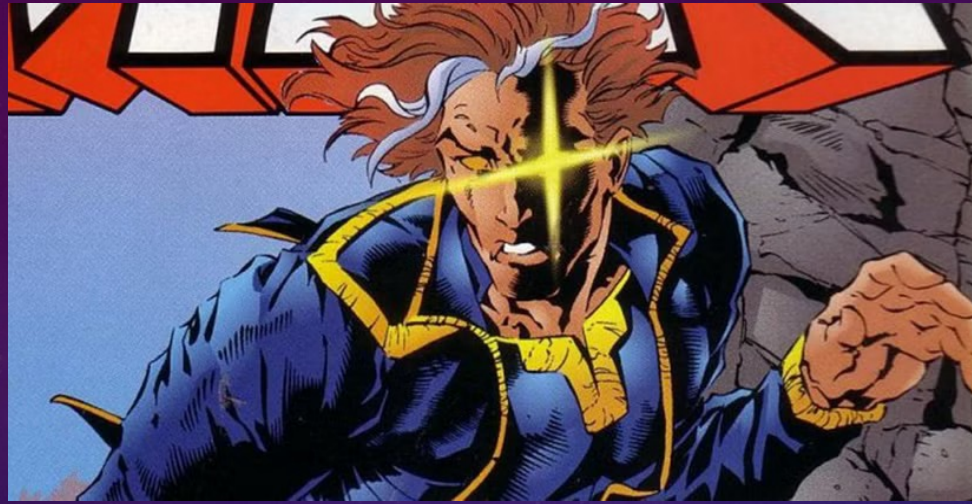


The background is a gradient from dark purple at the top to dark blue at the bottom, filled with a field of small white stars. Overlaid on this are several faint, light-colored circular patterns. Some are solid lines, some are dashed, and some are dotted. A prominent feature is a large circular scale on the left side, with numbers ranging from 140 to 260 in increments of 10, and tick marks along its circumference. Other smaller circles with arrows pointing in various directions are scattered across the scene.

READING THOUGHTS WITH PIXELS

45 MINUTES WHERE WE TALK TO YOU ABOUT OUR FAVORITE THING!



What do all of these characters have in common?

IS BRAIN IMAGING MIND READING?

- No

IS BRAIN IMAGING MIND READING?

- No
- Well...

SO, WHAT ARE SCIENTISTS DOING WITH BRAIN IMAGING?

Networks extracted from nonlinear fMRI connectivity exhibit unique spatial variation and enhanced sensitivity to differences between individuals with schizophrenia and controls

[Spencer Kinsey](#) ✉, [Katarzyna Kazimierczak](#), [Pablo Andrés Camazón](#), [Jiayu Chen](#), [Tülay Adalı](#), [Peter Kochunov](#), [Bhim M. Adhikari](#), [Judith Ford](#), [Theo G. M. van Erp](#), [Mukesh Dhamala](#), [Vince D. Calhoun](#) & [Armin Iraj](#) ✉

Brain activity explains message effectiveness: A mega-analysis of 16 neuroimaging studies 

[Christin Scholz](#) ✉, [Hang-Yee Chan](#) ✉, [Jeesung Ahn](#), [Maarten A S Boksem](#), [Nicole Cooper](#), [Jason C Coronel](#), [Bruce P Doré](#), [Alexander Genevsky](#), [Richard Huskey](#),

Mind captioning: Evolving descriptive text of mental content from human brain activity

[TOMOYASU HORIKAWA](#)  [Authors Info & Affiliations](#)

WHAT DOES THIS MEAN?

Networks extracted from nonlinear fMRI connectivity exhibit unique spatial variation and enhanced sensitivity to differences between individuals with schizophrenia and controls

[Spencer Kinsey](#) ✉, [Katarzyna Kazimierczak](#), [Pablo Andrés Camazón](#), [Jiayu Chen](#), [Tülay Adalı](#), [Peter Kochunov](#), [Bhim M. Adhikari](#), [Judith Ford](#), [Theo G. M. van Erp](#), [Mukesh Dhamala](#), [Vince D. Calhoun](#) & [Armin Iraj](#) ✉

...finding early signs of schizophrenia!

