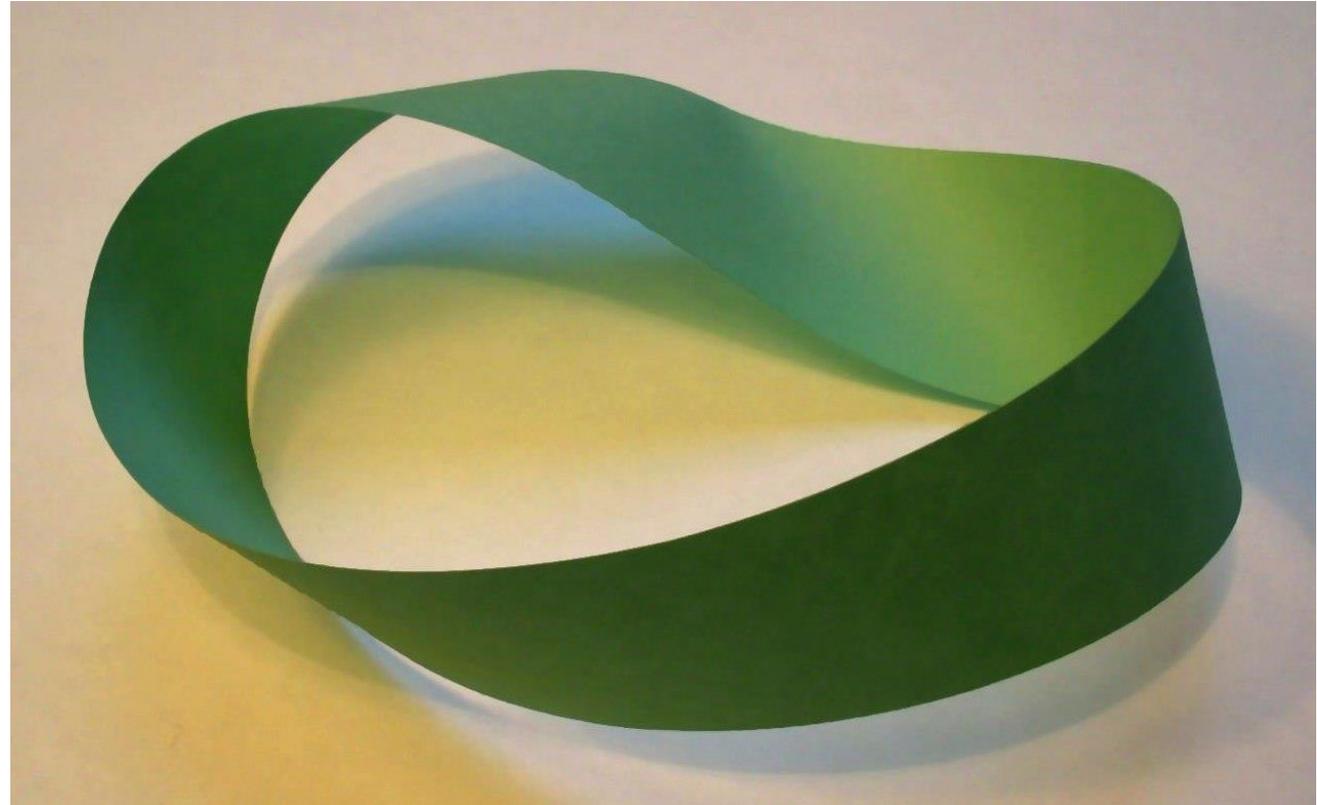
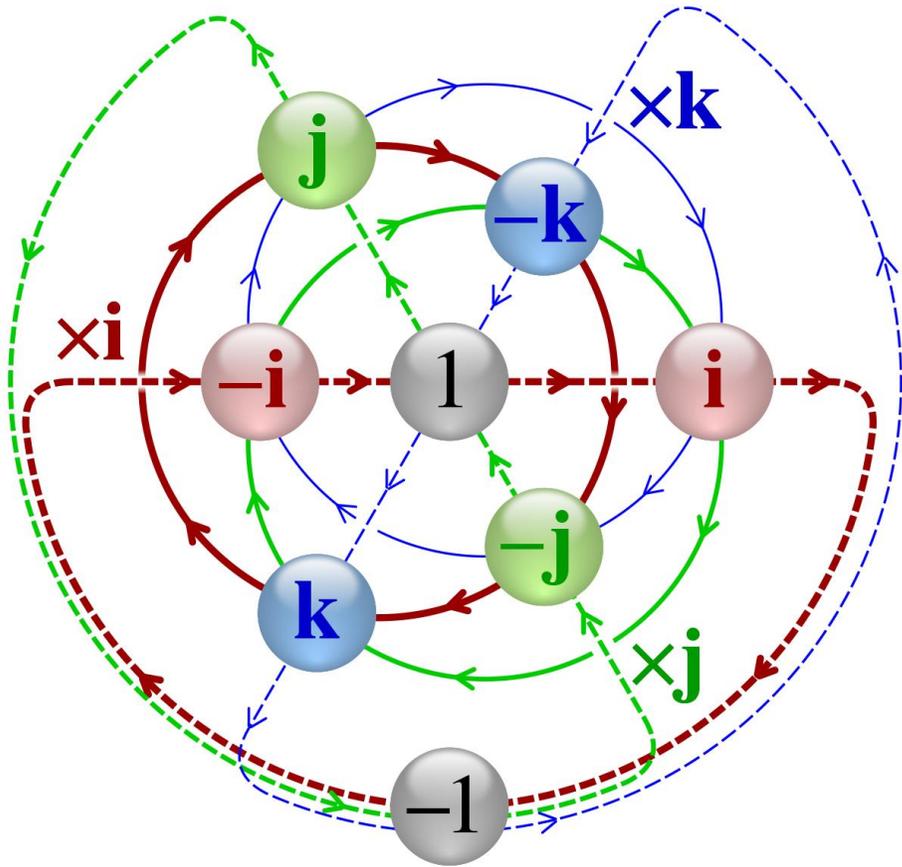
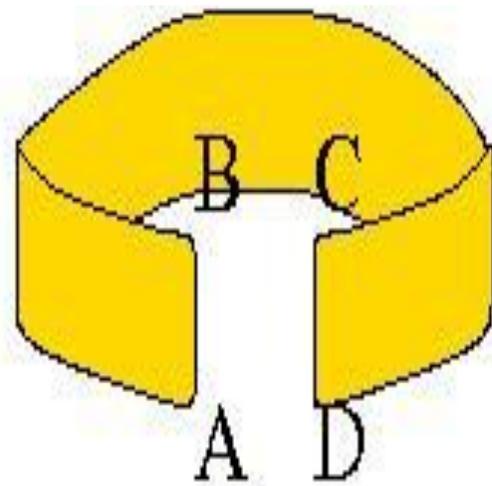
