



Theory: T-12

“Shipwreck”

## Motivation

- How to use the astronomical skill to find a position with limited conditions



# T-12 Shipwreck



*Credit: National Geographic*



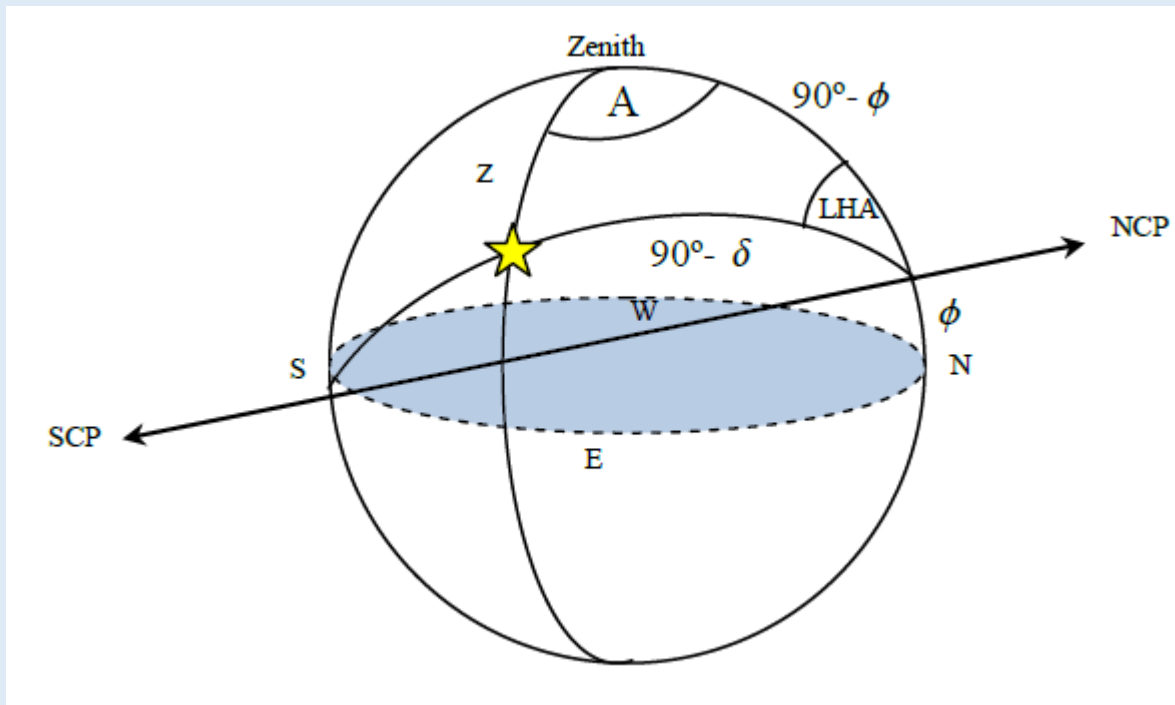
# T-12 Shipwreck

## Objectives

- Find the position of the island with limited information

## Task T12a (10 marks)

- Find the Local Hour Angle (LHA) of Rigel.