Mind captioning: Evolving descriptive text of mental content from human brain activity

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Brain activity explains message effectiveness: A mega-analysis of 16 neuroimaging studies 

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...predicting what will go viral online!

...describing what someone is looking at by studying their brain while they look at it!

FIGHTING DISEASE WITH BRAIN IMAGING

- Schizophrenia is a mental illness that affects over 24 million people worldwide
- Schizophrenia is a **neurological disorder** – people with schizophrenia are not at fault, their brains are functioning improperly beyond their control
- By learning more about how schizophrenia works, we may be able to develop more effective treatments for it

Georgia State University researchers are using fMRI to find differences in the brains of people with schizophrenia and without schizophrenia

PREDICTING VIRAL MESSAGES WITH BRAIN IMAGING

- Marketers often want to know how a message will be received, whether a political campaign, a television advertisement, or a TikTok video
- When we trust something, are excited by it, or want to share it, areas of the brain involved with reward and social processing are more active

Researchers from many universities collaborated to find a way to predict whether a video would go viral by looking at the brains of people viewing it

MIND CAPTIONING WITH BRAIN IMAGING

- Scientists want to study how the brain functions in everyday tasks to learn about how the physical processes of our brain can lead to our mental experiences (qualia)
- Learning about how our thoughts translate into brain activity can help us understand how the brain represents concepts

Researchers at NTT Data Group in Japan created a machine learning model that can add captions to images of people's brain that describe what the person is looking at and thinking.

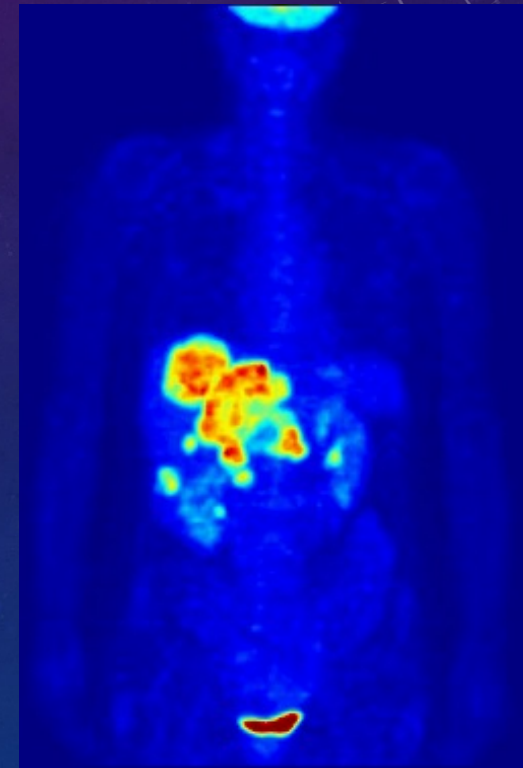
IMAGING MODALITIES: PET & MRI



WHY DO WE WANT TO TRACE CHEMICALS?

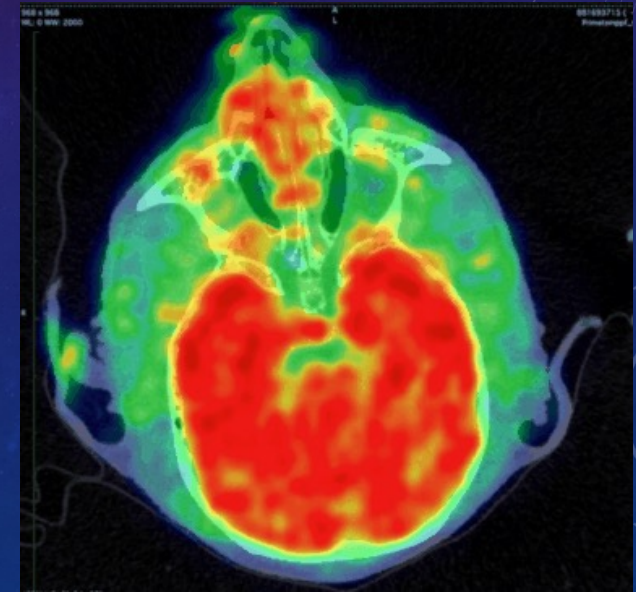
If we can “track” the movement of these chemicals, what do you think we can learn?

