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Mouvement français des Exposciences
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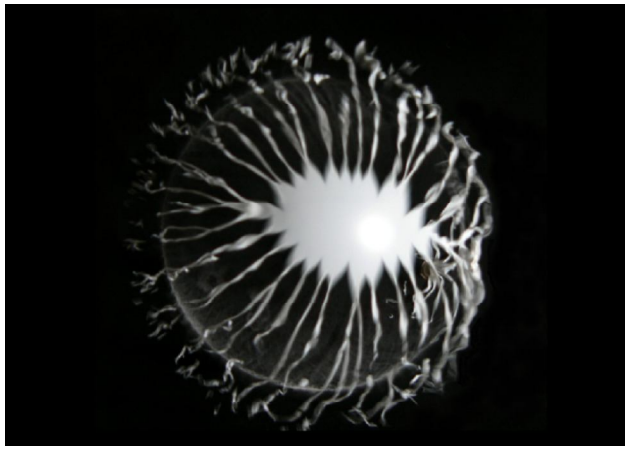
Scientific and Artistic project :
« How to photograph the invisible? »



EXPO-SCIENCES INTERNATIONAL 2013
Welcome to Abu Dhabi - United Arab Emirates

Abu Dhabi

“how to photograph an invisible phenomenon ?”

Developing the imagination in the sciences...

Many surprising things occur in a fraction of a second but it often goes too fast to be able to observe them.

Scientific approach bases itself on a precise observation of a phenomenon for which it will be necessary to emit hypotheses. But it suppose to be able to emit such hypotheses that it will be necessary to make out a will in a experimental way to verify them.

But are we able to imagine hypotheses?

In high speed photography it is possible to investigate with rigor various imperceptible physical phenomena to the naked eye. Most of these fast events are going to produce an associated physical phenomenon (sound, movement...).

The pupils are going to imagine what " invisible phenomenon " they have to reproduce in laboratory. How to detect the fast event ? With which sensor ? Are human reflexes fast enough to take the photo ? Which electronic system can land in the slowness of our reflexes ?

So many problems for which the pupils are going to have to imagine hypotheses (tracks of solutions). Test every hypothesis . Test every hypothesis to succeed in photographing correctly the studied invisible physical phenomenon.

What is high-speed photography ?

High-speed photography is the process of photographing fast moving subjects or action.

How to create a high-speed pictures with “flash method” ?

The picture is taken by opening the shutter of the camera (for a few seconds), activating an external flash and closing the shutter. The picture needs to be taken in a dark room. Because the room is dark, the long exposure time will not have any effect on the final output. The flash light duration now becomes the actual exposure time.

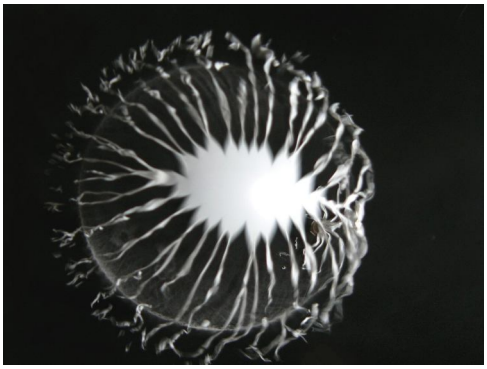
The main advantage of the flash method is the exposure speed and better timing consistency. Electronic flashes are capable of light strobes with durations of 1/10,000 or faster (lower the power setting of the flash, the shorter the flash duration).

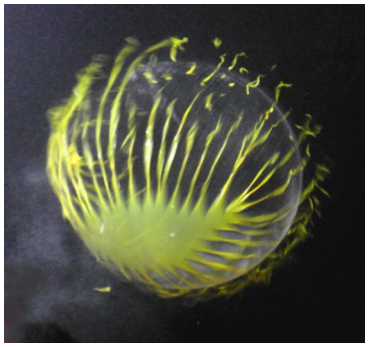
How to synchronize the discharge of a flash unit with the event to be photographed ?

