



# Applied physics

with Dr Orang Alem

## Talking points

### Knowledge

1. What does the field of applied physics involve?
2. What is magnetoencephalography (MEG)?
3. What is an optically pumped magnetometer (OPM)?

### Comprehension

4. Why is it important for MEG sensors to be as close to the brain as possible?
5. How do OPMs employ quantum mechanics?

### Application

6. How do you think OPMs are used in geophysics, navigation and materials testing?
7. How do you think MEG is used in the diagnosis and monitoring of epilepsy (a health condition caused by abnormal electrical activity in the brain)?

### Analysis

8. What factors lead to the high costs of cryogenic MEG technologies? Which of these does the FieldLine HEDscan eliminate, and which remain?
9. When scanning a child's brain, what are the advantages of the FieldLine HEDscan system compared to a cryogenic MEG device?

### Evaluation

10. MEG devices in cities are far more vulnerable to interference from other magnetic signals than those in rural areas. Despite this, why do you think they continue to be found in hospitals in large cities? Weigh up the likely costs and benefits of locating these systems in urban or rural areas.
11. The FieldLine HEDscan wearable MEG device has many benefits compared to cryogenic MEG devices. What do you think is the single most important advantage, and why?

## Activity

Design a poster or presentation that explains how optically pumped magnetometers (OPMs) work. Orang's article gives a brief overview of OPM function, but there is much more to learn. To build your understanding, follow this research process:

- Search online to find articles, diagrams or videos that explain what OPMs are.
- This is complex technology, so these explanations will likely include terms that you are unfamiliar with. Look up any unfamiliar words to find simpler definitions. You may have to repeat this process if the definitions are still very technical.
- When you are confident you understand all the terms involved, return to the original definitions of OPMs. Do you now understand how the process works?

Create a poster or short presentation to summarise what OPMs are and how they work. Use diagrams and simple explanations to illustrate each principle in an engaging and accessible way.

Next, choose a practical application for OPMs. This could be within medicine or in another field (Orang mentions a few examples, but there are many more). Look online to find out more about this use for OPMs. How are OPMs used for this application, and why? What are the advantages and disadvantages of using OPMs compared to other technologies? Create an additional poster or presentation (or extend your original one) to explain to your classmates how and why OPMs are used for your chosen application.

## More resources

- Find out more about the FieldLine HEDscan wearable MEG device: [fieldlinemedical.com](https://fieldlinemedical.com)
- This page from RadiologyInfo explains what MEG is and what is involved in an MEG procedure: [www.radiologyinfo.org/en/info/meg](https://www.radiologyinfo.org/en/info/meg)
- In this video, Svenja Knappe, one of the co-founders of FieldLine Medical, explains how OPMs can be applied to MEG: [www.youtube.com/watch?v=KXyuHOG98dY&t=91s](https://www.youtube.com/watch?v=KXyuHOG98dY&t=91s)