

Ripple tank for projection

DW401-2W

Experiment Manual

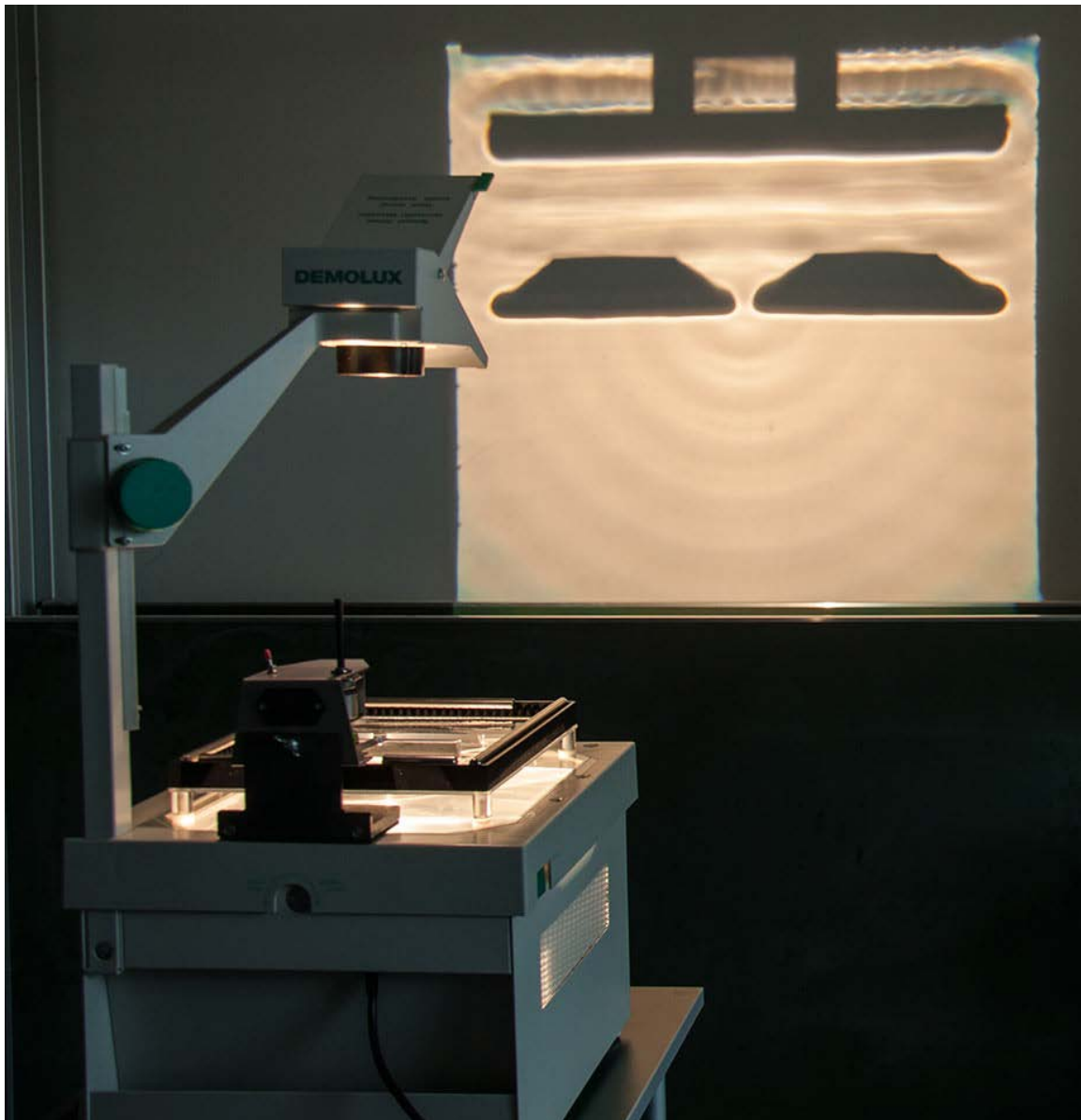


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Material:

Item no.	Qty.	Name
DW401-2W	1	Ripple tank for overhead projection
	1	Overhead projector

Purpose:

To demonstrate the dispersion of waves.

Set-up:

Set up and adjust according to the assembly instructions.
Only one ripple generator for point-source waves is used in the rippler initially.



Experiment 1:

The oscillation controller is set to a low oscillation rate.
The rippler is switched on and the oscillating bar nudged into motion with a finger.

Discovery:

We create a circular wave.

Bright and dark concentric circles occur according to the wave crests and troughs.

The points reached by a wave at the same time form a wavefront.
Each point on the wavefront can be regarded as the starting point of a new elementary wave, the full overlapping of which forms the observable wave.



Please note:

A wavelength corresponds to the distance between two wave crests or two troughs.

Experiment 2:

We increase the oscillation rate and compare the wavelength to Experiment 1.

Discovery:

The faster the oscillation, the shorter the wavelength.



