

A composite image of Earth from space, showing the continents of North and South America. Overlaid on the Earth are blue, glowing magnetic field lines that curve from the top to the bottom of the frame, representing the planet's magnetic field. A solid red rectangle is positioned on the right side of the image, containing the title text.

Magnetometers

Kelan Solomon

Finding Noth

- A **magnetometer** is an instrument used to measure magnetic fields. It can be used to detect the **strength**, **direction**, and **changes** in magnetic fields.

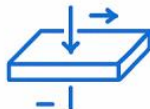


Different Types of Magnetometers



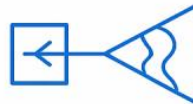
Fluxgate

- High sensitivity, wide range can measure static fields
- Bulky, high power consumption



Hall Effect

- Compact, low cost, low power consumption
- Limited sensitivity, accuracy impacted by temperature



Optically Pumped

- Very high sensitivity, very high accuracy
- Complex design, expensive, requires controlled environment



Magneto-Resistive

- Compact, low cost, low power consumption, good sensitivity
- Sensitive to temperature variations, require calibration



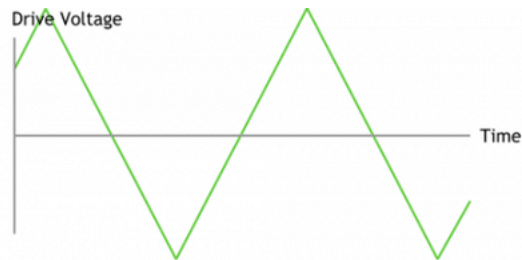
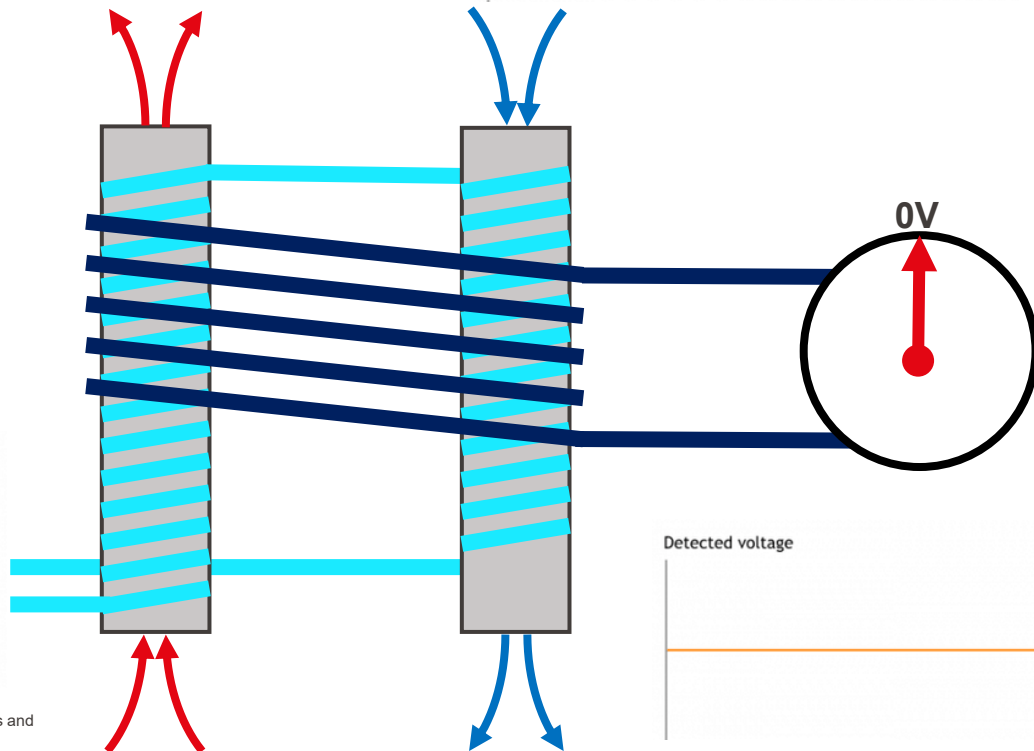
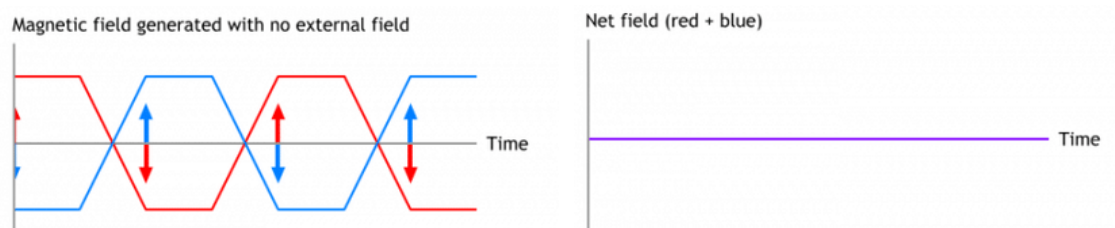
SQUID

