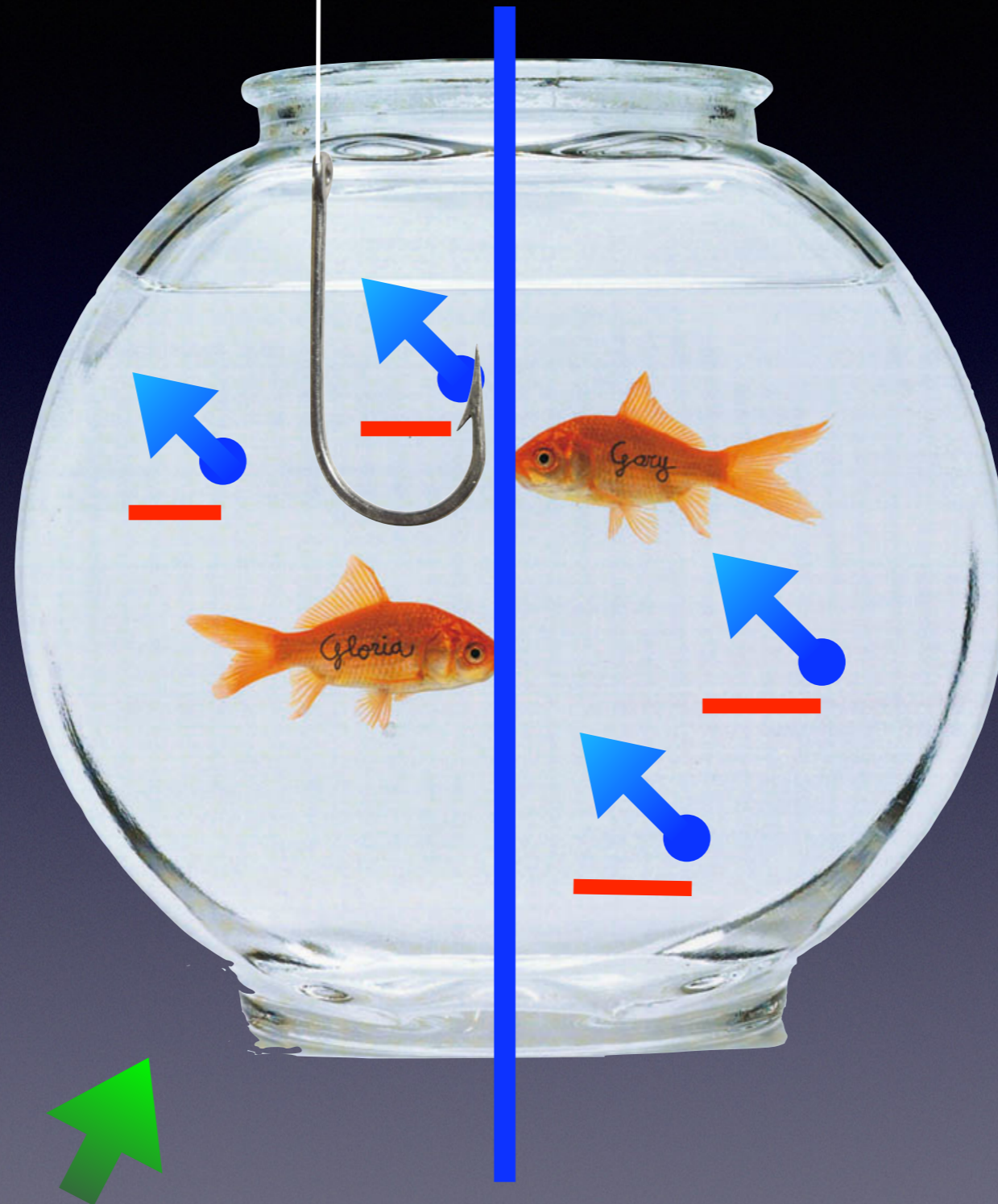
4. Relax

5. Go back to 1.

fMRI (BOLD)

