

Okayama University  
Faculty of Science

Research Institute for Interdisciplinary Science  
Prof. Harald Jeschke  
Asst. Prof. Nayuta Takemori



Okayama, October 30, 2018

Exercises for Advanced Physics 2, 2018 term 3

**Exercise Set 4**

(Due date: Tuesday, November 13, 2018)

**Exercise 7 (Spin orbit coupling)** (10 points)

The operator for the spin-orbit interaction is given by

$$H_{\text{SO}} = \lambda \vec{L} \cdot \vec{S}$$

Calculate the following commutators and comment the meaning of your result:

- (a)  $[\mathbf{H}_{\text{SO}}, \vec{L}]_-$
- (b)  $[\mathbf{H}_{\text{SO}}, \vec{S}]_-$
- (c)  $[\mathbf{H}_{\text{SO}}, \vec{L}^2]_-$
- (d)  $[\mathbf{H}_{\text{SO}}, \vec{S}^2]_-$
- (e)  $[\mathbf{H}_{\text{SO}}, \vec{J}^2]_-$  where  $\vec{J} = \vec{L} + \vec{S}$ .