

## Electromagnetism 4

### 17.1 Ampère's law

Ampère's circuital law relates the total magnetic field along an arbitrary, closed loop  $C$  to the electric current passing through an open surface bounded by the loop. In integral form, Ampère's law is

$$\oint_C \mathbf{B} \cdot d\boldsymbol{\ell} = \mu_0 \int_S \mathbf{J} \cdot d\mathbf{S} = \mu_0 I_{\text{enc.}}, \quad (17.1)$$

where  $d\boldsymbol{\ell}$  is an infinitesimal line segment of the curve  $C$ ;  $d\mathbf{S}$  is an infinitesimal area segment of the surface  $S$ , in the direction of the normal to  $S$ ;  $\mu_0$  is the permeability of free space and  $I_{\text{enc.}}$  is the current passing through the surface  $S$ .