- Blood?
- Hormones (e.g. Serotonin)?
- Medication?



WHY DO WE WANT TO TRACE CHEMICALS?

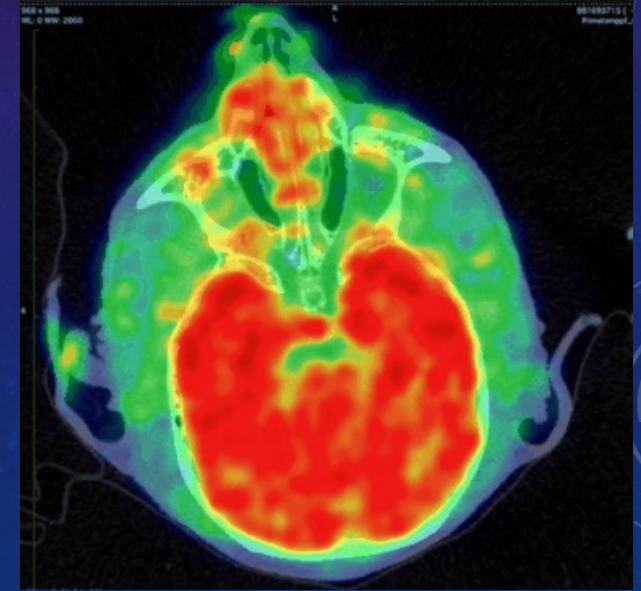
- Blood – Measure the brain's metabolic function
 - Find what areas have higher activity, understand epilepsy, stroke
- Hormones – Locate chemical messages
 - Hormones play a key role in how brain cells communicate and how you feel
- Medication?
 - If we try to treat, say, brain cancer, how can we be sure the medicine is going where it needs to?



POP QUIZ!

What do red blood cells carry?

Oxygen!



EVIL OXYGEN (OXYGEN-15 RADIOTRACER)

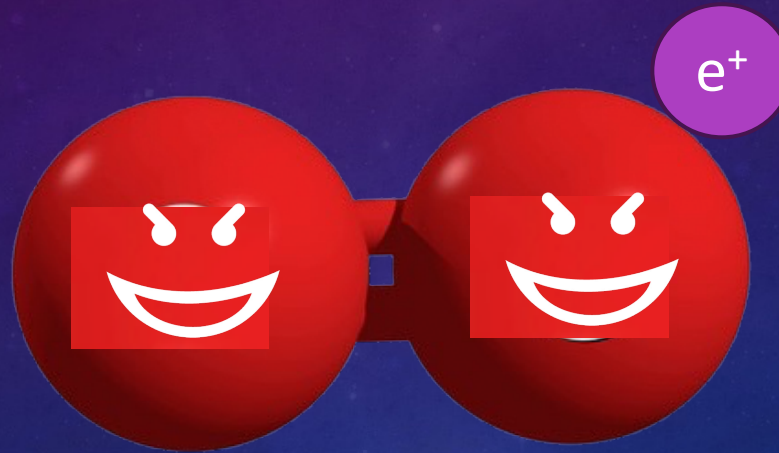
OXYGEN-16 OXYGEN-15



WE CAN DO THIS WITH MANY MOLECULES

- Serotonin/other neuroreceptors
 - F18
 - C11
 - Many many more!