Note:

At a certain oscillation rate (around the middle position of the knob) the leaf spring reaches resonance, resulting a large amplitude.

This can cause the point dipper to touch the base plate and splash water about.

The device does not suffer any damage from this.
To prevent this, simply limit the amplitude with your index finger.

DISPERSION OF WAVES

AKD 7.01

Experiment 3:

Only one ripple generator for plane waves is used in the rippler initially.



Discovery:

We now generate plane waves.

According to the wave crests and troughs, light and dark parallel stripes result.

As the oscillation rate (frequency) is increased, the wavelength decreases.



Material:

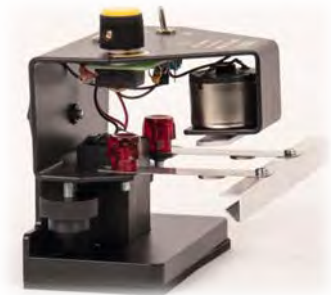
Item no.	Qty.	Name
DW401-2W	1	Ripple tank for overhead projection
	1	Overhead projector

Purpose:

To demonstrate diffraction at an edge.

Set-up:

Set up and adjust according to the assembly instructions.
The ripple generator for plane waves is used in the rippler.



Experiment 1:

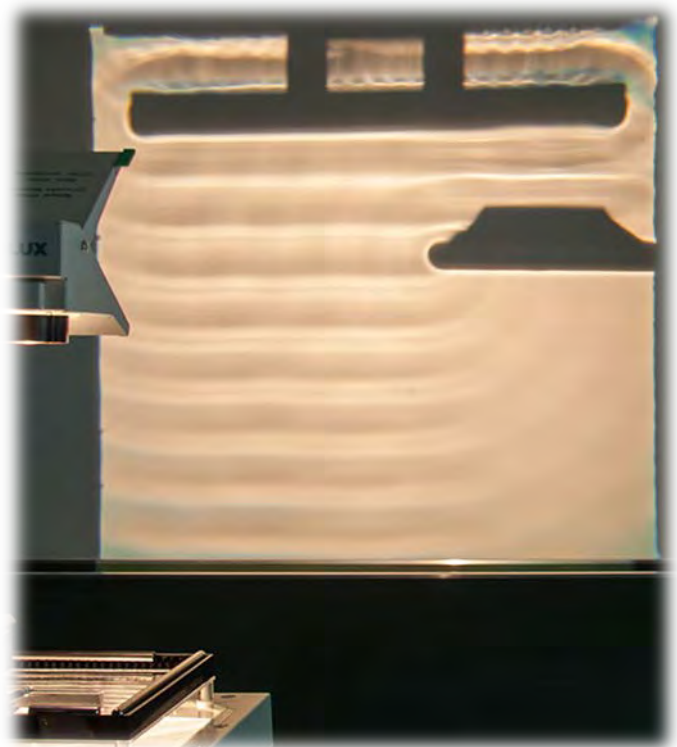
The oscillation controller is set to a low oscillation rate.
The rippler is switched on and the oscillating bar nudged into motion with a finger.

A narrow obstacle (85 mm diffraction plate) is placed in the tank at a distance of about 5 cm from the ripple generator bars.

Discovery:

The obstacle casts a distinctive wave shadow.

The waves enter the resulting shadow space in the form of circular waves, starting from the edge.



Please note:

This experiment shows, for example, how sound waves enter the room from behind walls.
Diffraction effects occur at the edges.

Experiment 2:

We move the obstacle into the middle of the tank and repeat the experiment.

Discovery:

Diffraction effects occur at both of the outer edges of the object.

The waves enter the resulting shadow space in the form of circular waves, starting from the edges.

The oscillation speed can also be changed during each experiment.



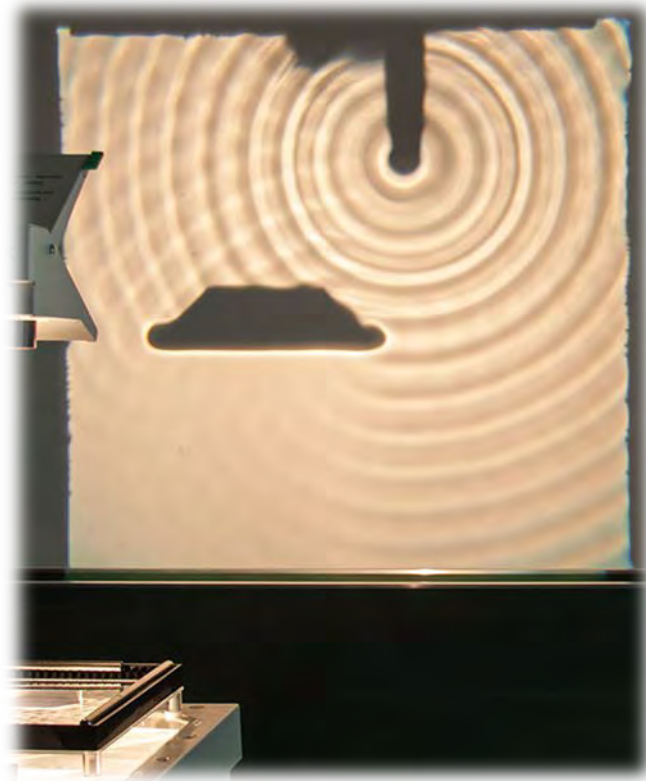
Experiment 3:

We replace the 85 mm diffraction plate with the small one (25 mm) and repeat the experiment.



