

1 Unitary matrices

Unitary matrices are complex matrices that satisfy the condition $M^\dagger M = I$, where I denotes the identity matrix. *Special* unitary matrices satisfy the additional condition that $\det M = 1$. The $n \times n$ special unitary matrices are denoted by $SU(n)$, which turns out to be a Lie group.

- (a) Find any one element of $SU(2)$.
- (b) Find at least one 1-parameter family of elements of $SU(2)$, that is, a family of matrices $M(\alpha) \in SU(2)$ satisfying:
 - $M(0) = I$
 - $M(\alpha + \beta) = M(\alpha)M(\beta)$
- (c) Find the most general element of $SU(2)$.