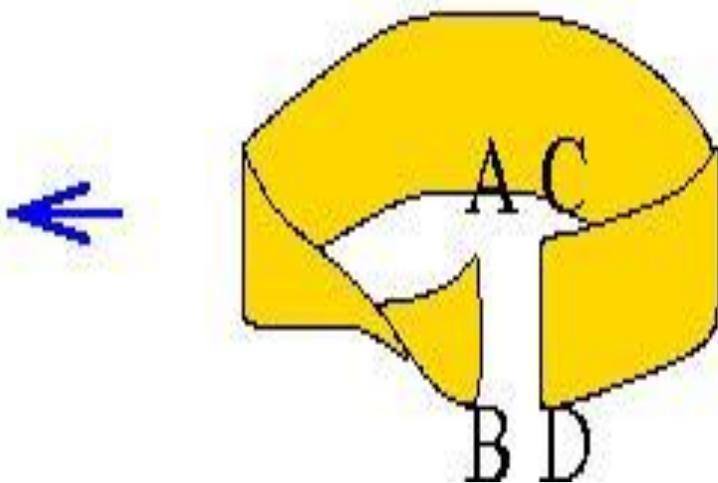
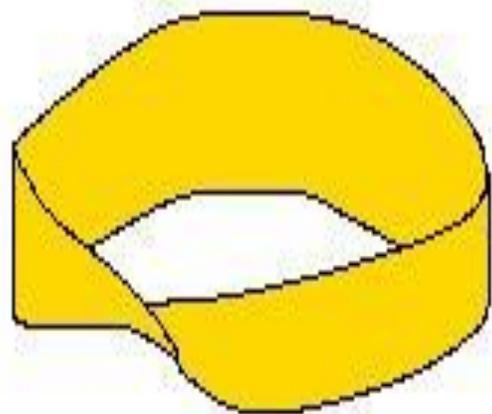