Experiment 4:

We now use the point-source ripple generator.



Note:

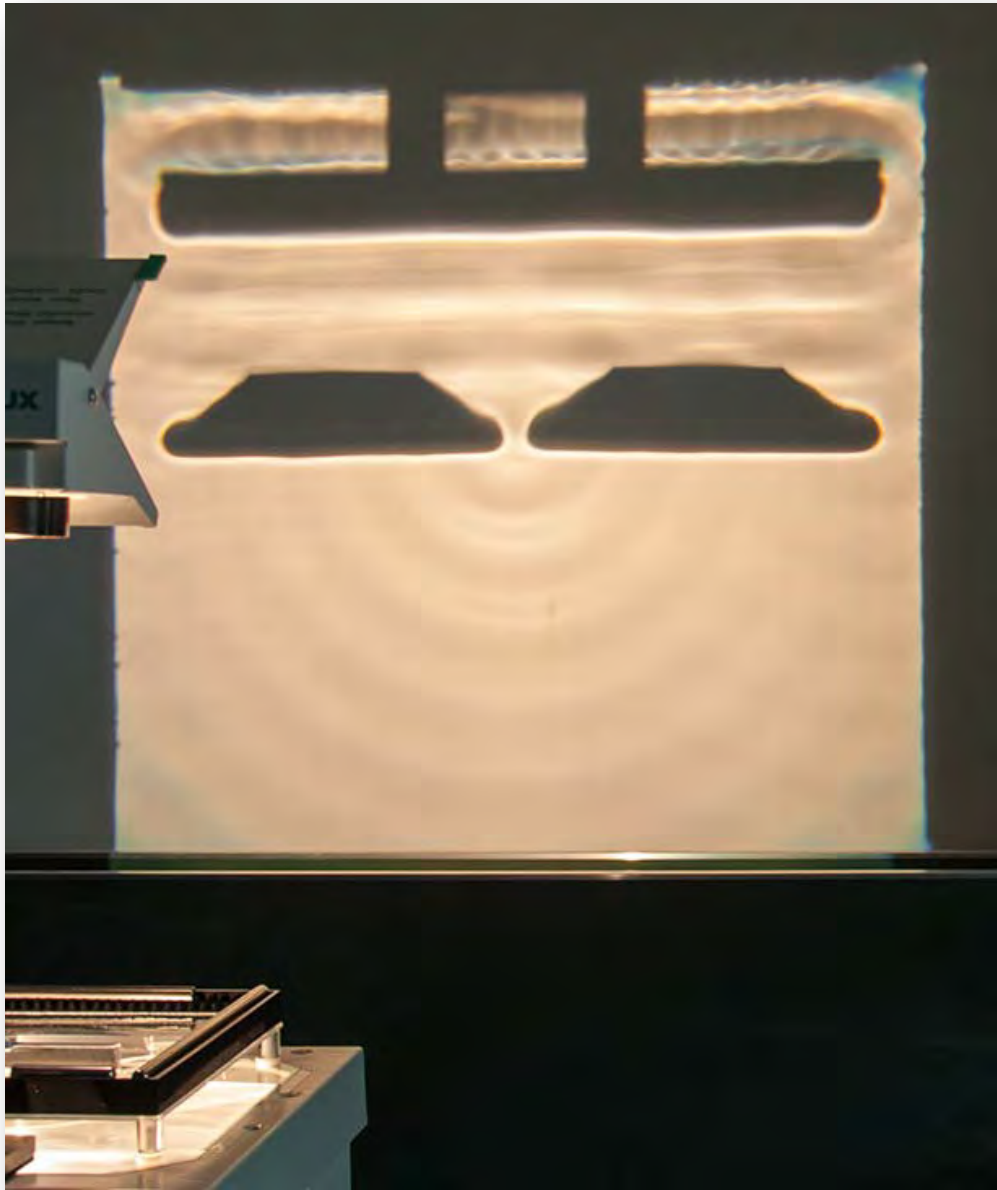
At a certain oscillation rate (around the middle position of the knob) the leaf spring reaches resonance, resulting a large amplitude.

This can cause the point dipper to touch the base plate and splash water about.

The device does not suffer any damage from this.
To prevent this, simply limit the amplitude with your index finger.

DIFFRACTION AT A SINGLE SLIT

AKD 7.03



Material:

Item no.	Qty.	Name
DW401-2W	1	Ripple tank for overhead projection
	1	Overhead projector

DIFFRACTION AT A SINGLE SLIT

AKD 7.03

Purpose:

To demonstrate diffraction at a single slit.