Delay units are typically used with photogates (Infrared sensor). For example, if a falling drop breaks the infrared beam, the event of interest : **a splash -** occurs below that point. With a delay unit you adjust the amount of time after the beam is broken until the flash discharges.

Some examples of High speed pictures (without special effect).

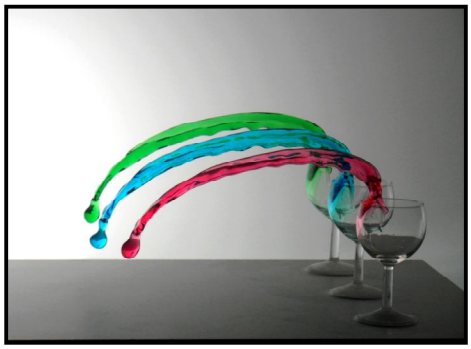
bursting balloon – using sound trigger





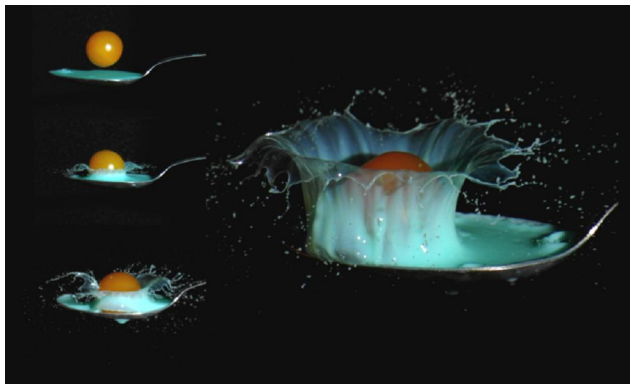
flow of water – using sound trigger






Glass breaking – using sound trigger

water splash – using infrared photogate trigger + delay unit


EQUIPMENT REQUIRED FOR HIGH SPEED PHOTOGRAPHY

1- **Camera.**
2- **Flash** (external).
3- **Different trigger with sensors** in order to activate en external flash unit or a camera (sound / Infrared photo gate or contact trigger).
4- **Delay Unit** (to synchronize the discharge of a flash unit with the event to be photographed)**.**

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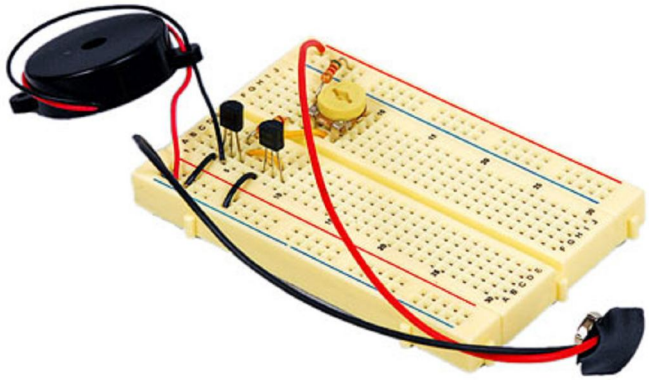
SOUND TRIGGER

This sound trigger uses a piezoelectric element that is sensitive to sharp sounds like claps, snaps, and bursts. It can trigger on a finger snap from a distance of about 10 feet.

