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Glossary

Asteroid: A stony object, sometimes with a metallic core, that orbits the Sun.

Asteroid Belt: A ring of debris located between Mars and Jupiter that is the home of millions of asteroids. It is the only asteroid belt in our Solar System, though other planetary systems have multiple asteroid belts.

Bolide: An extremely bright meteor that typically explodes within Earth's atmosphere.

Broom star: Archaic Chinese term for comet.

Bushy star: Archaic Chinese term for comet.

Chaman tz 'utan: An ancient Mayan term for a small comet, translating to 'a magician's cigar'.

Chondrite: A stony meteorite.

Comet: A celestial body that contains ice and dust; when near the Sun a 'tail' of gas and dust becomes visible.

Cometa: The Latin for comet used in medieval Europe, borrowed from the Greek *komētēs*, which means 'long-haired'.

Elliptical orbit: The egg-shaped trajectory of a celestial object as a consequence of gravitational forces.

Ejecta: Matter that is ejected, typically as a result of a meteorite impact, stellar explosion, or volcanic eruption.

Exosphere: The outermost (fifth) layer of Earth's atmosphere composed of light gases.

Flaming sword: Medieval European term for a comet.

Flower of the sky: A Victorian poetic term for a comet.

Guest star: Ancient Chinese term for a comet or supernova.

Hyperbolic orbit: A one-time flight path of a celestial object that does not repeat or return.

Impact event: When an object from space, such as an asteroid or meteor, collides with a planet or its satellites.

Impact winter: The theorised period of prolonged global cooling after an asteroid or comet impact. The resulting dust, debris and soot block sunlight for many months or years, resulting in reduced photosynthesis and ultimate starvation for many species.

Kamacite: A nickel-iron alloy (up to 7% nickel) primarily found in iron meteorites and occasionally stony meteorites.

Kuiper Belt: A disk-shaped home of relics from the formation of the Solar System, containing comets and Pluto, located beyond Neptune. It differs from the Asteroid Belt in size (much larger), location, and contains bodies largely comprised of ice and gas.

Long-period comet: Orbital periods can be many hundreds, thousands or even millions of years and originate from the Oort Cloud.

Mesosphere: The third and coldest layer of Earth's atmosphere, where friction with the layer's gas molecules causes meteors burn up.

Meteor: When a meteoroid enters Earth's atmosphere, it heats up and vaporises due to friction with the air, creating a bright streak of light in the sky known as a meteor or 'shooting star'.

Meteorite: If a meteoroid is large enough, it can survive its fiery passage through the atmosphere and strike the Earth's surface. The recovered object is then called a meteorite.

Meteoroid: The general term for a small, rocky or metallic object traveling through space.

Meteor air burst: The explosion of a meteor upon entry to a planet's atmosphere.

Meteor shower: The debris of comets or asteroids; there are nine major meteor showers and 21 minor meteor showers every year; they are named after constellations from which they are deemed to fall.

Octahedrite: The most common iron meteorite.

Oort Cloud: A theoretical ring around the Solar System that is the home of long-period comets.

Pallasites: Stony meteorites with iron-nickel matrix that contains yellow-green olivine silicate crystals.

Parallax: The apparent shift of an object when viewed from different points of the Earth's orbit.

Perihelion: The closest a planet, asteroid or comet gets to the Sun, typically making this the point the object is at its brightest.

Pheasant star: Archaic Chinese term for a shooting star.

Primitive comet/asteroid: A body as ancient as our Solar System, containing residual materials of its creation.

Pyrite: In this instance: meteorites containing iron sulphide or 'fool's gold'.

Shooting star: A rapidly moving celestial object, typically a meteor but often associated with other fast-moving materials in space.

Short-period comet: Orbital periods of under 200 years and originate from the Kuiper Belt.

Stratosphere: The second layer of the atmosphere, which contains the ozone layer.

Strewn Field: Area of dispersal of a meteorite fall.

Sungrazer: A comet that passes very close to the Sun.

Superbolide: An exceptionally bright meteor, or fireball, visible in daylight, they are around 100 times brighter than a full Moon.

Taenite: A mineral alloy of iron and nickel (nickel proportions of up to 65%) found mostly in iron meteorites.

Tektite: A black, molten glassy ejecta from a meteorite impact.

Thermosphere: The fourth layer of Earth's atmosphere and the layer where aurora borealis and aurora australis occur.

Thunderstone: Colloquial term for the Ensisheim meteorite of 1492.

Troposphere: The first and lowest layer of Earth's atmosphere, which begins on the Earth's surface up to an altitude of around 7½ miles (12km).

Uncommon Star: Tudor term for the comet of 1577.

Widmanstätten pattern: The interleaving of kamacite and taenite that results in a pattern unique to each octahedrite or pallasite meteorite.