Set-up:

Set up and adjust according to the assembly instructions.
The ripple generator for plane waves is used in the rippler.



Experiment 1:

The oscillation controller is set to a low oscillation rate.
The rippler is switched on and the oscillating bar nudged into motion with a finger.

The two 85 mm diffraction plates are placed in the tank at a distance of about 5 cm from the ripple generator bars. The two objects are first placed at the edge so that the slit is as large as possible. However, this slit is then made narrower.

Discovery:

If the opening is relatively wide, the wave will pass through almost unhindered.
The obstacles “cast” clear wave shadows, into which the wave overlaps in the form of weak circular waves - starting from the edges of the opening.

If the opening reaches approximately the order of magnitude of the wavelength, strong diffraction occurs; a circular wave develops behind the slit, which makes the wave shadow increasingly unclear.



Please note:

Sound waves move in the order of “metres” - “decimeters”, therefore diffraction effects occur at doors and windows, etc.

Note:

At a certain oscillation rate (around the middle position of the knob) the leaf spring reaches resonance, resulting a large amplitude.

This can cause the point dipper to touch the base plate and splash water about.

The device does not suffer any damage from this.
To prevent this, simply limit the amplitude with your index finger.

DIFFRACTION AT A DOUBLE SLIT

AKD 7.04



Material:

Item no.	Qty.	Name
DW401-2W	1	Ripple tank for overhead projection
	1	Overhead projector

DIFFRACTION AT A DOUBLE SLIT

AKD 7.04

Purpose:

To demonstrate diffraction at a double slit.

Set-up:

Set up and adjust according to the assembly instructions.
The ripple generator for plane waves is used in the rippler.



Experiment:

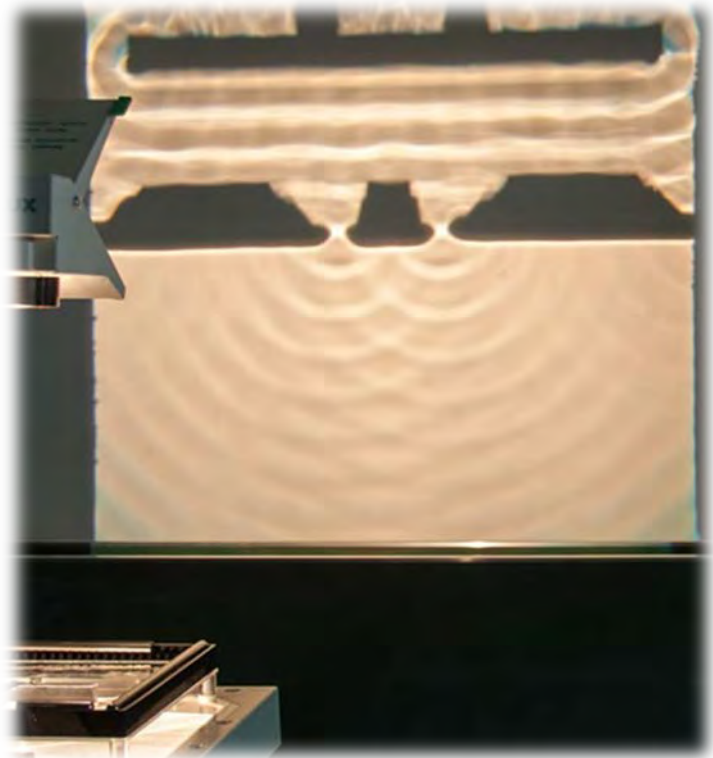
The oscillation controller is set to a low oscillation rate.
The rippler is switched on and the oscillating bar nudged into motion with a finger.

All three diffraction plates are placed in the tank at a distance of about 5 cm from the ripple generator bars.
The two large objects are each placed at the edge so that the slit is as large as possible. The small object is placed in the middle of this slit.

Discovery:

According to the principle of Huygens, any wave that passes through a very small opening is diffracted at this opening, resulting in a circular elementary wave behind the slit.

The overlapping of the two circular elementary waves results in an interference pattern.



Note:

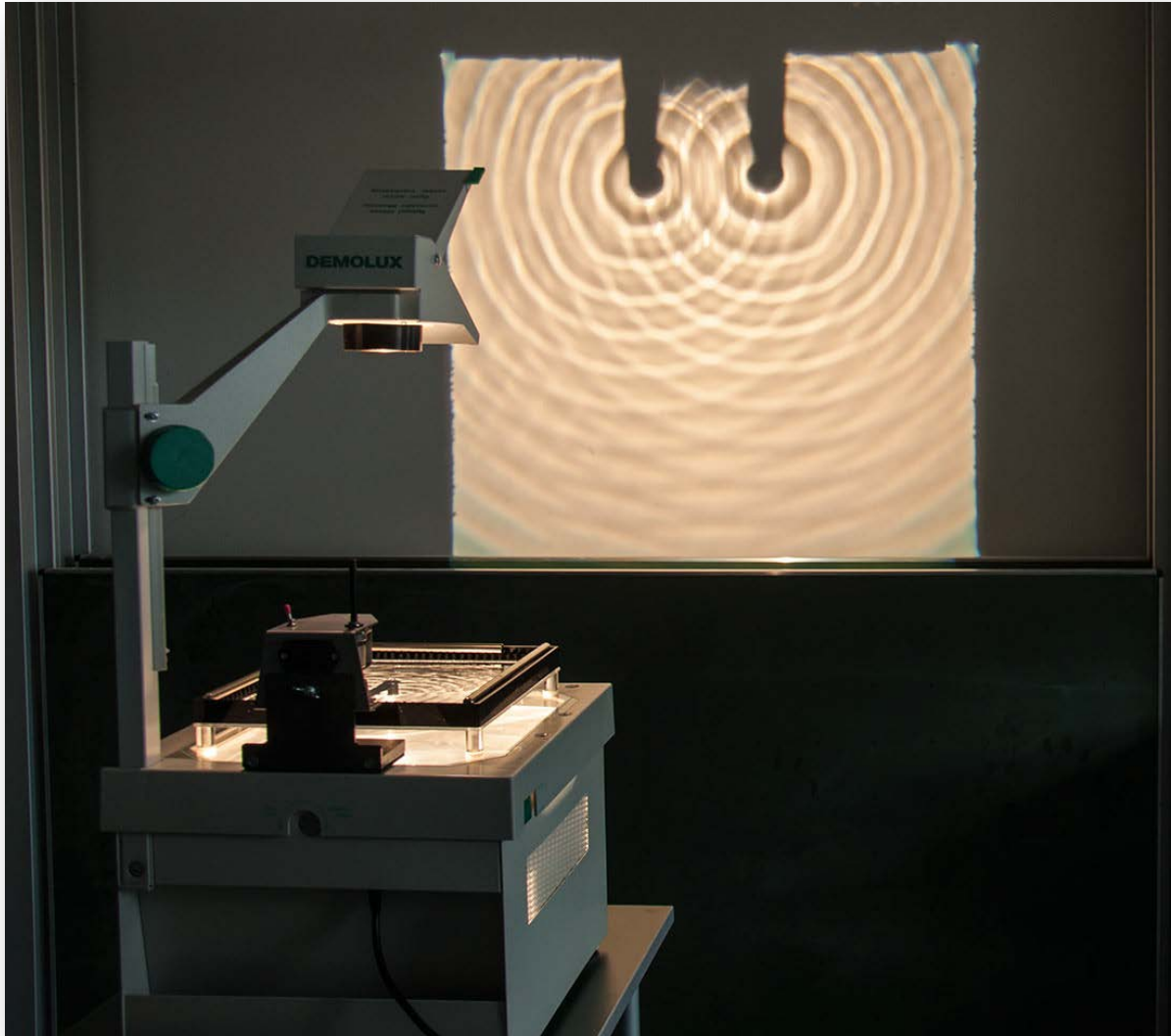
At a certain oscillation rate (around the middle position of the knob) the leaf spring reaches resonance, resulting a large amplitude.

This can cause the point dipper to touch the base plate and splash water about.

The device does not suffer any damage from this.
To prevent this, simply limit the amplitude with your index finger.

INTERFERENCE OF TWO CIRCULAR WAVES

AKD 7.05



Material:

Item no.	Qty.	Name
DW401-2W	1	Ripple tank for overhead projection
	1	Overhead projector

INTERFERENCE OF TWO CIRCULAR WAVES

AKD 7.05

Purpose:

To demonstrate interference between two circular waves.

Set-up:

Set up and adjust according to the assembly instructions.
Two point source ripple generators are used in the rippler.



Experiment:

The oscillation controller is set to a low oscillation rate.
The rippler is switched on and the oscillating bar nudged into motion with a finger.

Discovery:

The two circular waves run over each other and overlap in a complicated interference pattern.

At the points where wave crests overlap, wave crests twice as high are formed. Similarly, wave troughs are twice as deep.

At the points where a wave crest meets a wave trough, mutual cancellation occurs. The cancellation and reinforcement points lie on hyperbolas, the focal points of which lie at the centres of the rippers. (Visible in the projection as darker and lighter stripes.)



Note:

At a certain oscillation rate (around the middle position of the knob) the leaf spring reaches resonance, resulting a large amplitude.
This can cause the point dipper to touch the base plate and splash water about.

The device does not suffer any damage from this.
To prevent this, simply limit the amplitude with your index finger.

REFLECTION FROM A PLANAR MIRROR

AKD 7.06



Material:

Item no.	Qty.	Name
DW401-2W	1	Ripple tank for overhead projection
	1	Overhead projector

REFLECTION FROM A PLANAR MIRROR

AKD 7.06

Purpose:

To demonstrate reflection at a flat mirror.

Set-up:

Set up and adjust according to the assembly instructions.
The ripple generator for plane waves is used in the rippler.