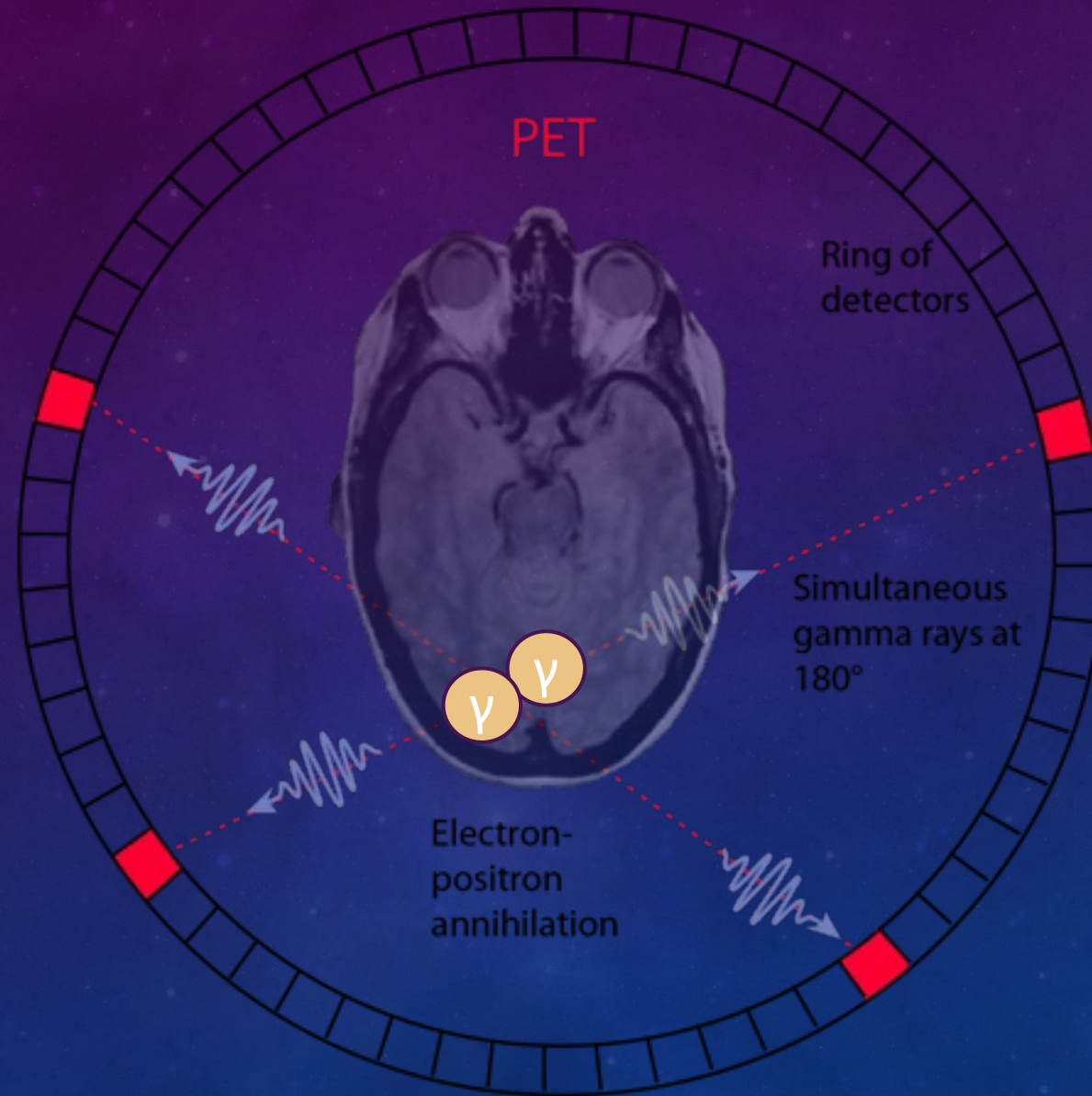
DECAY



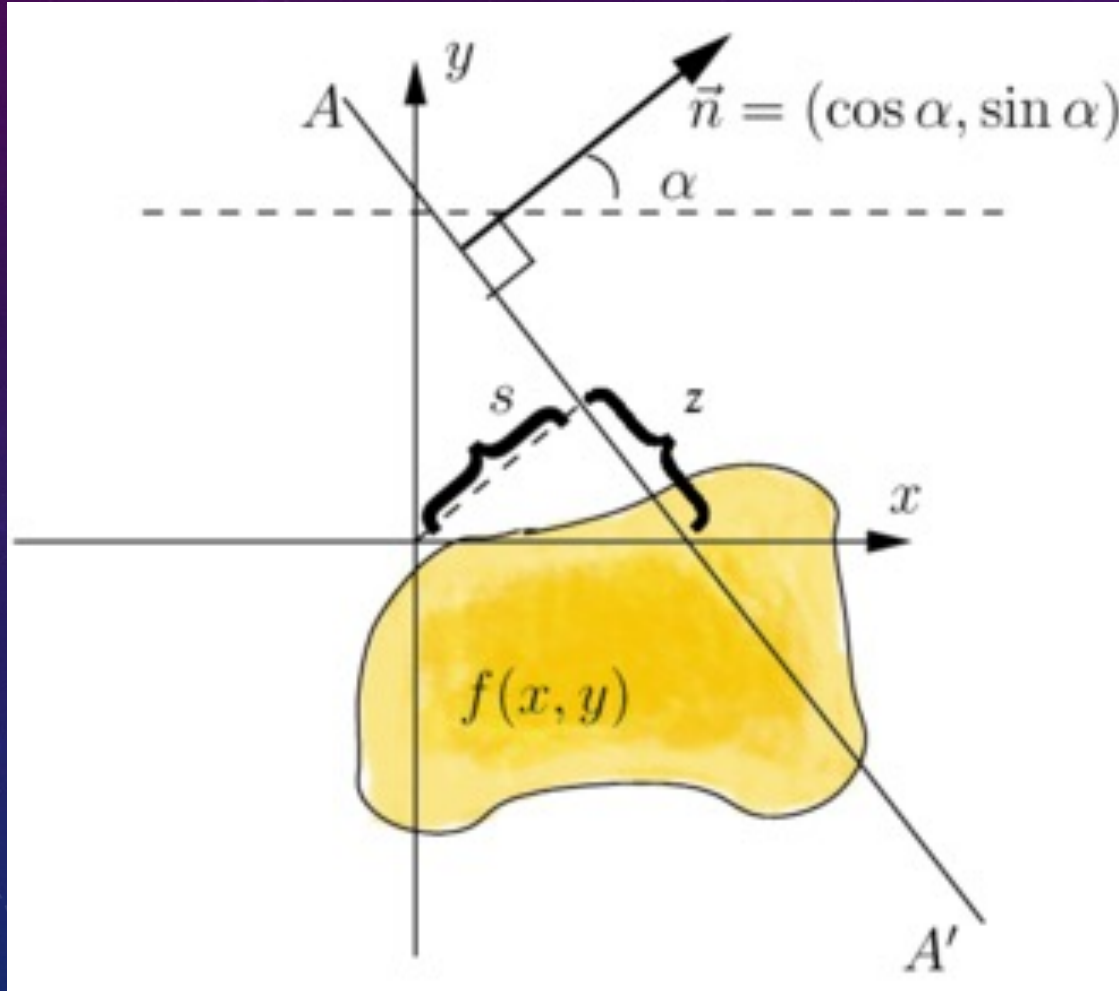
DECAY



DETECTION



PUTTING IMAGES TOGETHER



$$f(x) = \int_0^\pi (R f(\cdot, \theta) * h)(\langle x, n_\theta \rangle) d\theta$$

