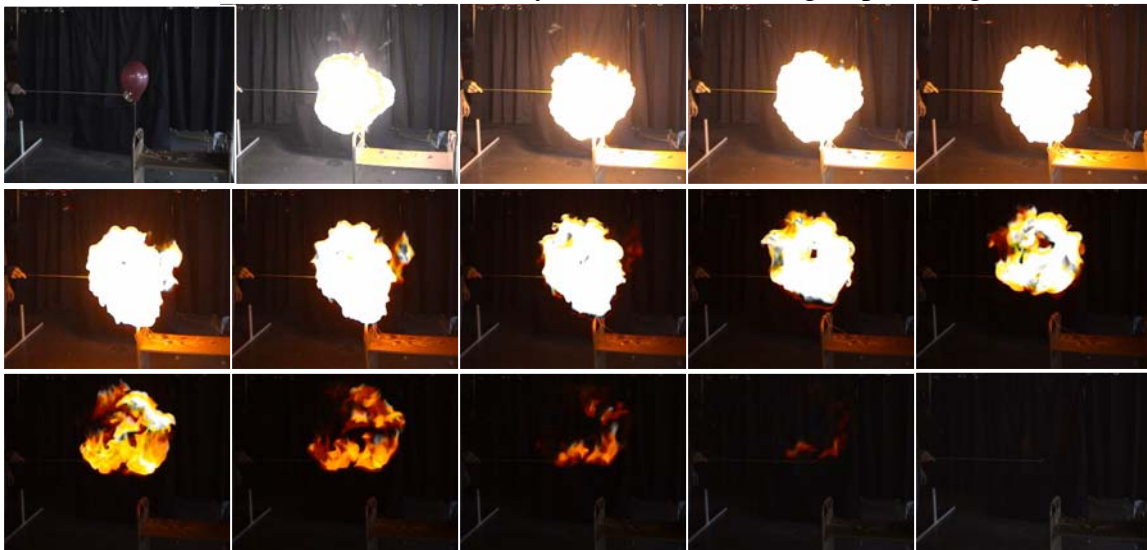


## How Hydrogen Ignites or Detonates.

Before igniting the 100% hydrogen I explain the properties of hydrogen and suggest if they have sensitive hearing they cup their hands over their ears. We call out the safety gear needed and they count down to the explosion. After a few seconds to calm down, the students and I review what they have seen with the group of images



Because hydrogen requires oxygen that it gets from air and it burns out rapidly in less than  $\frac{1}{2}$  second, the resulting fireball has a stationary flame front.

Ignition of the  $\frac{2}{3}$  hydrogen and  $\frac{1}{3}$  oxygen is in the perfect proportion to give a really good KaBoom! Again they go through our safety checklist and are cautioned to guard their ears. The sound amplitude drops off rapidly as a function of  $x^{-2}$ . At the distance they are sitting, it will not pose a danger as this demonstration has been done safely in university settings for several decades and more safety precautions are taken here than in the classrooms. While static electricity may be a concern for premature ignition, the balloon is connected by a string and the rubber of the balloon seems to be enough to isolate the gas mixture as I know of no example of static igniting a latex balloon. If it were to detonate unexpectedly the flames last less than 100 mS and other than being a surprise, it will not be lasting effects. Again the balloon limits the total reactants present.

A 2:1 ratio of  $H_2$  to  $O_2$  yields maximum detonation and a major shock wave!