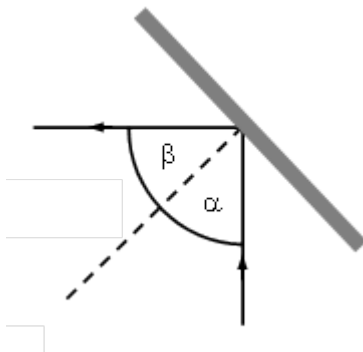
Experiment:

The oscillation controller is set to a low oscillation rate.
The rippler is switched on and the oscillating bar nudged into motion with a finger.
The 170 mm reflection plate is placed in the tank at an angle of 45 degrees.

Discovery:

The reflection of sound waves is simulated by the water waves. In this experimental arrangement, the reflection takes place at right angles. The normal on a wavefront is called the wave train.

The angle between the incoming wave train and the axis of incidence is equal to the angle between the reflected wave train and the axis of incidence (law of reflection).



Note:

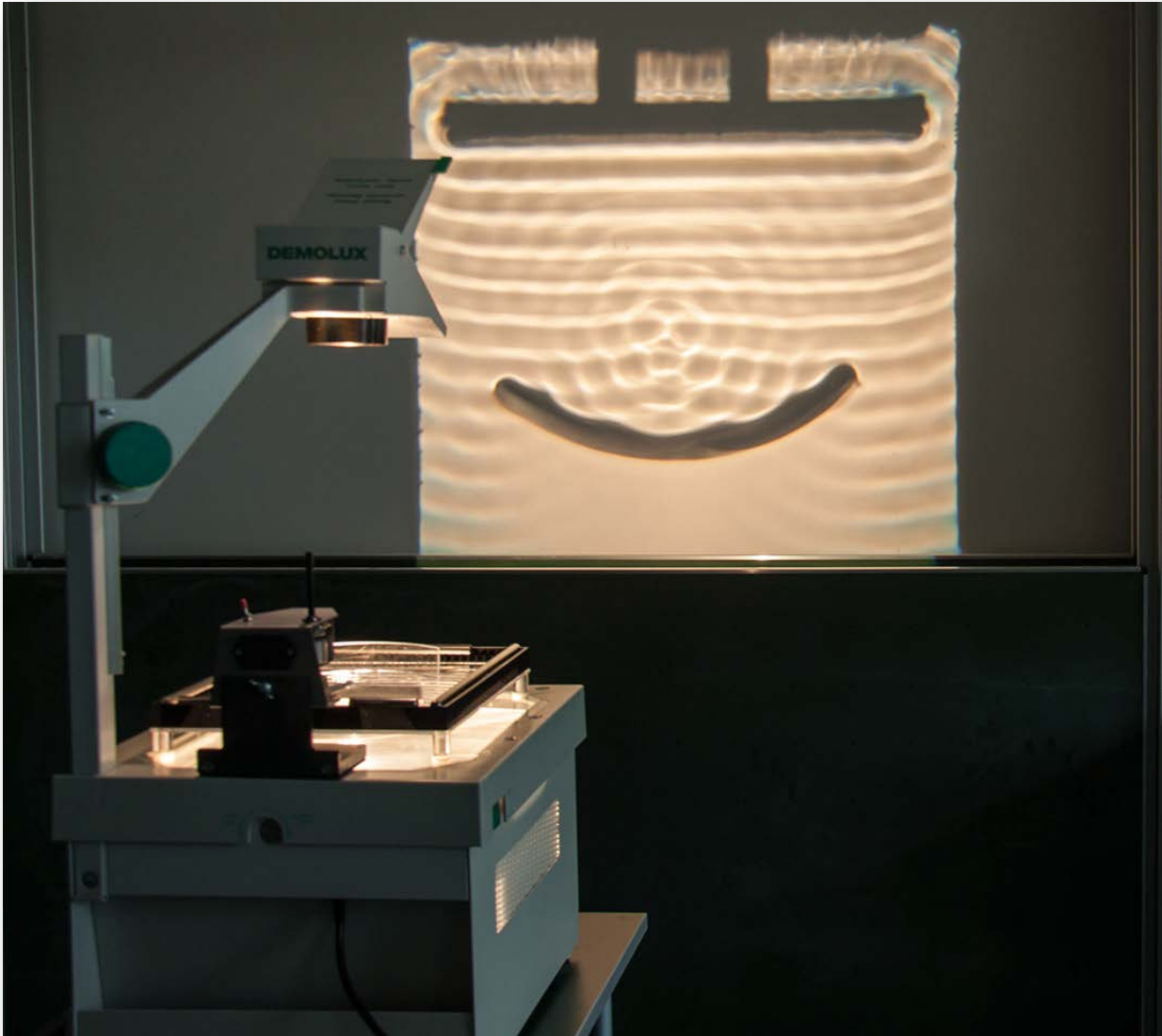
At a certain oscillation rate (around the middle position of the knob) the leaf spring reaches resonance, resulting a large amplitude.