# Quaternions et rubans de Möbius

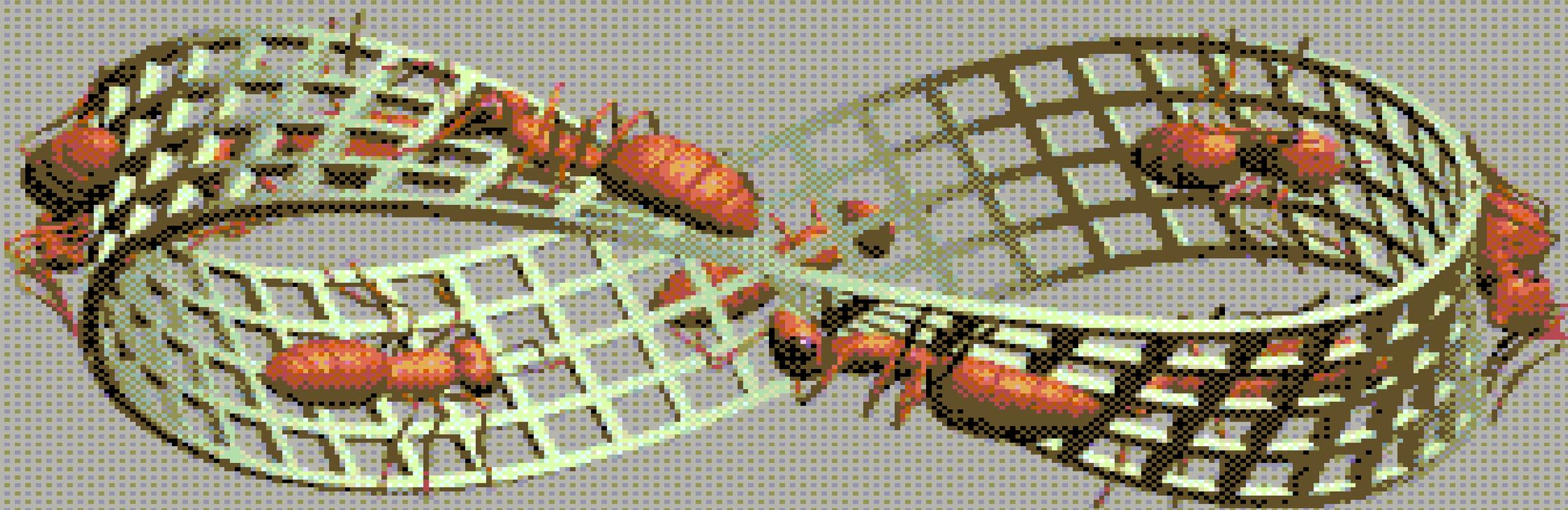




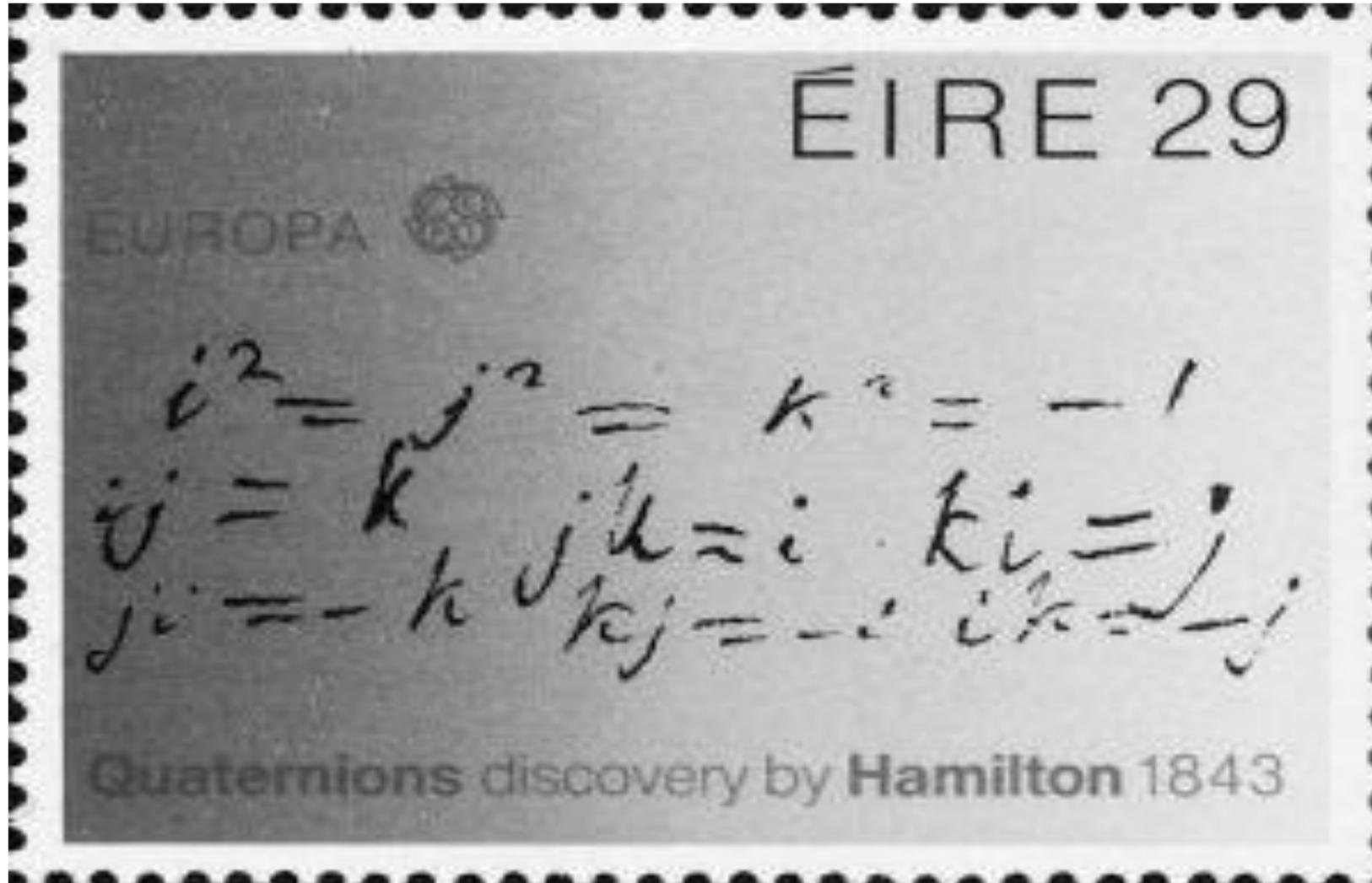
**RUBAN**



**De Möbius**



# Quaternions



# Quaternions

**Un microsystème de calcul  
multiplicatif à 8 éléments (Groupe)  
engendré par :**

$$1, i, j, k$$

**Tels que :**

$$i^2 = j^2 = k^2 = ijk = -1$$

# Quaternions

$\times$	$1$	$i$	$j$	$k$
$1$	$1$	$i$	$j$	$k$
$i$	$i$	$-1$	$k$	$-j$
$j$	$j$	$-k$	$-1$	$i$
$k$	$k$	$j$	$-i$	$-1$

