

Hi this is Steve Nerlich from Cheap Astronomy www.cheapastro.com and this is *Cheap Astronomy – Live in Dublin*.

Well, meaning no offence, at first this seemed like it might be a bit of challenge – I mean, you know, astronomy in Ireland? But, let's remember that pretty much everything in the world does end up having something to do with astronomy and finding an astronomy story in Ireland actually turned out to be laughably easy.

But first, to be strictly accurate, this is a story about the Republic of Ireland, which is every part of the mainland excepting Northern Ireland which remains a part of the United Kingdom. I landed in Dublin, capital of free Ireland as my taxi driver called it, on the day of the All-Ireland Hurling final. And so, later, on the advice of my taxi driver, I sat in a bar (actually The Bank of College Green - tis a grand place) sipping Guinness and watching the Kilkenny versus Galway match. As it happened the game ended up a tie and a replay was scheduled well after I had to go home.

But anyway, since this is supposed to be an astronomy podcast, why don't I just tell you that the next day I hopped on a bus to Newgrange. Newgrange is allegedly the world's oldest intact astronomical observatory insofar as, a bit like Stonehenge, it is a solar observatory - although it may have enabled observations of other celestial bodies as well.

Newgrange is not the original name of this Neolithic structure, the original name of which is unknown, since it was built around 3,200 BC - at which time systems of writing and record-keeping were just barely kicking off. Newgrange pre-dates Stonehenge by about a thousand years and the pyramids of Giza in Egypt by about 600 years. There has been some speculation that Wurdi Youang - an Australian Aboriginal solar observatory - could considerably pre-date all these structures, but for now the time of Wurdi Youang's construction remains to be properly determined.

Anyhow, this neolithic 5,000 year-old structure is given the name Newgrange, but that just means New Farm, a name given to it by some monks in the 12 century who obtained the land it is on near the river Boyne. What the monks saw was a large mound and indeed elsewhere on the land were a number of other mounds, or fairy mounds as they are sometimes known. And these mounds are kind of spooky - surrounded by myth, legend and of course ghost stories, stories which may have been further enhanced when someone re-discovered a door into the Newgrange mound back in the 1600s.

It's unclear if the door, a rock slab positioned adjacent to the opening of Newgrange today, was in the open or closed position upon its rediscovery. Either way, it's probably worth offering a congratulatory note to the extreme intestinal fortitude of whoever was the first to creep into that dark passage way beyond the door, a passage way which had been hidden for maybe 4,000 years. Whoever was the first would have crept, for 24 meters along the dark passageway, presumably with one of those burning torches much beloved by horror movie directors, until they reached the central chamber deep within.

Regardless of who it was that first girded their loins to find the courage to walk the passage back in the 1600s, a great many followed after them. Kind of appallingly by today's

standards, some people took relics out of Newgrange - and we can only guess today what they might have been, while others carved their names in the rocks of the inner chamber.

Now, the Newgrange mound is an entirely a dry stone construction – meaning there's no mortar. The whole thing is built from the careful stacking of large slabs of rock, most of which is solid fill but it does enclose the inner chamber and the passage that leads to that chamber. And despite having no mortar, this construction has continued to keep any water out of the central chamber for a whole 5,000 years now. And, if you are familiar with Ireland's weather, you can appreciate what a remarkable achievement that is.

Apparently all those big rock slabs were transported by river from a quarry about 22 kilometres away in an concerted effort that may have required several hundred workers working away for 20 years or more to finish the building. The completed dome is about 60 metres in diameter and about thirteen, sorry turteen, metres high.

It was not until the 1960s, that a Professor Michael J O'Kelly began to undertake a proper archaeological study of the place, recognising it as a passage tomb – of which there about 400 all over Ireland.

Professor O'Kelly realised that the passage leading to the inner chamber in Newgrange was aligned due East and then he uncovered another structure above the door, that he called the roofbox, which was a separate small opening, too small for a person to crawl through, but clearly a deliberate part of the construction. You can draw a straight line from the horizon to the roofbox and extend that line to a point on the floor of the inner chamber – since the 24 metre passage leading to the inner chamber has a gentle upper gradient. In other words, if you lay flat on the floor of the inner chamber you can see the distant horizon through the roofbox. This was not, as it turns out, a coincidence.

In 1969, Professor O'Kelly cancelled a planned trip home for Christmas, and just before sunrise on the 21st of December, which was of course the winter solstice, he made his way into the inner chamber and became possibly the first person in more than four thousand years to watch as a beam of sunlight crept along the floor and then lit up the whole chamber for about 17 minutes before the light began to fade again and the beam of light slowly receded back down the passage.

Of course, ever since then, this yearly event has been watched by an enthusiastic audience. In fact, there is a national Ireland lottery run each year to pick 20 lucky people who will have the privilege of watching a 21st of December sunrise from the inner chamber - and it's just too bad if it's cloudy on the day.

So, is it a stretch to say that Newgrange is the oldest intact astronomical observatory? Proponents of this view stress the word intact, since there are a few older, though non-intact structures, which were clearly built to mark the solstices or equinoxes or perhaps both.

Some people also suggest that Newgrange wasn't just built to capture the winter solstice, since in looking to the path of the Sun, it is also looking towards the ecliptic, which means it's sometimes possible to view the Moon and even the visible planets through the Newgrange roofbox. For example, we know that the movement of Venus through the sky follows an eight

year cycle - so, it is interesting to note that a diagram of eight shapes has been carefully engraved into the rock just above Newgrange's roofbox.

And do I think that Newgrange is an astronomical observatory? Sure. It's clearly a complex engineering project, specifically designed to collect light and to provide important information about the position of at least one celestial body. And maybe it even represents mankind's first attempt at science advocacy. Although this was a time that way pre-dates electricity or magnification lenses, once every year you could invite people into the inner chamber where it goes from being pitch black into a breath-taking light show.

Also, remember this is about the winter solstice which, if we put all the vagaries of the Gregorian calendar to one side, really is the start of a new year. So maybe the Newgrange light show was the next best thing to fireworks for its Neolithic builders.

Thanks for listening. This is Steve Nerlich from Cheap Astronomy, www.cheapastro.com. Cheap Astronomy offers an educational website that has kissed the Blarney stone. No ads, no profit, just good science. Bye.