This can cause the point dipper to touch the base plate and splash water about.

The device does not suffer any damage from this.
To prevent this, simply limit the amplitude with your index finger.

REFLECTION FROM A CONCAVE MIRROR

AKD 7.07



Material:

Item no.	Qty.	Name
DW401-2W	1	Ripple tank for overhead projection
	1	Overhead projector

REFLECTION FROM A CONCAVE MIRROR

AKD 7.07

Purpose:

To demonstrate reflection at a flat mirror.

Set-up:

Set up and adjust according to the assembly instructions.
The rippler generator for plane waves is used in the rippler.



Experiment:

The oscillation controller is set to a low oscillation rate.
The rippler is switched on and the oscillating bar nudged into motion with a finger.
The curved reflection plate is placed in the tank at a distance of 10 cm.

Discovery:

The occurrence of a focal point is clear.

Please note:

In the lower grades, the reflection effects are mainly used to explain acoustic phenomena (sound is reflected, sound is concentrated).

In the upper grades, this aspect is enhanced through application in the explanation via wave optics of geometrical and optical phenomena.



Note:

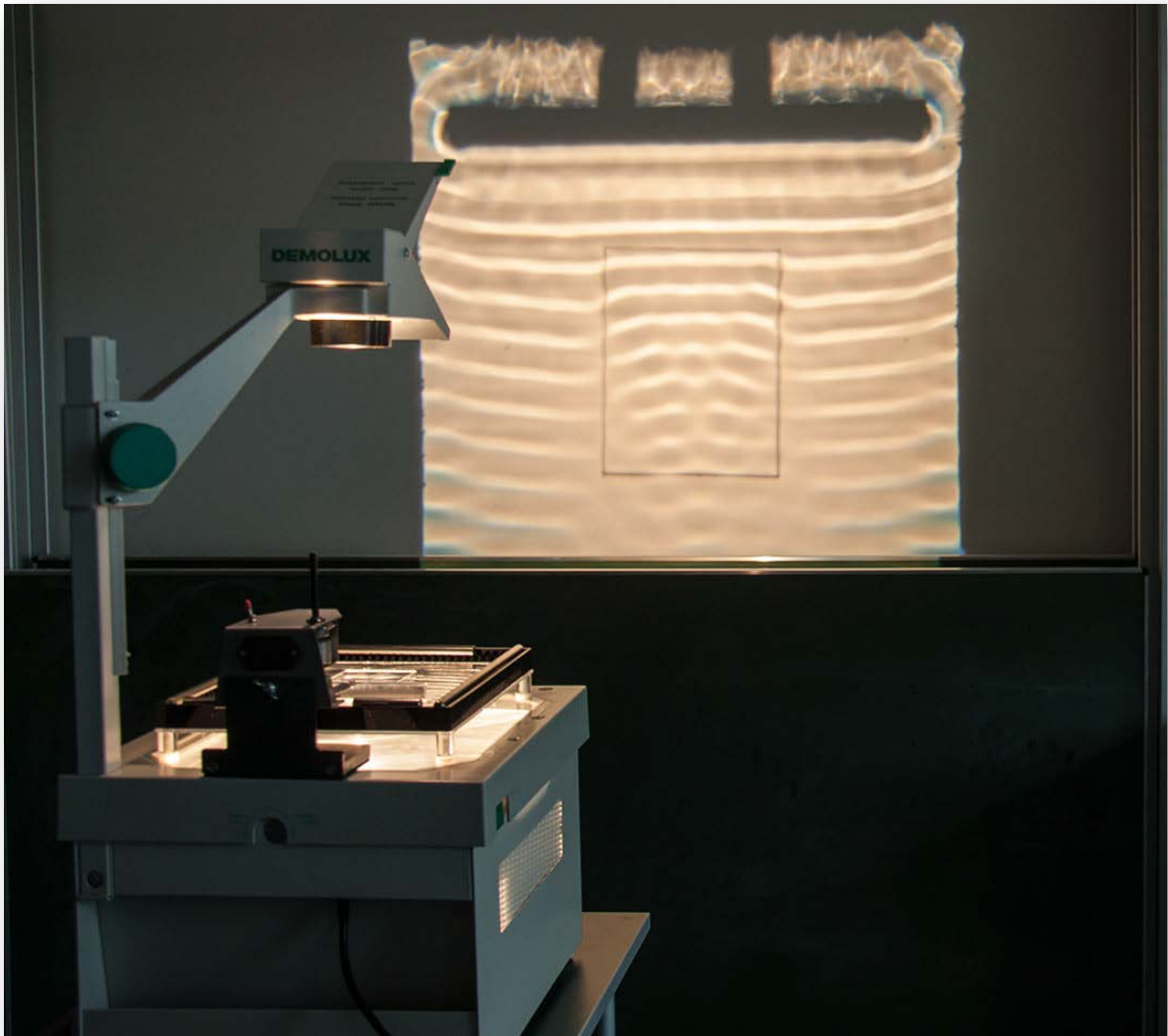
At a certain oscillation rate (around the middle position of the knob) the leaf spring reaches resonance, resulting a large amplitude.