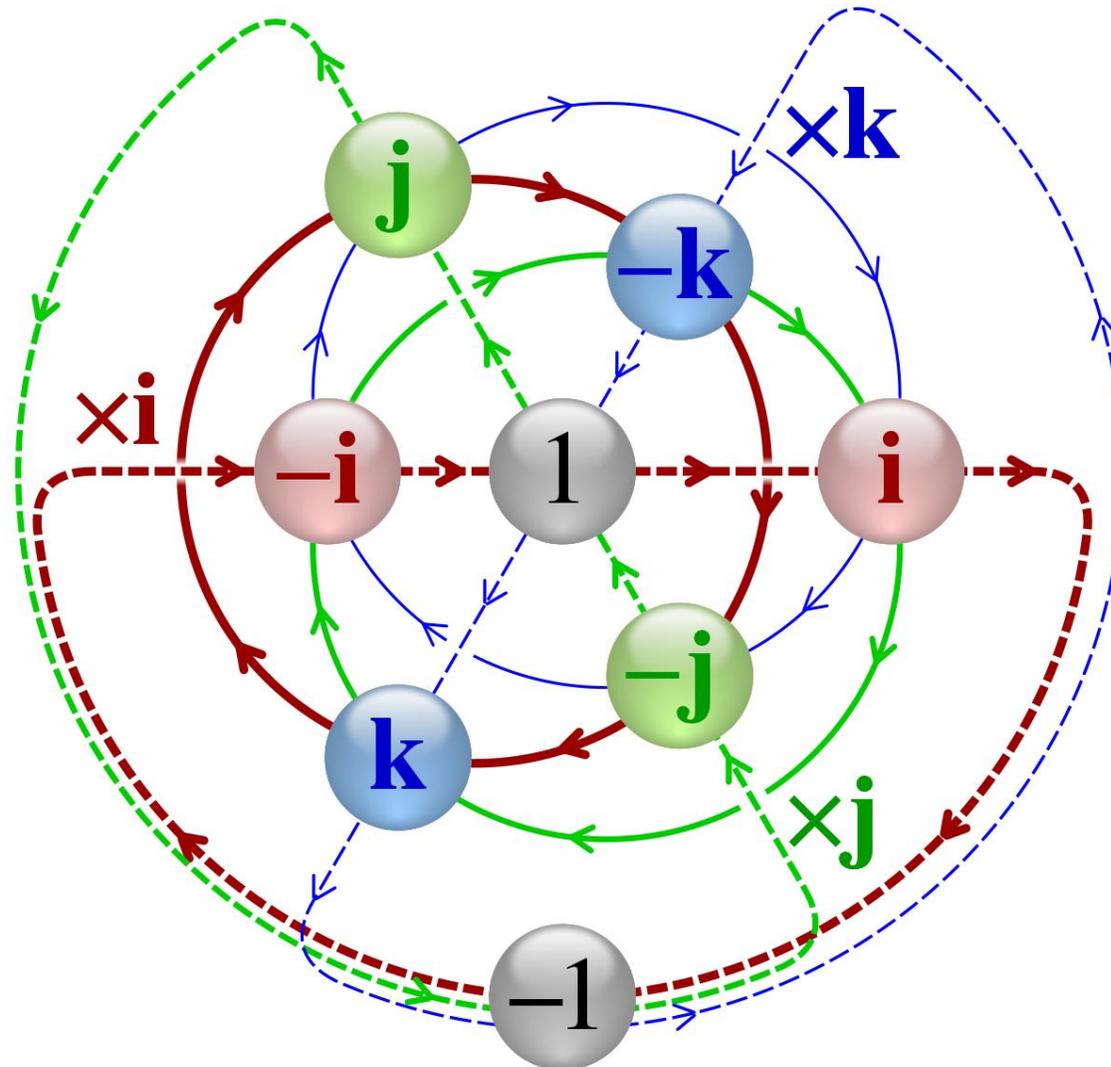
**Table de multiplication**

$$Q = \{\pm 1, \pm i, \pm j, \pm k\}$$

$$(-1)^2 = 1, \quad i^2 = j^2 = k^2 = -1$$