Introduction

L'Aigle, France – 1803

Swallows fly through an early spring afternoon in the rural French town of L'Aigle, Normandy. Horse and carts clatter down the main streets, transporting the town's mesdames, gossips and local celebrities to lunch. A clerk scratches at his paper with a quill, signing a court release. Thirty leagues away, a young boilermaker, laden with tools and sheets of metal, packs up after his last job – he whistles to his friend across the street before hopping into a light cart that speeds him back home to L'Aigle. In the fields, oxen heave ploughs through the earth, their tough white hides whipped by peasant farmers longing for their lunch.

It is April in the eleventh year of the Republican Calendar, and the French Revolution simmers in the country's memory. In Paris, it is the Age of Reason, and rational thinking has superseded luxury, superstition and frivolity: men of science dissect and discount the cosmos in the wooden rooms of the Institute of France. Unbeknown to them, in the not too distant future, they will be in receipt of hundreds of rocks reported to have fallen from the sky and onto the small town of L'Aigle, this very day. Despite their misgivings, they will dispatch a young physicist, Jean-Baptiste Biot, to the town to investigate a phenomenon still regarded by such enlightened men as the superstition of peasants; like the sky raining blood, milk or honey, the idea of rocks falling from the heavens is for the birds.

Meanwhile, back in L'Aigle, it is now approaching 1 o'clock. The farmer climbs onto his plough to take an early lunch. Sweating, he swills some beer and, tilting his head back to reach the dregs, catches a series of bright flashes, brighter even than the clear spring sky. He blinks. More flashes, so dazzling that when he rubs his eyes streaks of colour glow across his retinas. He hears a sound like a whistle, and a small rock lands by his feet. He turns to see who has thrown it. The field is empty but he can hear shouts in the distance. Then comes a rushing roar, like a mortar.

The townspeople of L'Aigle have grown up with the tale of a rock that had fallen from the sky some three

centuries earlier, onto what was then the Germanic town of Ensisheim in Alsace, which later became part of north-east France. In 1492, a 280lb (127kg) meteorite fell to Earth. The 'thunderstone' left a hole in the ground the size of a small child and foretold the defeat of French forces at the hands of the Holy Roman Emperor that same year. It had been kept chained inside the town's church so that it would not 'wander' until the recent Revolution, when it was liberated along with much of the church's property by revolutionaries. To symbolise the triumph of the secular Revolution over religion and superstition, the meteorite had been temporarily relocated to Colmar, on France's border with Germany, to undergo scientific analysis.

Like most people, the farmer had heard the legend of the thunderstone. When he was a boy, his grandfather had told him that the victorious Holy Roman Emperor had kept fragments of it for good luck. It had been a source of pride for the Germanic peoples, a talismanic weapon against the French. In their oral history, stones falling from the heavens foreshadowed plague, pestilence and defeat. In the field the falling rock is accompanied by the smell of sulphur – the smell of hell. The crack of an almighty explosion is followed by a sound like a large tree falling, and the sky now belches a torrent of rocks. The farmer hides beneath his plough, inhaling the smell of damp earth as the trailing flashes that he had once

marvelled at as a boy transform into a globe of fire before his eyes.

Two hundred and twenty-three years later, a dark grey rock, smoothed as if by a river of time and space, sits under white LED lights inside a glass box in a provincial museum in the sleepy town of Angers, in western France. If a rock were ever to be described as looking mischievous, it would be the L'Aigle meteorite.

The L'Aigle meteorite was one of over 3,000 rocks that fell to Earth that April day in 1803. Originating from a larger meteor that was dislodged from the asteroid belt – a necklace of frigid debris between Mars and Jupiter – this meteorite travelled over 92 million miles (148 million km) to change our understanding of shooting stars forever.

Because the strewn field (the area over which meteorites from a single fall are dispersed) was so vast, eye-witness accounts of the event weren't limited to the tales of isolated peasant farmers, as had so often been the case previously, and whose accounts were typically discounted and ridiculed. Now, educated, upper-class citizens, who had nothing to gain from perceived fantasising, were giving the same testimonial as peasants to Jean-Baptiste Biot, the young physicist that had been dispatched by the Institute.

Accumulating testimony from all walks of life – farmers, dignitaries, clerks and young boilermakers

heading home, all talking about the 'rain of stones thrown by the meteor' – Jean-Baptiste Biot would be able to prove to rational men that rocks falling from the sky were no longer a matter of superstition and folk belief, but a reality.

Culturally, instinctively, how much did this shift in perception and understanding matter to the Western mind? Did scientific understanding of these celestial phenomena shift our association with shooting stars away from the portentous or the miraculous? Were there other cultures that already saw them as gifts from the gods, and used these cosmic offerings to better their day-to-day lives? What perceptions, superstitions and beliefs have we held historically regarding shooting stars across the globe – have they always been portents of doom, signs of the falling of kings, the physical manifestation of a miracle? Or were there other, stranger beliefs regarding these uncommon stars?

And did this new, rational knowledge change how a person – standing on a moor, in a desert, out at sea, driving home – felt when they saw a light tearing through the sky? Did we continue to feel as we have always done when witnessing a shooting star, filled with awe and terror in equal measure? *When the Sky Falls* will delve into our ancient past, turn over our present and grasp at our potential futures to explore where shooting stars have taken us, and where they may yet lead.

