

**Exercise Sheet 13**  
**Advanced Quantum Theory**  
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**Exercise 1:**

Show that  $SU(2)$  is simply connected.

Hint:

- (a) simply connected  $\Leftrightarrow$  a continuous closed curve can be continuously contracted = deformed to a point.
- (b)  $\mathbb{R}^3$  is simply connected.

**Exercise 2:**

Show that the construction carried out in III.2.9 produces  $\vec{S} = \frac{\sigma}{2}$  on a two dimensional Hilbert space.

**Exercise 3:**

Verify the  $\vec{x}$ -representation of the free particle time evolution in III.3.3.