CANADIAN ASTRONOMY OLYMPIAD

2018 Problems

6 problems Total: 36 points

Problem 1 Repetition of Uranus Opposition and Saturn Conjunction (6 points)

On September 17th, 2009, Uranus was in opposition and Saturn in conjunction, so the two planets were on opposite sides of the Sun. After how many years does their maximum-separation configuration repeat?

Problem 2 Initial Distance of a Receding Galaxy (6 points)

During the time light from a distant galaxy took to reach us, the galaxy receded by 10 Mpc. Estimate its initial distance.

Problem 3 Orbital Distance of Two Neutron Stars (6 points)

Two neutron stars of equal mass orbit their common centre of mass with a period of 7 hours. Each has mass $1.4\,M_\odot$. Find their separation. Take $M_\odot = 2 \times 10^{30}$ kg.

Problem 4 Field of View of a Telescope (6 points)

In a non-tracking telescope, α Aurigae $\left(\delta = +46^\circ 0' 14.4''\right)$ takes 2.5 minutes to cross the field *along its diameter*. For a telescope with aperture $d = 400$ mm and focal length $f = 4000$ mm, can the full Moon fit entirely in the field?

Problem 5 Mass of an Elliptical Galaxy (6 points)

An elliptical galaxy has apparent magnitude $m = 18$ and redshift $z = 0.1$. Estimate its mass, neglecting interstellar absorption.

Problem 6 Latitude of an Observer on June 22 (6 points)

At *local solar noon* on June 22, an observer standing upright on level ground finds that their shadow has the same length as their height. Find the observer's latitude.