






## Measuring the Universe 4: Cosmic distance ladder

### Components

	NAME	DESCRIPTION	AUDIENCE
	<i>Cosmic distance ladder</i> teachers guide	The guide includes information about how to use the factsheets and worksheet contained within this resource.	teachers
	<i>Explanation of the cosmic distance ladder</i> background sheet	Four rungs on the cosmic distance ladder are explained in detail: stellar parallax; Cepheid variables; Type 1a supernovae; and cosmological red-shift.	teachers
	<i>Climbing the cosmic distance ladder</i> fact sheet	This fact sheet shows the scales on which different measurement techniques operate. Collectively, these techniques are known as the cosmic distance ladder.	students
	<i>Death of a star</i> fact sheet	Certain types of supernovae are instrumental in measurements across the Universe. This fact sheet explains how supernovae form.	students
	<i>Travelling the Universe</i> worksheet	How big is the Solar System? How far away are the stars? This worksheet explores distances in the Universe through a practical activity and questions.	students

### Purpose

To extend students understanding of how astronomers use a variety of techniques to measure the Universe, and construct a scale known as the cosmic distance ladder.

### Outcomes

Students:

- describe how astronomers use a variety of extra-terrestrial objects to build the cosmic distance ladder;
- describe how astronomers use direct and indirect measurement techniques to build the cosmic distance ladder;
- explain the progressive steps of the cosmic distance ladder; and
- use a scale to build a model of the solar system, and perform calculations involving astronomical units.

### Activity summary

ACTIVITY	POSSIBLE STRATEGY
Distribute the fact sheets, <i>Climbing the cosmic distance ladder</i> and <i>Death of a star</i> . Record, on a placemat, information under the headings 'direct measurement', 'indirect measurement', 'Cepheid variables' and 'supernovae'.	Students work in groups on a placemat activity.
Distribute the worksheet, <i>Travelling the Universe</i> . In part one of the worksheet, students construct a model of the Solar System that addresses the size of the Solar System, and relative sizes of planets and the Sun.	whole class discussion and activity
Part two of the worksheet contains more challenging questions that relate to concepts explored in the fact sheets, and calculations using astronomical units.	individual or pairs

## Technical requirements

The teachers guide, fact sheets, background sheet and worksheet require Adobe Reader which is a free download from [www.adobe.com](http://www.adobe.com). The worksheet is also provided in Microsoft Word format.

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## Associated SPICE resources

*Measuring the Universe 4: Cosmic distance ladder* may be used in conjunction with related SPICE resources to address the broader topic of tools used by astronomers to measure distances in the Universe.

DESCRIPTION	LEARNING PURPOSE
<i>Measuring the Universe</i> This learning pathway shows how a number of SPICE resources can be combined to teach aspects of how astronomers measure distances in the Universe.	
<i>Measuring the Universe 1: Transient astronomy</i> A video describes mysterious gamma ray bursts, which were first observed in the sixties.	<b>Engage</b>
<i>Measuring the Universe 2: Virtual observatory</i> Students use a learning object to simulate processes used by astronomers to discover supernovae.	<b>Explore</b>
<i>Measuring the Universe 3: Distances in the Universe</i> A presentation and worksheet introduce different methods used by astronomers to measure distances in the Universe.	<b>Explain</b>
<i>Measuring the Universe 4: The cosmic distance ladder</i> The cosmic distance ladder is the term used to describe the collection of techniques used by astronomers to measure distances in the Universe. Measurements established by one technique are used to calibrate techniques that measure greater distances.	<b>Elaborate</b>