

**GEEK  
& CO.  
SCIENCE!**



PROJECT KIT **Ages  
8+**

# MuSiCaL UFO

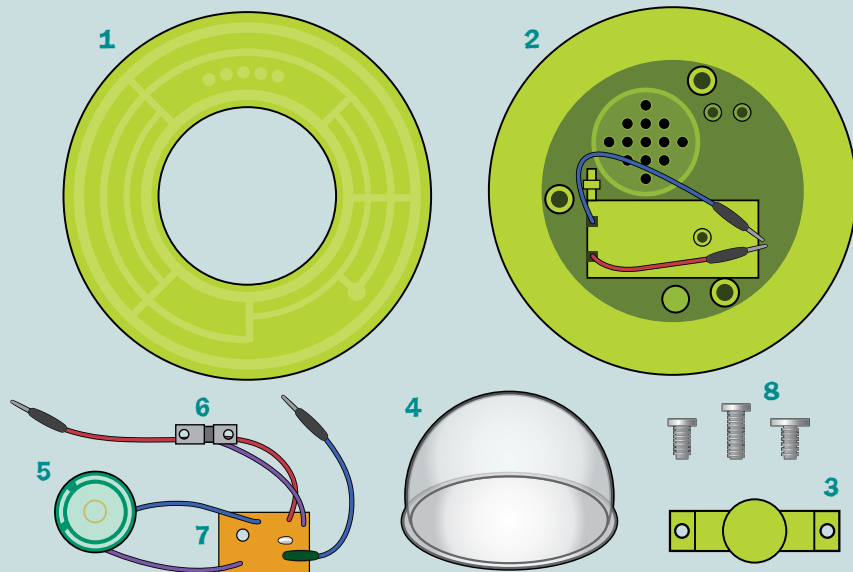


**THAMES & KOSMOS**



Franckh-Kosmos Verlags-GmbH & Co. KG, Pfizerstr. 5-7, 70184 Stuttgart, Germany | +49 (0) 711 2191-0 | [www.kosmos.de](http://www.kosmos.de)  
Thames & Kosmos, 301 Friendship St., Providence, RI, 02903, USA | 1-800-587-2872 | [www.thamesandkosmos.com](http://www.thamesandkosmos.com)  
Thames & Kosmos UK Ltd, Goudhurst, Kent, TN17 2QZ, United Kingdom | 01580 212000 | [www.thamesandkosmos.co.uk](http://www.thamesandkosmos.co.uk)

# KIT CONTENTS



- 1 | Cover
- 2 | Saucer
- 3 | Speaker cover
- 4 | Dome

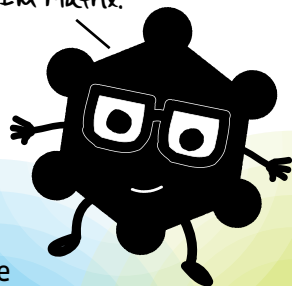
- 5 | Speaker
- 6 | On-off switch
- 7 | Circuit board
- 8 | Screws (8)

**YOU WILL ALSO NEED:** *Two AA batteries (1.5-volt, type AA/LR6), small Phillips head (cross-head) screwdriver*

## Greetings, Earthlings!

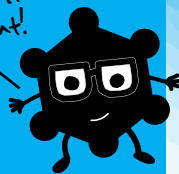
Everyone knows what an alien flying saucer is, and everyone has their own idea about what one should look like — despite the fact that nobody has actually ever seen one. Still, the idea of visitors from other another planet inspires our fantasies. And who knows? Maybe one day we really will have a close encounter of the “third kind.” Until then, you can use this experiment kit to build your own UFO and send musical messages into outer space. These instructions will show you how to do it. So let’s get going!

Hi! I'm Matrix!



# WHAT'S A THEREMIN?

My favorite  
instrument!



The Musical UFO is based on an invention known as the **theremin**. That's a musical instrument that, like the UFO, can be played without actually touching it with your hands. Instead of responding to light, though, the theremin reacts to the electrical capacitance inside every human body. This influences the theremin's electromagnetic field, which then produces sounds.



*Leon Theremin*

The theremin gets its name from its Russian inventor, **Leon Theremin**. His invention was the inspiration for other electronic instruments such as the **synthesizer**, without which today's electronic music would be inconceivable. A theremin that responds to light is also known as a **photo-theremin**.

For decades, theremins have been used in science fiction and horror movie soundtracks. This is why their unique sound is associated with the eerie sounds of UFOs and monsters. Today, theremins are used by many rock, electronic, and concert musicians.



*Theremins  
have been  
custom built  
in many  
shapes and  
sizes*



# HOW DO THE UFO'S ELECTRONICS WORK?

To really understand how the Musical UFO works, you need to understand how four important electronic components work: the **phototransistor** (which is a type of **transistor**), the **integrated circuit**, the **speaker**, and the **capacitor**.

## THE TRANSISTOR

A transistor is a semiconductive device, meaning that it conducts different amounts of electrical current under different conditions. A transistor has three terminals. Differing current on one terminal changes the amount of current that can flow through the other two terminals.

There are many different types of transistors, but to understand how they work, let's explore two of them: NPN and PNP transistors.

In an NPN transistor, when a current **1** flows into the base terminal **B**, it allows current **2** to move through the other two terminals, from the collector **C** to the emitter **E**. If there is no current at the base, no current will flow through the collector to the emitter.

In a PNP transistor, when a current **1** flows out of the base terminal, it allows current **2** to move from the emitter to the collector.

An NPN transistor is a sandwich of "p" material between two layers of "n" material. A PNP is the opposite: "n" material sandwiched between two layers of "p" material. The "n" zone contains mobile electrons (shown here in green), while the "p" zone contains empty spaces, or holes. Between the zones, there are thin boundaries that normally block the current flow, since the electrons are attaching themselves to the holes there. When electrons either flow into or out of the base, they allow electrons to cross the boundaries, opening up the flow of current.