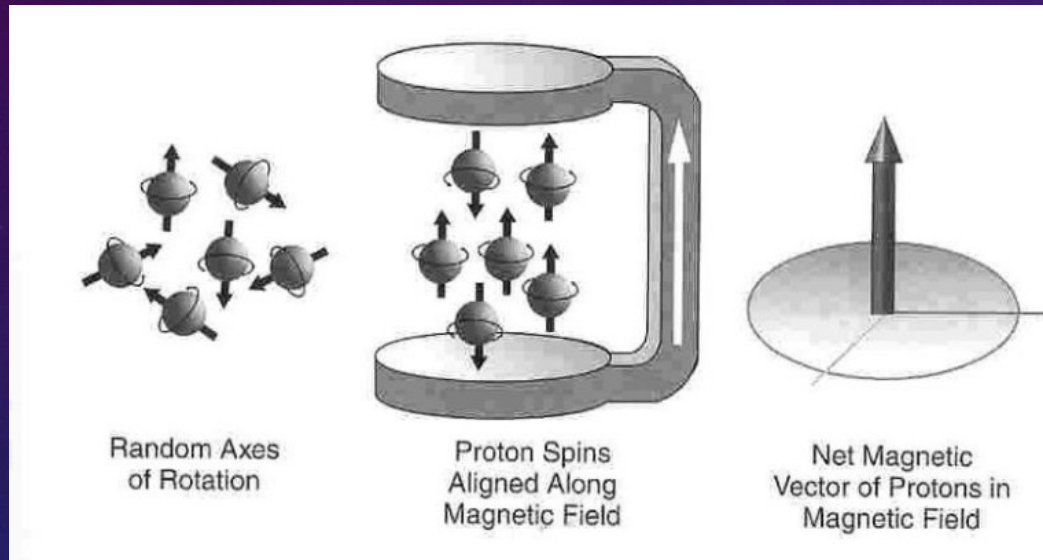
FMRI IMAGING

- *No radioactive agents this time! Just physics :D*

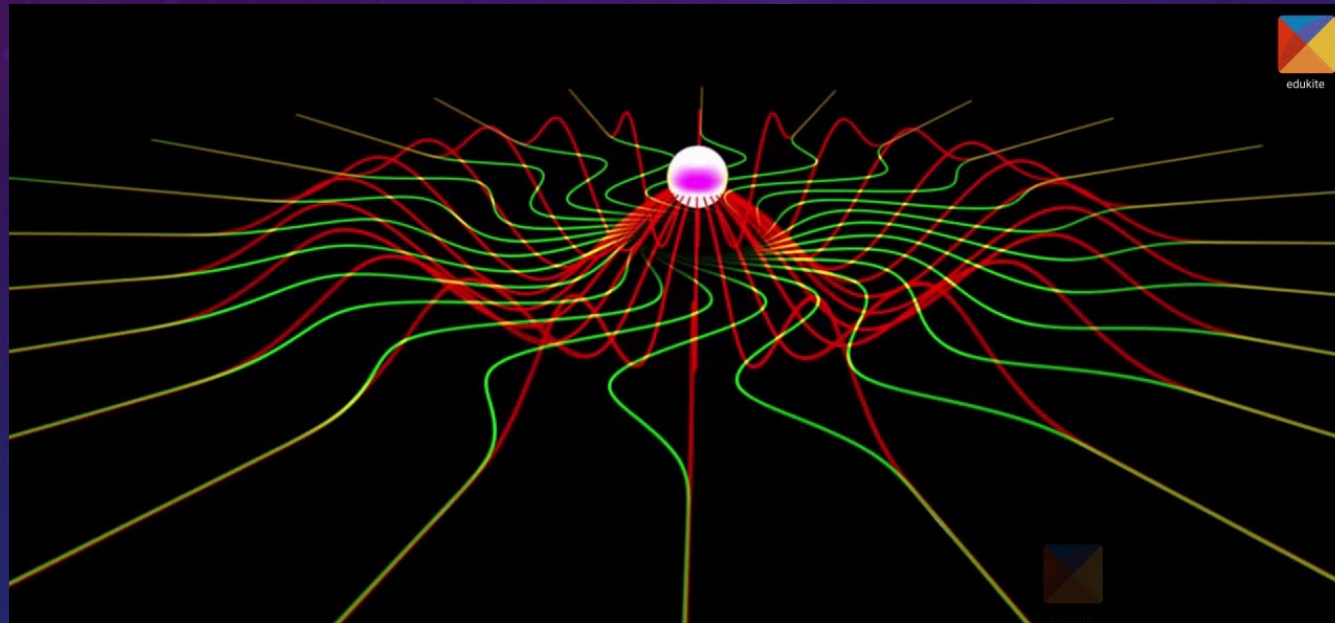
FMRI IMAGING

- *No radioactive agents this time! Just physics :D*

STRONG MAGNETIC FIELDS ALIGN PROTONS

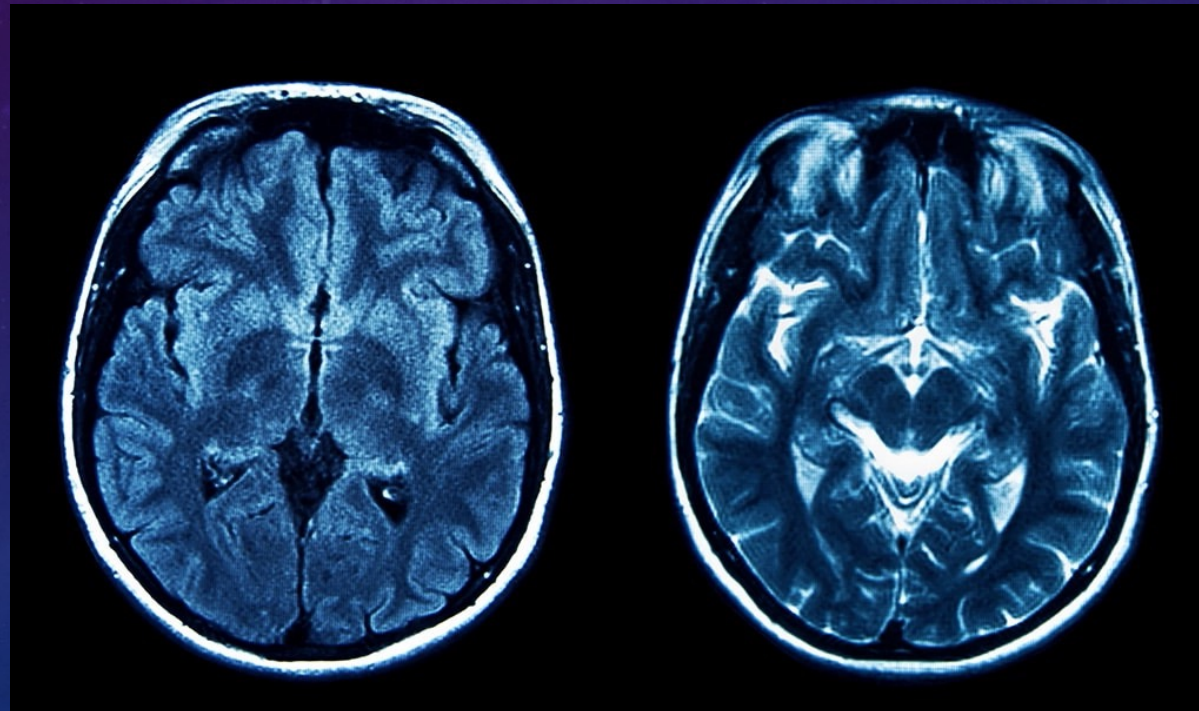


ACCELERATING CHARGED PARTICLES CREATE DETECTABLE ELECTROMAGNETIC RADIATION



RECONSTRUCTION

Using the electromagnetic radiation, we can reconstruct fMRI images!



RESEARCH IN MEDICAL IMAGING AT STANFORD

- *New PET/MRI hardware*
- *Better reconstruction*
- *Using AI to advise reconstruction or transfer between imaging modalities*
- *Now that we have an image, what now?*

IS BRAIN IMAGING MIND READING?

- No
- Well...
- *No, if we choose for it not to be*

NEUROETHICS

"What should we do with brain imaging?" >>> "What can we do with brain imaging?"

In your perfect world, what would we use brain imaging for? What would we not use it for?