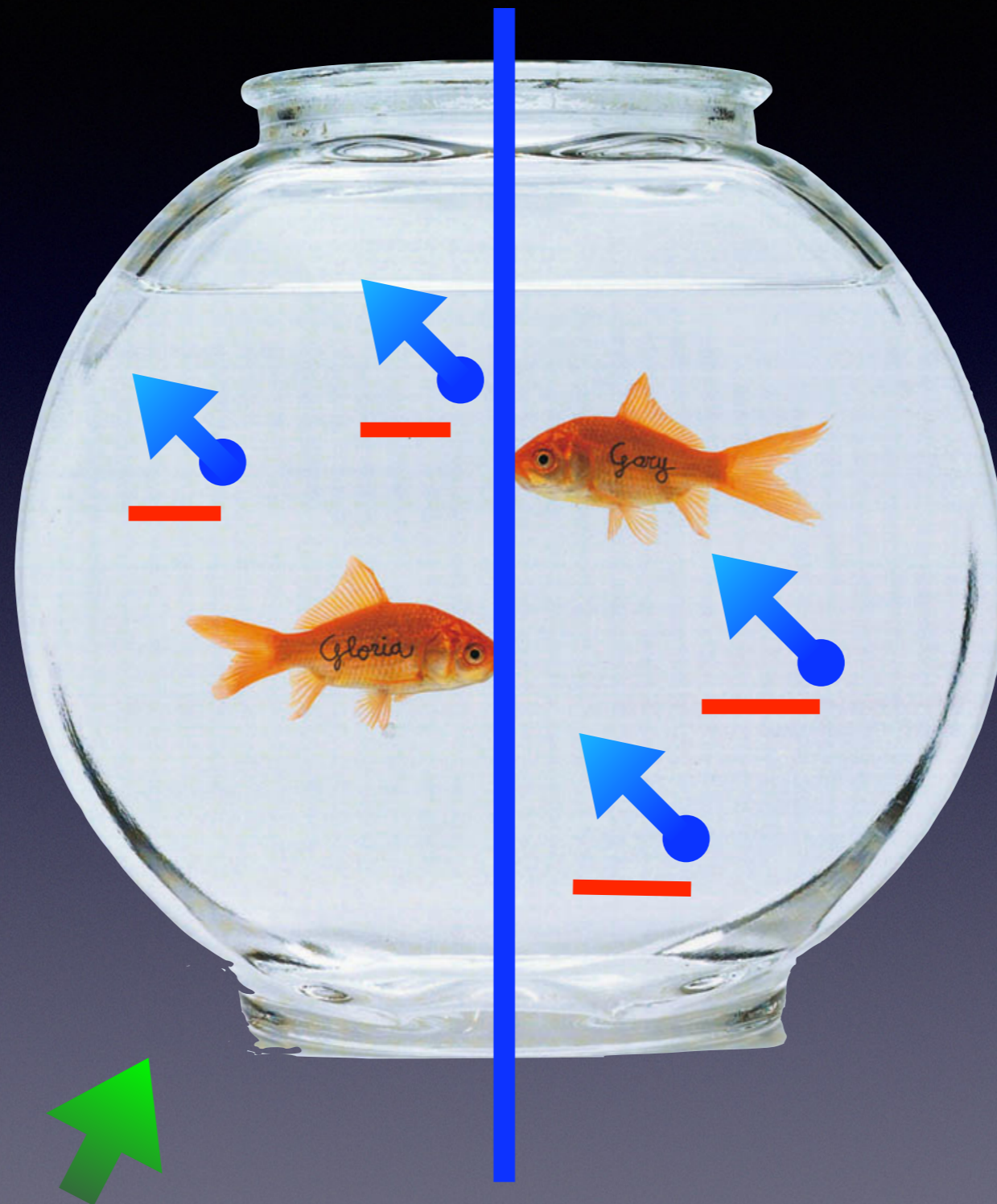


fMRI (BOLD)



this side dephases faster = less signal

fMRI (BOLD)



this side's T2 returns to normal

questions?