*

In the not so distant past, I grew up near a Dark Sky Zone, which ensured our evenings in the countryside were ruled by the stars, or the clouds that obscured them, depending on which way the wind was blowing. I remember nights during the long summer holidays where I lay out on our hard, cold, stony drive, staring like a thwarted magpie at the glittering sky, waiting and watching for a lone shooting star or the volley fire of the Perseids. This was before there was the clutter of satellites that now haunt our sky, which hardly detract from the surprise of a shooting star but can become something of a frustration, causing the observing hand to shoot up and point, and then retract, disappointed. It was also before I had any real concept of, or interest in, what these declining lights were aside from the primal enchantment they held for a young girl whose principal interest was in the mud and all that sprang from it. In place of the fireflies and glowworms I read about and longed to see, I had these bright beings. I looked up simply because I could, because this impossible canopy hung above me.

My fascination with shooting stars endured a punk rock phase and a move to a city; but it was then largely confined to the blue glow of a computer screen as I learned about the backrooms of heaven, where such superlunary

phenomena originate. Where there is no life as we know it. Where all is an inanimate kingdom of rocks waiting to be nudged, like chicks nesting on a cliff, into their first and only flight, their moment in the Sun.

Confused about where I was and what I was doing with my life, I watched plasma, gases and debris fight and play; rise and fall like empires; explode in furious death rages; swallow themselves whole. Travelling to Los Angeles during this period, I found that there were places, even within a city, where residents were encouraged to turn off their outdoor lights at night to prevent light pollution and increase the visibility of stars. And while I looked up and watched the sky's white lights, infinite as the white lights on the eight-lane highways, I wondered why this phenomenon wasn't more prevalent in towns and cities in the UK. I was envious of the residents of Topanga Canyon, and the longer I lived in a city the more I felt that some priceless inheritance was missing in a life without a clear night sky.

By the time I returned to the countryside and its open-ended evenings, I had changed careers and started to write. I developed a fascination, not only with meteors and comets, but with asteroids, their trajectories and their gravitational pull, together with a morbid excitement when entertaining their absolution. I spent four years writing a novel that, in part, followed the journey of an

impending asteroid. The book was as unwieldy as the asteroid that featured in it and would never be finished, but the research I did then informed and perpetuated this enchantment with fires that fly.

I have since spent time speaking with astrophysicists, read papers and sifted through archeological and anthropological research about humankind's relationship with, and beliefs surrounding, sky fires; and I have sought out more dark zones to better watch the skies fall. But the most memorable occasion was the time I was not looking for shooting stars, when I found myself on a tiny island in lockdown during the Geminid meteor shower – one of only two meteor showers created by the debris of an asteroid rather than a comet. I wrapped myself up and sat with a glass of wine in a deckchair in December, outside the island church I was living in, and watched as sparks seemingly fell from the universe, only to be extinguished by the howling wind.

Certainly, this was my most memorable occasion – until last night, the day before I was due to complete this book. Driving home on potholed country back roads, I looked up above the dark fields and evergreen conifers at what, at first, appeared to be a lone firework above the forest. Then I realised what I was seeing: a meteor falling from north-east to south-west. A long, smoky orange tail chased the head as it barrelled down like an impending,

fire-starting fist. I stopped the car and watched open-mouthed as its brightness increased, becoming a flare of white-green, before disappearing, leaving the crisp night black and silent, as if it had never been there. It was a rogue, an imp in the uniform march of time. A sight I had longed for my whole life. In that instant there was no ambiguity between me and the universe. Time eroded and I experienced the full grace of existence: the present moment.

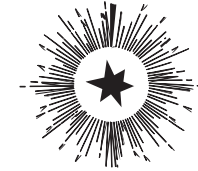
When the Sky Falls is the culmination of these years and experiences: I hope to share the curious, the terrifying, the beautiful, the strange, the dark, the backwards, the progressive and the inspiration we have drawn from such rare, travelling stars. Meteors, meteorites, meteoroids, bolides, comets and asteroids have shaped our belief systems, folklores, countries, monarchies, histories, our understanding of the universe, and the course of life itself. Perhaps what is most remarkable is that, after billions of years, they continue to influence many of these things.

What I find most heartening about our shared history of shooting stars is not their propensity to bring about sublime realisations from the exceptionally gifted, it is that we have not needed high intellect to see the miracle or the doom. It was the labourers out on the land who saw stones fall from the sky and needed no further

evidence to comprehend that, strange as it may be, this was the way of things. It was the person, anywhere in the world, who picked up a rock that had fallen from the sky and knew, instinctively, that it was different to the stone they stood upon. And for a time, they alone knew that we could reach out and touch something that was out of this world.

Devon, England, 26 November 2025

PART ONE



When the City
is a Star:

*Art, Culture and the
Shooting Star*