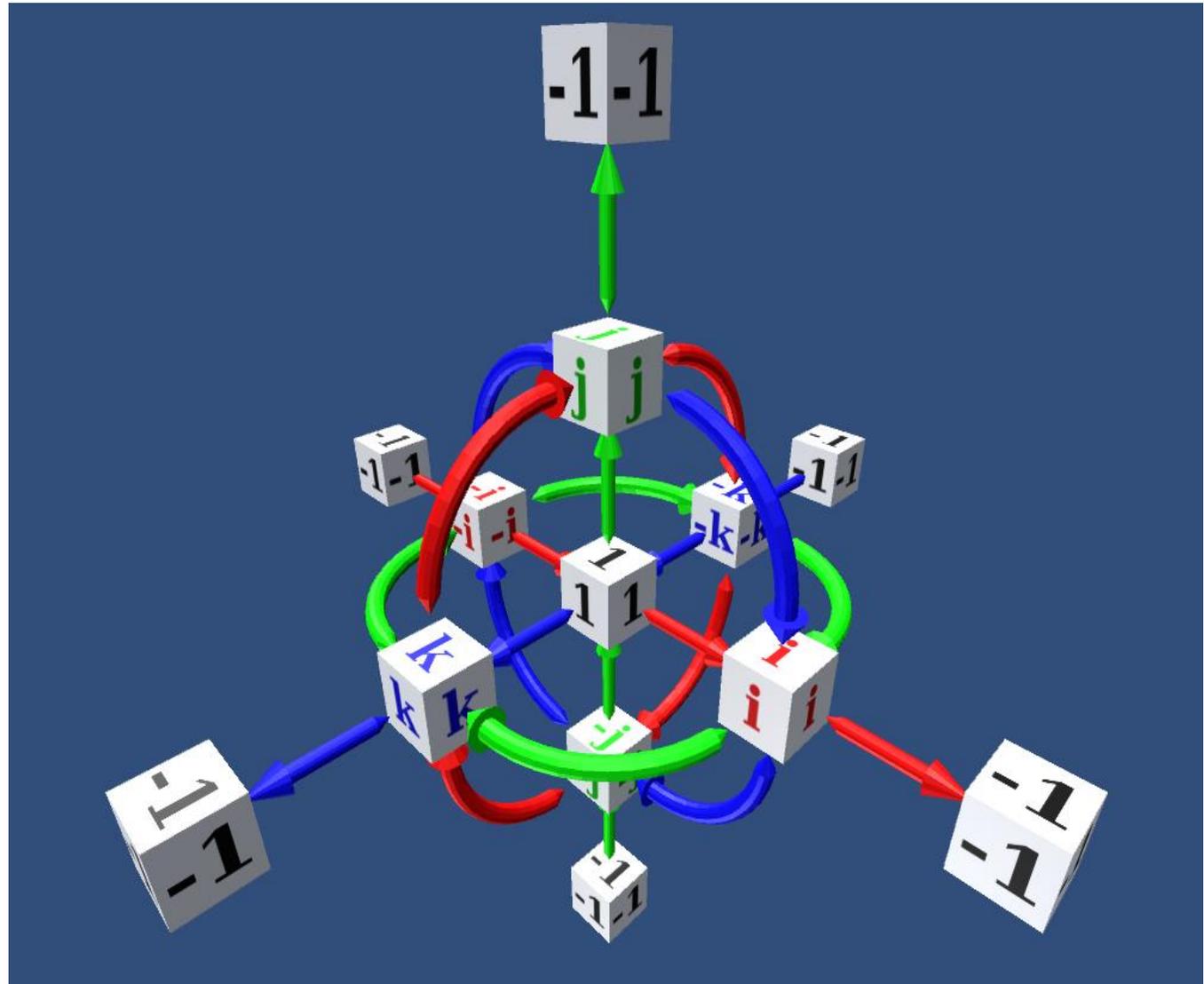
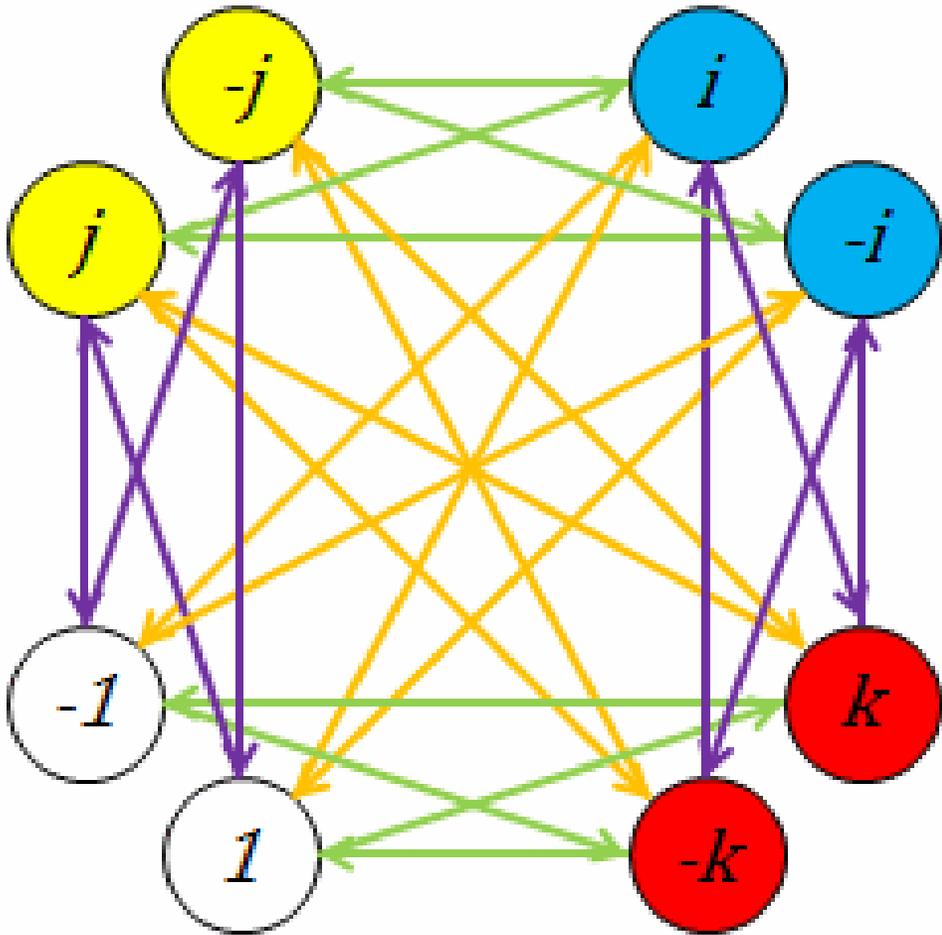
$ij = k,$	$jk = i,$	$ki = j$
$ji = -k,$	$kj = -i,$	$ik = -j$