This can cause the point dipper to touch the base plate and splash water about.

The device does not suffer any damage from this.
To prevent this, simply limit the amplitude with your index finger.

REFRACTION OF PLANE WAVES

AKD 7.08



Material:

Item no.	Qty.	Name
DW401-2W	1	Ripple tank for overhead projection
	1	Overhead projector

REFRACTION OF PLANE WAVES

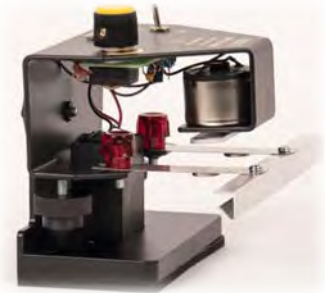
AKD 7.08

Purpose:

To demonstrate the refraction of plane waves.

Set-up:

Set up and adjust according to the assembly instructions.
The ripple generator for plane waves is used in the rippler.



Experiment 1:

The oscillation controller is set to a low oscillation rate.
The rippler is switched on and the oscillating bar nudged into motion with a finger.
The transparent, rectangular refraction plate is placed in the ripple tank. The plate must be completely covered in water; however, the depth of the water above the plate must only be 1 - 2 mm.

Discovery:

Different dispersion velocities of the wave fronts can be detected. At the interface there is a transition - a "bend" occurs in the wavefronts.

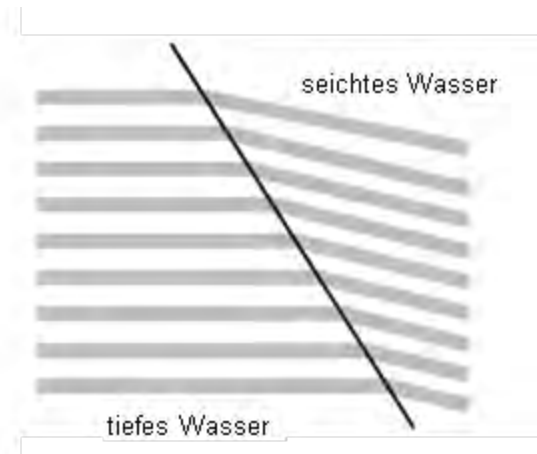


REFRACTION OF PLANE WAVES

AKD 7.08

Experiment 2:

If the refraction plate is rotated by 45° , the two wavefronts form an angle with each other, the size of which depends on the depth of the water (dispersion speed of the wave).



Note:

At a certain oscillation rate (around the middle position of the knob) the leaf spring reaches resonance, resulting a large amplitude.
This can cause the point dipper to touch the base plate and splash water about.

The device does not suffer any damage from this.
To prevent this, simply limit the amplitude with your index finger.



Material:

Item no.	Qty.	Name
DW401-2W	1	Ripple tank for overhead projection
	1	Overhead projector

DOPPLER EFFECT

AKD 7.09

Purpose:

To demonstrate the Doppler effect.

Set-up:

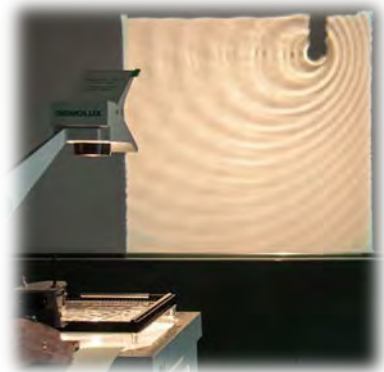
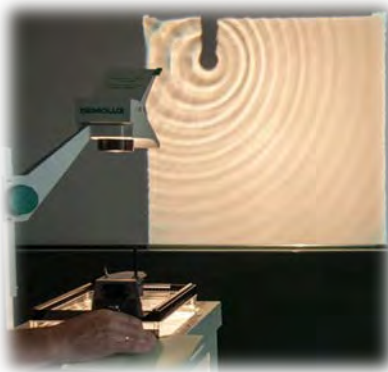
Set up and adjust according to the assembly instructions.
The ripple generator for point-source waves is used in the rippler.
The rippler unit is pushed to the right corner of the tank.
A sheet of paper is placed under the rippler unit, making it easier to move.



Experiment:

The oscillation controller is set to a low oscillation rate.
The rippler is switched on and the oscillating bar nudged into motion with a finger.

The entire rippler unit is now quickly moved from the right side to the left, then back in the opposite direction.
The wave pattern is observed when doing so.



Discovery:

The circles in front of the point dipper are compressed against one another. The wavelengths are smaller.
Behind the point dipper, the circles are further apart. The wavelengths are therefore greater.

Please note:

We know the Doppler effect from everyday life, when a passing emergency vehicle has its siren switched on.
As the vehicle approaches, the tone of the siren is higher; once the vehicle has gone past, the tone of the siren is lower.

In the upper grades, the potential applications are extended from mechanical waves to wave optics.