

# Science of fireworks

**D**ramatic displays of fireworks celebrating the New Year around the world are now commonplace.

Each firework is a carefully combined mixture of fuel and chemicals, individually selected to provide an array of colour and shapes. The formula for making them has remained more or less unchanged since they were first used in China over 1,000 years ago!

A firework is an explosive device used for entertainment, so only adults who are properly trained in the handling of explosives should set off fireworks.

We may be more used to hearing about explosives on a big scale, such as in the demolition of buildings, but explosives are any material that contain a great amount of a particular type of energy called potential energy. When this energy is released suddenly it can produce light, heat, sound and pressure.

The art of making fireworks has its own dedicated branch of science, called pyrotechnics.

A firework is a tube called an aerial shell containing explosive chemicals responsible for its light, sound and colour. These shells are packed with gunpowder, fuel and a well-known explosive.

The gunpowder is mixed with small blobs of more explosive materials called stars, which are made up of four chemical ingredients, including a metal containing colourant. In the presence of a flame, or spark, a chemical reaction occurs,

which releases intense heat and gas.

To blast the firework into the air, the shell is placed on a stand called a mortar

which is usually

partially buried in the ground. The mortar has more gunpowder, as well as a fuse called a fast acting-fuse. When this fuse is lit, it explodes the gunpowder and releases lots of heat and gas which causes a build-up of pressure big enough to lift the firework into the air.

Once in the air, a time-delay fuse inside the shell ignites and another build-up of heat and pressure causes the shell to burst open and the stars to fly in every direction.

The expansion of gases leading to explosion occurs at a rate that is faster than the speed of sound, causing what is known as a sonic boom and accounting for the loud bangs.

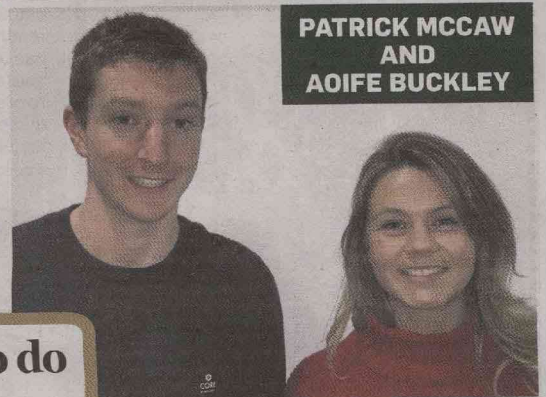
How the stars are arranged inside the aerial shell will determine the type of firework we see and there are many different effects.

If the stars are arranged randomly, they will scatter evenly in the sky, but if they are arranged

in a particular pattern it will give the firework a special shape such as the willow, the spider or the peony which is the most common firework shape.

Firework colours come in red, orange, yellow, green, blue, purple and silver. Blue and purple are the most difficult effects to achieve, so when you see them they are an indication of particular quality.

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**PATRICK MCCAW AND AOIFE BUCKLEY**

## Are we mad to do all that Christmas shopping?

with a gift, forcing us to scramble in search of something with which to return the gesture.

But all is not lost. The materialism often associated with Christmas is far more complex than may first appear. Gift-giving is a symbolic medium through which we create and maintain kinship bonds. Rather than bemoaning gift-giving as simply another form of economic transaction, or seeing Christmas as an extravagant display of consumer society, we can view it

as a ritual that transforms mass-produced commodities into an expression of the affection and sentiment embedded within our personal relationships. The care and effort we put into choosing gifts allows us to demonstrate our understanding of the recipient. Wrapping and presenting these gifts is a labour of love, celebrating our relationships. Why else would we put ourselves through the madness of shopping on Christmas Eve and getting tangled in Sellotape? Exchanging gifts links us to others in enduring ways; we are not merely trading things, rather, we give a little bit of ourselves with the gift. The gifts we give are inalienable from our

intentions and sentiments. In Ireland today, gift-giving retains a central role in celebrating Christmas. We surround ourselves with those we love at Christmas and, in turn, we surround them with gifts, strengthening our relationships. Gifts express love and, whilst it is easy to get caught up in the trimmings of the day (the tree, the presents, the turkey and the tinsel), it is important to take a breather and remember that Christmas is as much about our presence amongst our loved ones as the presents we give to them.

After all, 'tis the thought that counts and if you are really stuck on that awkward-to-buy-for person on your list, remember that while a partridge in a pear tree is a conversation starter, practically everyone wears socks.

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**P**icture the scene — you make your way from shop to shop, battling through the throngs of crowds, arms laden with bags searching for the last gifts you need for your nearest and dearest. You make your list, check it twice and realise that you still have to go home and wrestle with the wrapping paper.

You'll probably lament leaving it this late and vow to start earlier next year. Many shoppers even question if Christmas has become too materialistic with recent shopping trends like 'Black Friday' eclipsing the spirit of Christmas.

Shopping is a mundane activity in which we all partake, yet, at Christmas time, shopping for gifts is often considered an immensely stressful experience. We may feel embarrassed if reciprocal exchange has not occurred; when we have committed the faux pas of omitting someone from our list who presents us