- Extremely high sensitivity, very low noise
- Requires cryogenic cooling, delicate handling

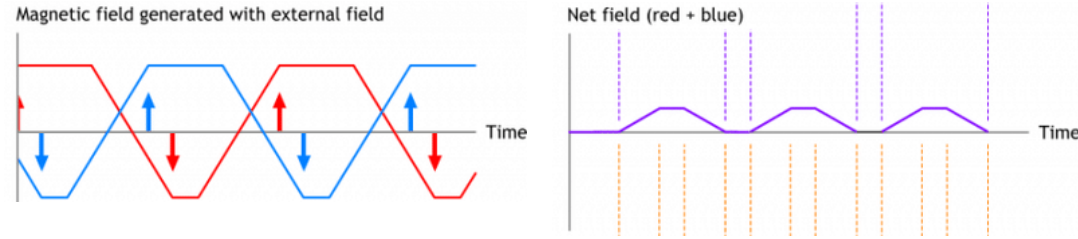


Lorentz Force

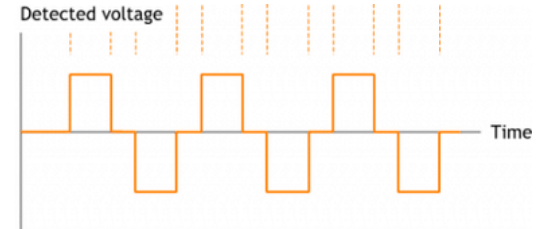
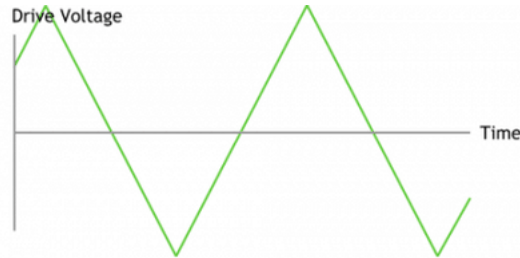
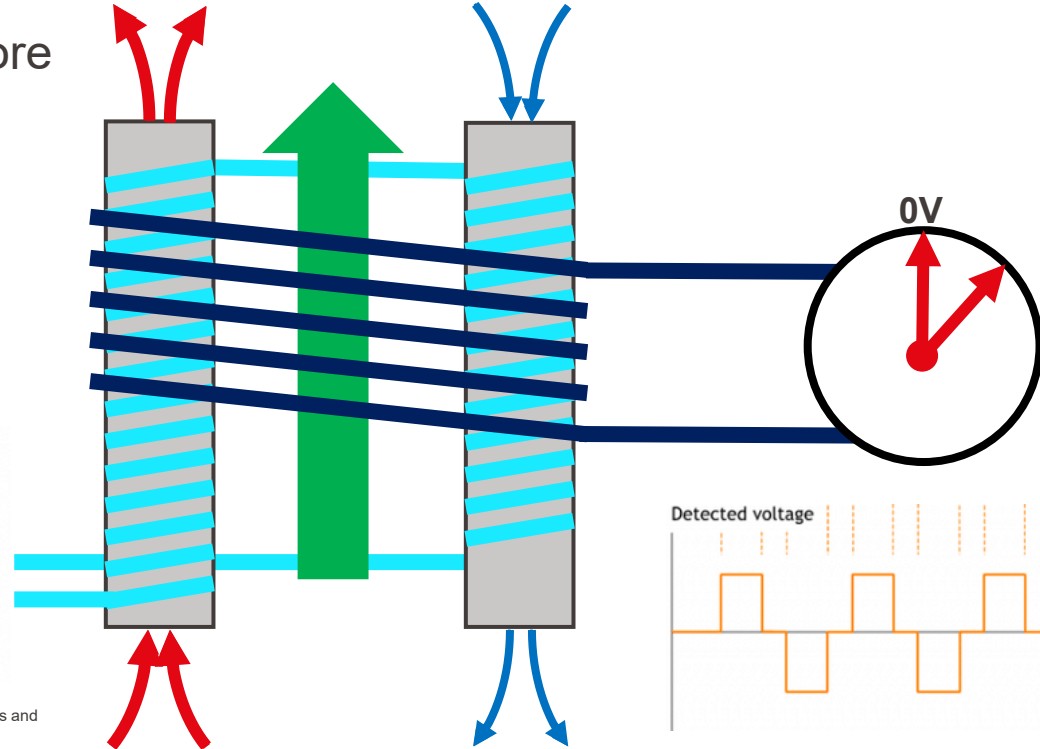
- Compact, low cost, good sensitivity
- Some sensitivity to temperature, may require calibration