$$\frac{\sin \text{LHA}^*}{\sin z} = \frac{\sin A}{\sin(90^\circ - \delta)}$$

## Task T12b (10 marks)

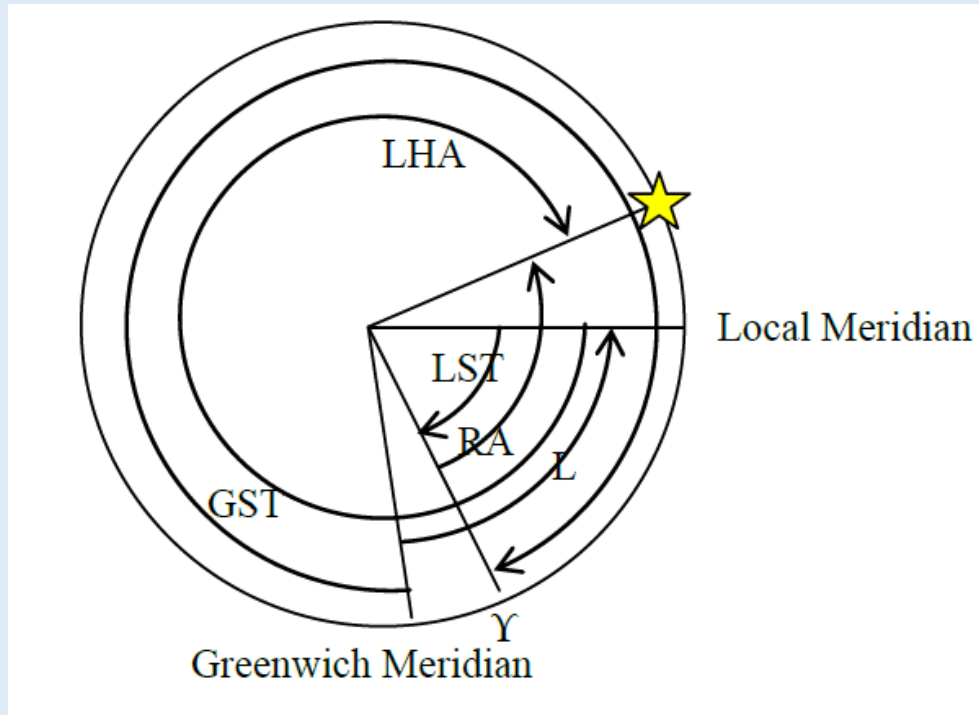
- Find the Greenwich sidereal time (GST).

$\text{GST} = \text{GST of 1}^{\text{st}} \text{ Jan} + \text{The angle that } \Upsilon \text{ moves away from 1}^{\text{st}} \text{ Jan}$

$$\text{GST} = 6\text{h } 43\text{min} + \left( 323 \frac{18}{24} \text{ days} \right) \left( \frac{1}{365.2564^{\circ}} \right) \times 24 \frac{\text{h}}{\text{day}} + 18\text{h}$$

## Task T12c (10 marks)

- Find the longitude of the island.



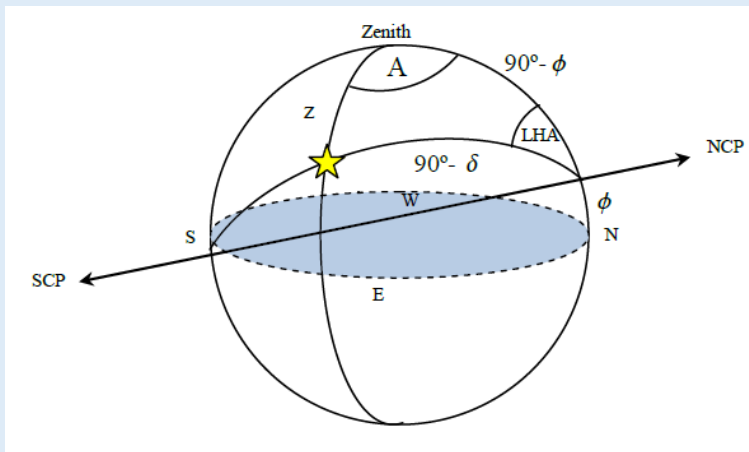
$$24\text{h} - \text{LHA} = \text{RA} - \text{LST}$$

$$\text{LST} = \text{RA} - 24\text{h} + \text{LHA}$$

$$L = \text{RA} + \text{LHA} - \text{GST}$$

## Task T12d (20 marks)

- Find, accurately to arcminute, the Latitude of the island.



$$\alpha = \sin \delta, \quad \beta = \sin(h), \quad \gamma = \cos(h) \cos A, \quad x = \sin \phi$$

$$\alpha = \beta x + \gamma \sqrt{1 - x^2}$$

$$(\beta^2 + \gamma^2)x^2 - 2\alpha\beta x + (\alpha^2 - \gamma^2) = 0$$

$$x = \frac{\alpha\beta \pm \gamma \sqrt{\gamma^2 + \beta^2 - \alpha^2}}{\beta^2 + \gamma^2}$$

$$\cos(90^\circ - \delta) = \cos z \cos(90^\circ - \phi) + \sin z \sin(90^\circ - \phi) \cos A$$

$$\sin \delta = \sin(h) \sin \phi + \cos(h) \cos A \cos \phi$$





# Knowledge

- Coordinate & Times
  - Celestial Sphere
  - Concept of Time