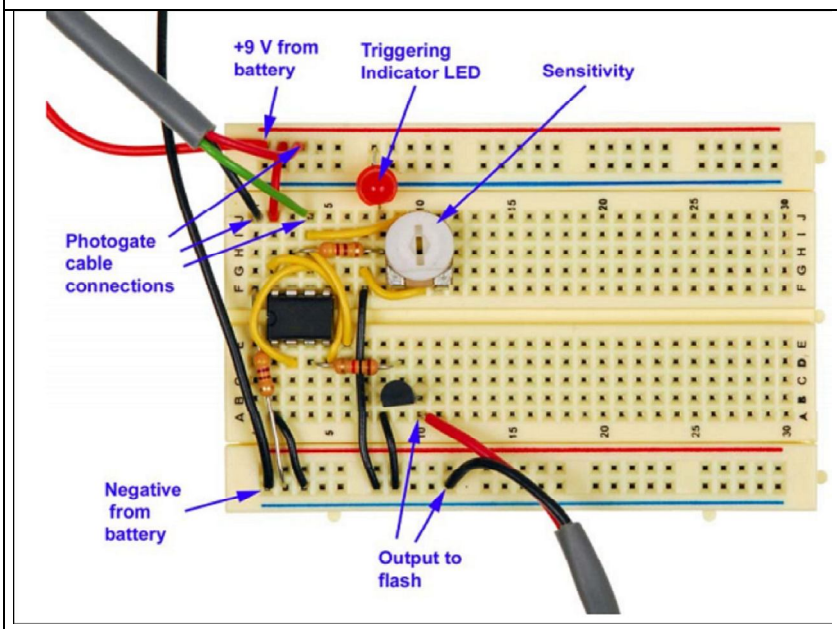
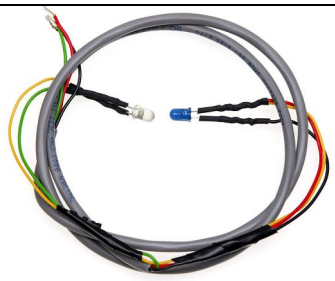
CONTACT TRIGGER

This is a pressure trigger in which two metallic contacts or plates are brought together by the force of a collision.

SOUND or CONTACT TRIGGER	Sound sensor	Contact sensor
	 piezolelectric	 Switch button

PHOTOGATE TRIGGER

This trigger initiates a triggering event when an object breaks an infrared beam between an emitter and a detector. If you wish to have greater separation, a red laser pointer can be used instead of the IR LED.

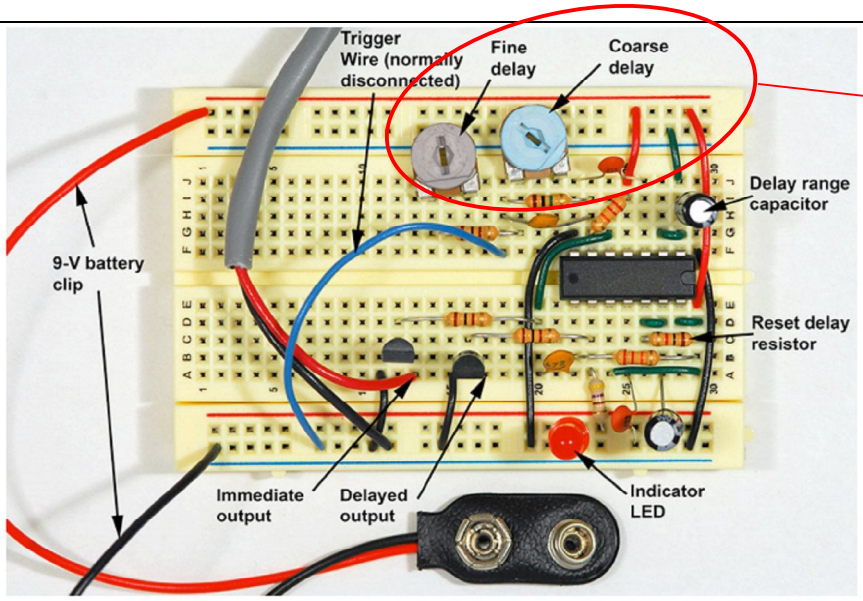
PHOTOGATE TRIGGER	Infrared photogate sensor
	 infrared emitter and detector

DELAY UNIT

The delay circuit can be used with sound, photogate, or contact triggers or simply with the closure of an electrical contact to synchronize the discharge of a flash unit with the event to be photographed.

Delays are adjustable from about 0.0002 - 0.5 seconds. There is both coarse and fine control of the delay interval. A red LED flashes when the circuit triggers.

DELAY UNIT



The BLUE 1- MΩ potentiometer provides **coarse delay** adjustment

The BROWN 100- kΩ potentiometer provides a finer delay adjustment.