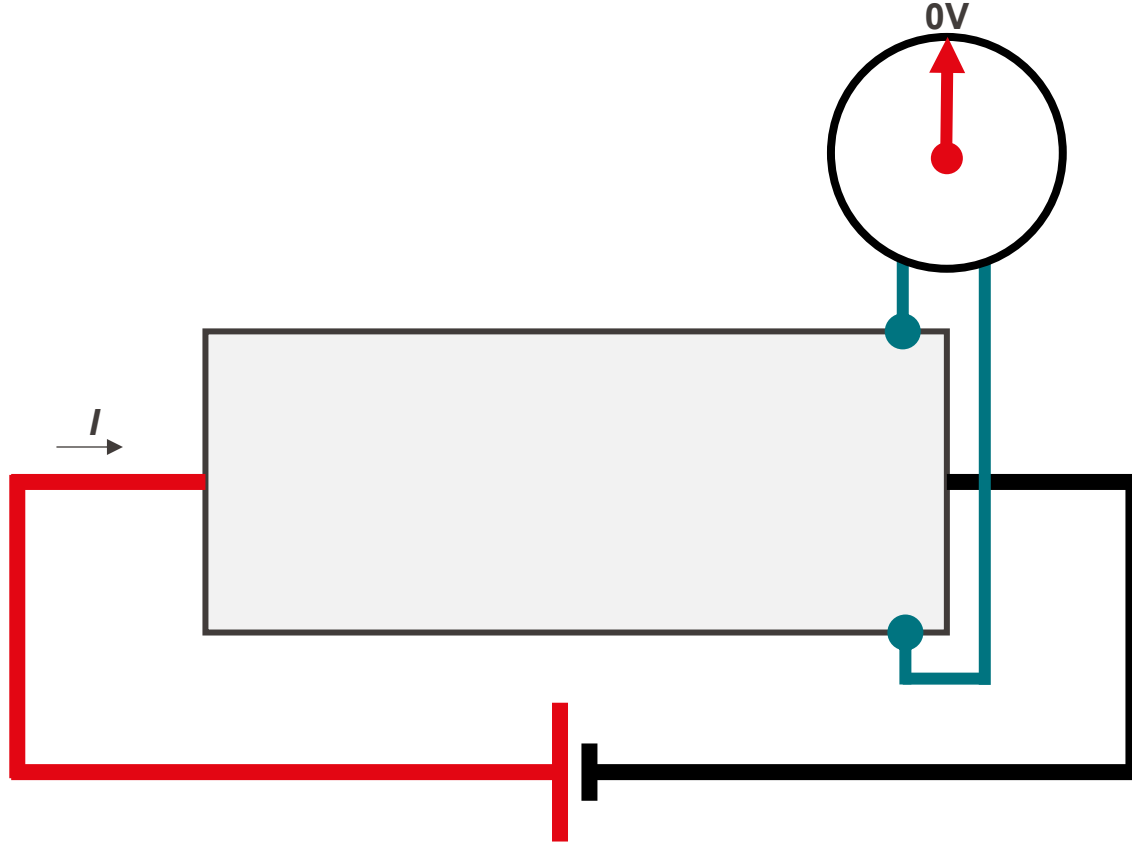
Graphs: Kwisanga, Christian. (2016). SQUID geomagnetic signal analysis and modelling of Schumann Resonances in the earth-ionosphere cavity.