# Représentation des Quaternions

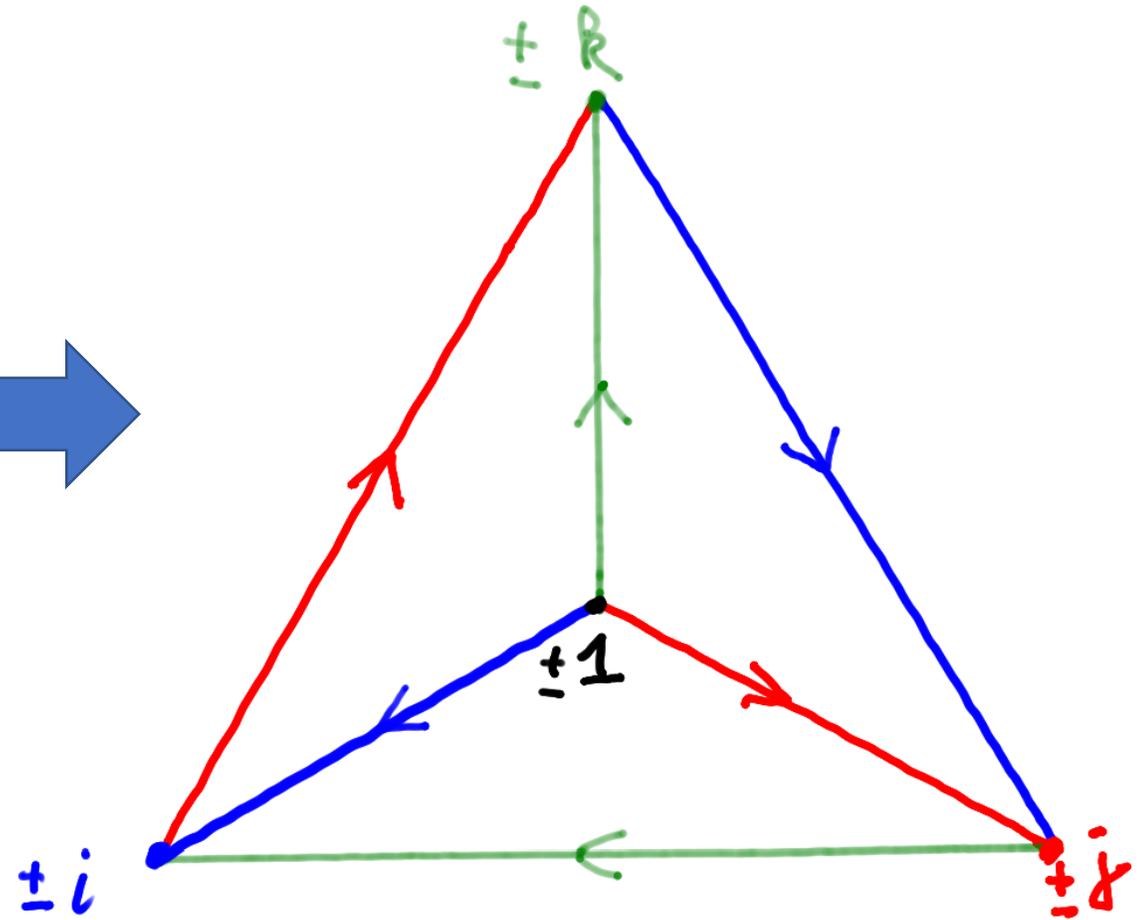
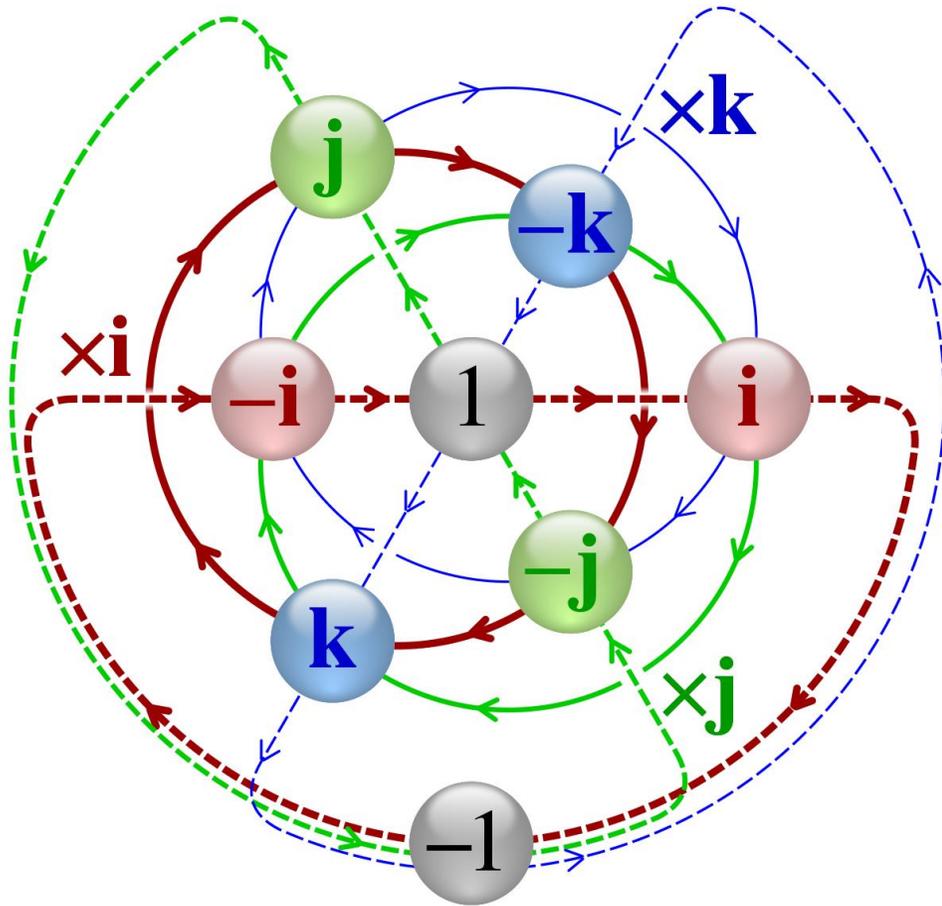


