

Hi this is Steve Nerlich from Cheap Astronomy www.cheapastro.com and this is *The week after Carl Sagan Day*.

Well, sorry - this is a little late since the inaugural Carl Sagan Day was November the 7th, but we had to get those Greenhouse episodes done – which Carl Sagan would have approved of having been a 1980s vintage awareness raiser of the planetary-level risks of stuffing up the atmosphere with pollutants. Anyway, the day was in celebration of Carl Sagan's birthday, which was actually November the 9th, so maybe doing this on November the 16th is OK too.

If you wish to make an apple pie from scratch, you must first create the universe.

And if you want to become a passionate astronomy and science advocate, it's a good idea to first create a prestigious career in science. Born in 1934, Carl Sagan completed undergraduate and graduate studies in physics and by 1960 had completed his PhD in astronomy and astrophysics – all at the University of Chicago.

From there he went onto lecture at Harvard from 1962 to 1969, while undertaking research at the associated Smithsonian Astrophysical Observatory – and then he moved to Cornell University to become a full professor and the Director of the Planetary Studies lab there. See, he wasn't just some guy who got on the telly.

Early on, Sagan became engaged as an adviser for a range of NASA programs, notably a range of unmanned interplanetary missions, up to and including the Voyager missions. Sagan is widely credited with first proposing that the surface of cloud-covered Venus – rather than being the lush rainforested planet described in Ray Bradbury stories – was in fact a deadly lead-melting hellhole due to extreme greenhouse effects, as confirmed by Mariner 2 when it did a fly-by way back in 1962.

Furthermore Sagan, who took an early interest not just in the planets, but also the moons of the solar system, suggested that Europa had a liquid ocean under its icy crust – later substantiated by the Galileo spacecraft – and that Titan had a dense hydrocarbon atmosphere – first confirmed by the Voyagers – and further confirmed by the Cassini Huygens mission which landed a probe there in 2004, eight years after Sagan's death.

It is far better to grasp the Universe as it really is than to persist in delusion, however satisfying and reassuring.

Apparently Carl Sagan was a big advocate of something called skepticism, of which Socrates (or Socrates as he is sometimes known) was an early proponent, spending much of his time wandering around the Parthenon going *Really?* every time someone uttered a time-honoured-truth with no evidence to back it up.

Throughout most of his career at Cornell University, Carl Sagan taught a hugely popular course on critical thinking and later wrote the skeptical classic *The Demon-Haunted World – Science as a Candle in the Dark* which was published only a year before his death in 1996 and included Sagan's signature *Baloney Detection Kit* – a series of rules and principles to test extraordinary claims and identify fallacious arguments.

Our planet is a lonely speck in the great enveloping cosmic dark. In our obscurity, in all this vastness, there is no hint that help will come from elsewhere to save us from ourselves.

Sagan, who was highly skeptical of the various claims of alien landings, crashes and abductions in the late seventies and eighties, nonetheless enthusiastically supported projects seeking to communicate with any aliens out there, including the 1974 Arecibo message in collaboration with Frank Drake (of Drake equation fame).

Sagan also drove design of the plaques carried on Pioneer 10 and 11 – and the phonograph records carried on Voyagers 1 and 2. And you could listen to Cheap Astronomy podcast number 5 for more information there. Carl Sagan was also involved in the fledgling SETI program, sitting on the Board of Trustees of the SETI Institute.

In 1980 he co-founded the Planetary Society which today has over 100,000 members representing the largest space advocacy group in the world – with a mission "*To inspire and involve the world's public in space exploration through advocacy, projects, and education.*" The public voice generated by the Planetary Society helped to counter a threat by NASA to close down monitoring of the Voyager program, before Voyager 2 had even done its fly-bys of Uranus and Neptune – all because the government of the time was seeking to divert funding to revitalise an arms race with the Soviet Union.

Sagan was also successful in lobbying NASA to turn Voyager 1 around to take a retrospective image of the solar system from its unique vantage point of 6 billion kilometres from Earth. This became the famous Pale Blue Dot picture – where Earth is seen a one pixel sized dot in the vastness of space.

Every thinking person fears nuclear war and every technological nation plans for it. Everyone knows it's madness, and every country has an excuse.

Being a seventies and eighties sort of guy – Sagan not only displayed a fondness for turtle necked sweaters and safari suits, but was also a passionate advocate for nuclear disarmament.

With his planetary scientist hat on he raised the spectre of a nuclear winter where multiple nuclear blasts would throw sufficient dust into the atmosphere to drastically limit the Sun's radiation, perhaps for decades.

With respect to the Fermi Paradox – that if other space travelling civilisations have evolved, how come we see no evidence of them – Sagan suggested with some genuine pessimism that most civilisations destroy themselves shortly after developing the technological capability to do so.

With his planetary scientist hat off, Sagan was twice arrested for scaling the fence of the Nevada Test Site during protests against the US government's refusal to agree to a moratorium on nuclear testing which had been proposed by the Russians.

But fortunately, here in 2009, all that stuff is no longer a problem because these days different nations invest huge amounts of funding to maintain nuclear arms with no intention of ever using them – because that would just be irrational.

One glance at a book and you hear the voice of another person, perhaps someone dead for 1,000 years. To read is to voyage through time.

Probably Sagan's best known work in public media included the TV series Cosmos first aired in 1980, just after I'd finished high school and then he wrote the science fiction novel Contact in 1985 after I'd finished university – and the movie came out in 1997 which is all a bit of a blur now, but was one year after he died.

What I remember best is my mother's collection of the 1966 LIFE Science Library – which had a fabulous volume on Evolution, including an absorbing chapter on dinosaurs – but also a nearly as fabulous volume called The Planets with speculations on what sort of life forms could develop on the different planets – which a 5 year old me went all goggle-eyed over. And just now who do I find, only after researching this podcast, had written all that material?

Yep, a then quite unknown academic from Harvard named Carl Sagan.

Thanks for listening. This is Steve Nerlich from Cheap Astronomy, www.cheapastro.com. Cheap Astronomy offers an educational website where you can contact the cosmos from a pale blue dot.