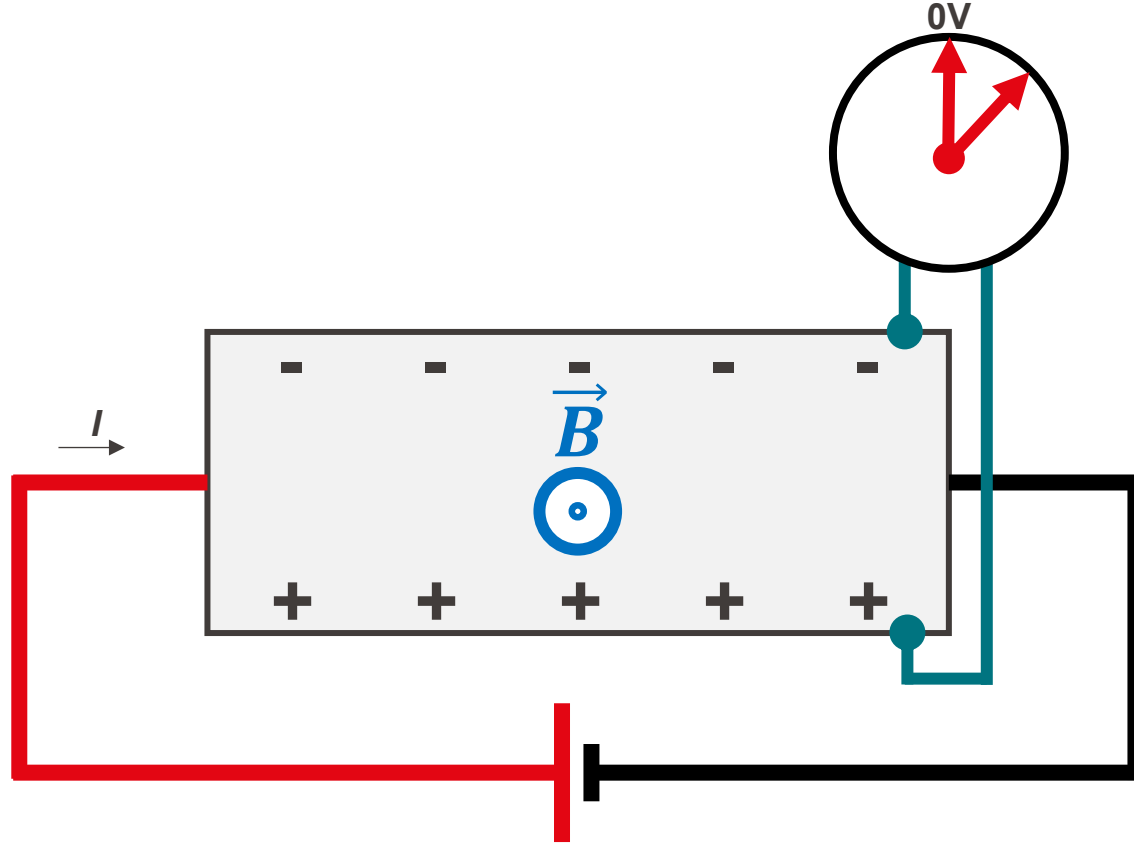


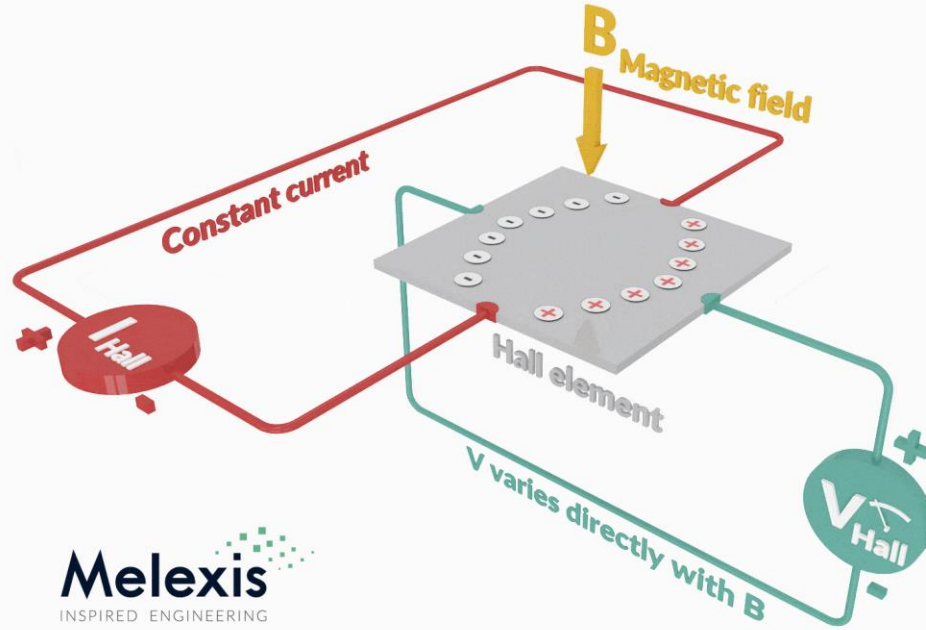
- One coil saturates before the other



Graphs: Kwisanga, Christian. (2016). SQUID geomagnetic signal analysis and modelling of Schumann Resonances in the earth-ionosphere cavity.

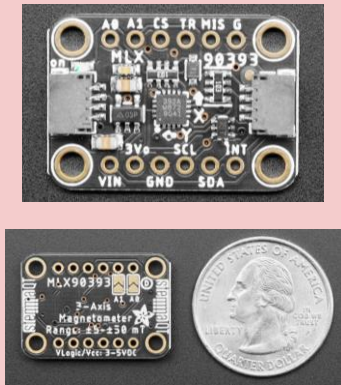







Melexis
INSPIRED ENGINEERING

Parameter	Hall Effect	Fluxgate
Sensitivity	$\sim 0.1 \mu\text{T}$	$\sim 0.1 \text{ nT}$
Cost	\$1-500	\$200-10,000+
Size	Chip-scale	cm-scale+
Power	μA -mA	10-100+ mA
Bandwidth	MHz	Hz-kHz
Temp Stability	Moderate	Good
Best Use	Consumer/Industrial	Scientific/Precision

Parameter	MLX90393	Mag-01H
Type	Hall	Fluxgate
Axis	3	1
Resolution	0.161 μ T	0.1nT
Price	10 chf	4'000 chf
Form factor		

- 9 Axis IMU
 - 3 accelerometers
 - 3 gyros
 - 3 magnetometers
- Strengths cover other sensor weaknesses
 - Gyroscopes drift over time → magnetometers help correct this by providing an absolute heading
 - When a magnetometer is tilted, it gives inaccurate heading unless corrected using accelerometer data.

A composite image of Earth from space, showing the continents of North and South America. The Earth is surrounded by a series of concentric, glowing blue lines representing its magnetic field. The background is a deep black space filled with numerous small, distant stars.

**Thank you for
listening**

Kelan Solomon