*Graphe de Cayley*

# Représentation des Quaternions

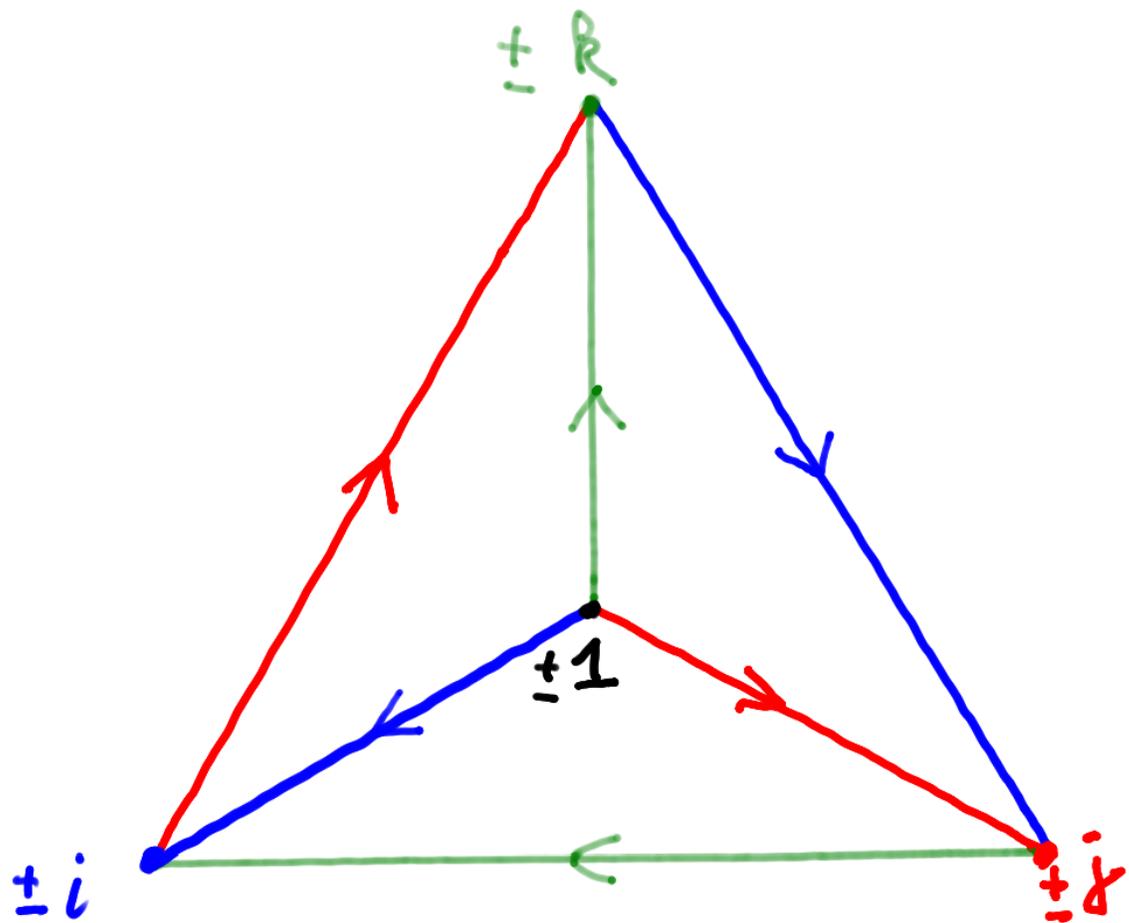
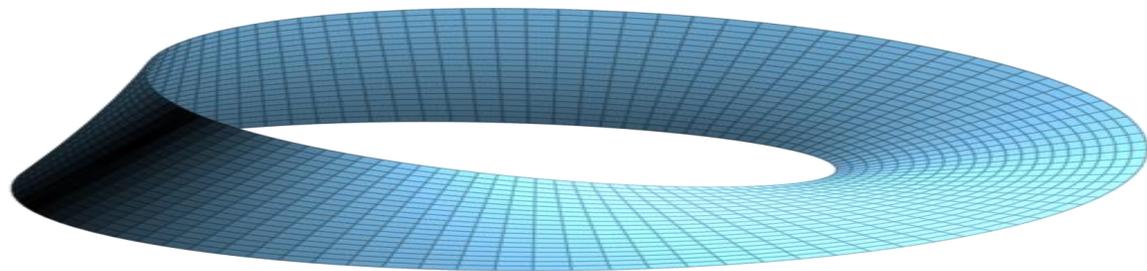


# Représentation des Quaternions





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