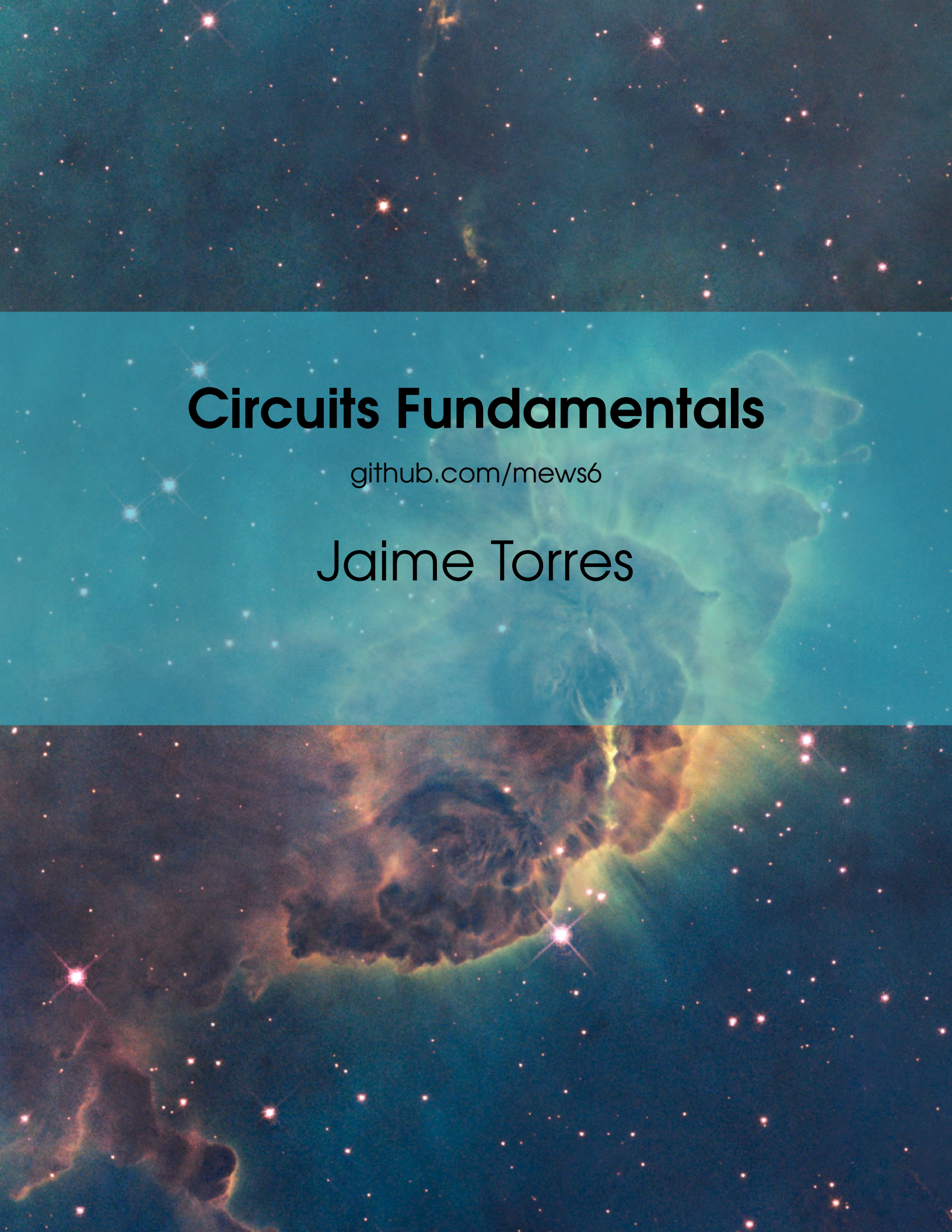

Circuits Fundamentals

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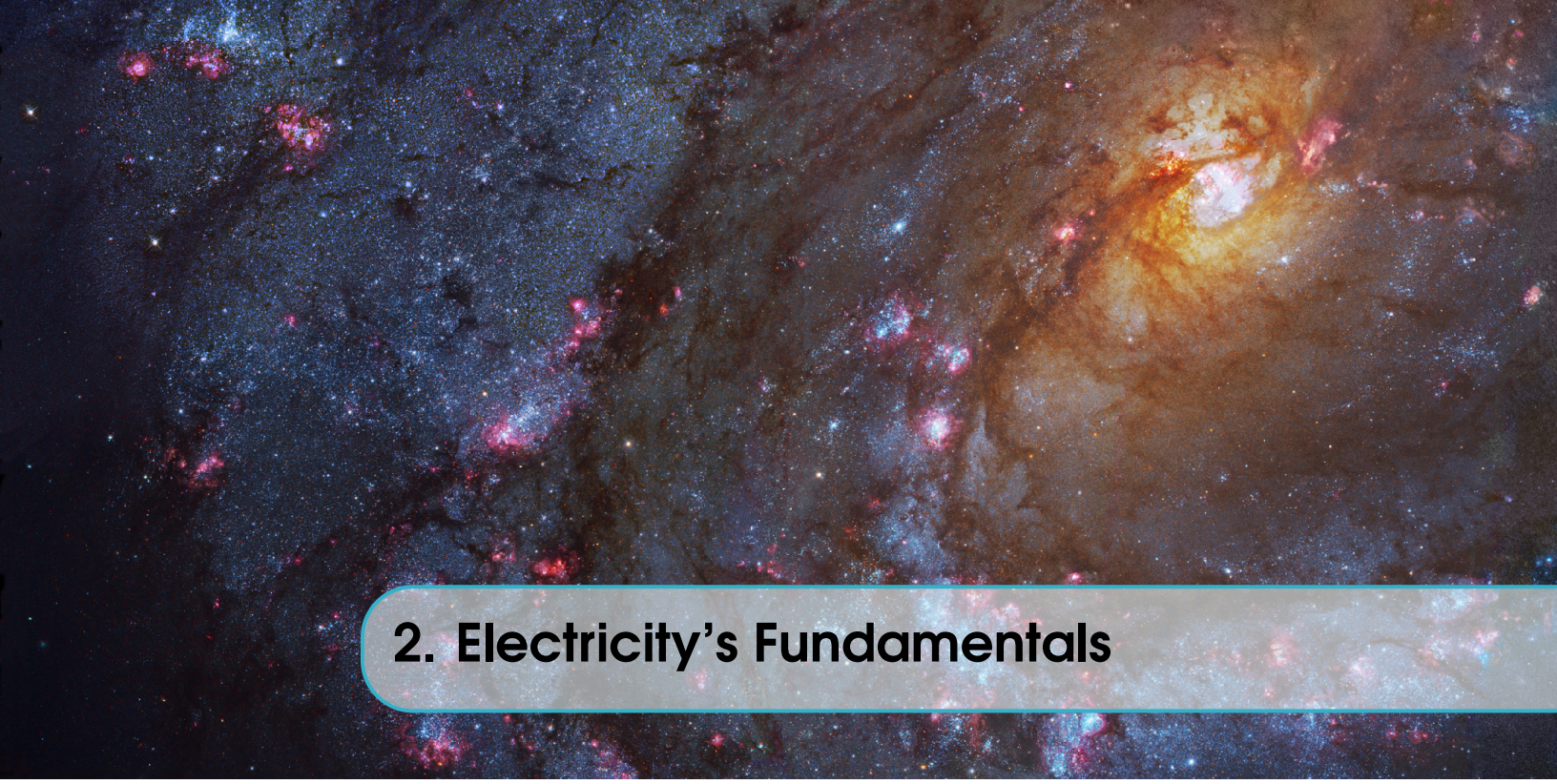
1. Introduction



2. Electricity's Fundamentals

Electricity is, in simple terms, (...)

Positive charges and negative charges are, per charge:

$$Positive: \ 1.6x10^{-19}C \tag{2.1}$$

$$Negative: \ 6.24x10^{18}e \tag{2.2}$$

They're both in the measuring unit of the other.

2.1 Coulomb's Law:

We mathematically define Coulomb's Law as:

$$F = K \cdot (\frac{Q \cdot q}{r^2}) \tag{2.3}$$

a few important constants come from:

$$K = \frac{1}{4\pi \cdot \varepsilon} \tag{2.4}$$

(2.5)

2.2 Current

When we have a group of charging moving at the same time, we can measure it in amperes, the specific measure can be explained mathematically as:

$$[I] = A = \frac{1C}{1S} \tag{2.6}$$

This is a measure of unit that has a direction, and is inherently vectorial. It is also the main way we'll measure electricity in this course

2.3 Resistivity

It is possible to control Current through resistant materials that can stop partially the flow of electrons. This comes in a sense, as a consequence of Ohm's Law.

We can calculate resistivity as:

$$R = \rho(T^o)x(\frac{L}{A}) \tag{2.7}$$

This 'R' we have in the previous formula is actually an Ohm, and can also be written as Ω.

2.3.1 Effects driven by temperature

Temperature can make it so there are more or fewer free electrons. The higher the temperature, the more free electrons; In a sense this happens because heat physically is a measure of how much (...). The fact there are little to no electrons helps the current technology on superconductivity.

2.3.2 Aislants

An Aislant is meant to make resistivity as large as possible, and even though perfect aislants are, in practice, impossible to achieve, it makes the flow of electrons negligible.

2.4 Conductivity

The opposite of Resistivity is conductivity. This is measured in Siemens, and can be expressed as:

$$[G] = S = \frac{1}{\Omega} \tag{2.8}$$

2.5 Closed and Open Circuits

We can think on circuits being broadly classified in two: An open circuit, which implies (...), or a closed circuit, which implies (...).

3. Kirchoff's Laws