

1. The beginning of space race

Space exploration is the investigation of physical conditions in space and on stars, planets, and other celestial bodies through the use of artificial satellites (spacecraft orbiting the earth), space probes (spacecraft that pass through the solar system and that may or may not orbit another celestial body), and spacecraft with human crews. The Space Race was a heated competition between the United States and the Soviet Union, as each side tried to match or better the other's accomplishments in exploring outer space. It involved the efforts to explore outer space with artificial satellites, to send man into space, and to land him on the Moon.

The Space Race effectively began after the Soviet launch of Sputnik 1 on October 4, 1957. The term originated as an analogy to the arms race. The Space Race became an important part of the cultural, technological, and ideological rivalry between the United States and the Soviet Union during the Cold War. Space technology became a particularly important arena in this conflict, because of both its potential military applications and the morale-boosting social benefits. After the Second World War, the US and the USSR, once wartime allies, became involved in a Cold War (1945–91) of espionage and propaganda. The United States defence strategy included a large air-refuelable, strategic bomber air force and advance bases in countries close to Soviet airspace. Having neither an equivalent air force, nor analogous advance bases near the continental United States, the USSR countered with long-range rockets and missiles.

On July 29, 1957, in recognition of the 1957-1958 International Geophysical Year, the White House announced that the U.S. intended to launch satellites by the spring of 1958. This became known as Project Vanguard. On July 31, the Soviets announced that they intended to launch a satellite by the fall of 1957. On 4 October 1957, the Soviet Union successfully launched Sputnik 1 into space, the first artificial satellite to orbit the Earth, thus beginning the Space Race and making the USSR the first space power. A month later, the USSR successfully orbited Sputnik 2, with the first living passenger, a dog named Laika.

In the Soviet Union, a country recovering from a devastating war, the launch of Sputnik and the following program of space exploration were met with great interest from the public. It was also important and encouraging for Soviet citizens to see the proof of technical prowess in the new era.

2. Moscow Region to get its own collider

The attention of physicists worldwide is currently riveted on the European Organization for Nuclear Research (CERN), which is operating the Large Hadron Collider (LHC). The LHC is expected to become the main impetus and pinnacle of achievement in high-energy physics research; however, it is already clear that answers to many questions will not come via the LHC. For example, it will be impossible to observe the process of very dense nuclear material transition to a new state - quark-gluon plasma - a mixed phase existing in the first moments after the Big Bang. There is a theory that that was when quarks existed in a free state. Then they grouped together and protons and neutrons appeared. In the LHC, this process is skipped because the energy of the particles' interaction is too high.

Alexei Sisakyan, director of the Joint Institute for Nuclear Research (JINR) at the international scientific center in Dubna, says that this may be compared to boiling water. If we can see how water (heavy nuclei) changes into steam (quark-gluons) at 100 degrees, then at 1000 degrees, this process is invisible - it takes a fraction of a second for the water to evaporate and observing it is impossible.

Scientists hope to register the transition of quarks into protons and neutrons in the collider that is planned to be built in the Moscow-region town of Dubna. The new physical device has been named NIKA (a high-energy heavy ion collider). A one-of-a-kind accelerator complex will be created. It will consist of a cascade of four accelerators, one of which is already built and activated - the superconductive ion synchrotron-nuclotron. The collider developers intended for the particles to be accelerated in several of its coils in one direction, picking up more and more speed. In the final stage, they will travel in the opposite direction in the two coils. Collision points for particle beams are anticipated in several places along these coils. It is expected that free quarks will be seen during the time of their collision (currently quarks exist only in clusters of three) and it will be possible to observe the process of their attractive interaction with one another.

Scientists are counting on being able to use the new installation to research the properties of the transition of matter from one phase state to another, as well as the conditions associated with the transition to this phase (if indeed such a transition takes place), during which the nuclear and quark-gluon material may coexist. It is not improbable that such conditions currently exist in the cores of neutron stars.

Today in Dubna, the updating of the nuclotron is in full swing - the vacuum in the coil has been fundamentally improved; the cryogenic unit, which is the heart of the superconducting accelerator, has been fully renovated.

3. Turning up the heat on quantum mechanics

Scientists have made a startling prediction about the quantum world that seems to show that simply taking the temperature of certain types of quantum systems at frequent intervals causes such systems to break one of the hard and fast rules of thermodynamics. Anyone who has dabbled in quantum mechanics will know just how slippery is the atomic and sub-atomic world of probability wave-functions where particles eddy and swirl like waves.

One of the underlying rules of the quantum world is the Time-Energy Uncertainty Principle. Wrapped up in this apparently simple phrase is the notion that it is impossible to know both the precise duration of any process and its exact energy cost in an atomic or subatomic particle with 100 % certainty; the very act of observing one or the other is somehow disturbing the counterpart property. The quantum world is spooky, to say the least. Now, the laws of thermodynamics are apparently irrefutable, after all they allow sceptics to see straight through the claims of those inventors who claim perpetual motion machines, they allow us to build power stations, and ultimately they will take us to the ends of the universe.

One law reveals that the interaction between a large heat source and a cluster of smaller systems will, on average, move progressively towards thermal equilibrium – hot moves to cold to even out the temperature, in other words; this is the so-called zero'th law of thermodynamics. But, it isn't necessarily so in the quantum world claim Weizmann chemists Gershon Kurizki, Noam Erez and Goren Gordon of the Weizmann Institute in Rehovot, Israel, working with Mathias Nest of Potsdam University, Germany. They have shown that an ensemble of quantum systems in thermal contact with a large heat source could buck this thermodynamic trend.

Their predictions suggest that such a quantum ensemble could actually heat up even if it is hotter than a neighbouring large heat source or if it is colder, it could get colder still, but only under certain conditions. The scientists showed that if the energy of these systems is measured repeatedly, both systems and large heat source will undergo a temperature increase or decrease, and this change depends only on the rate of measurement, not on the results of the measurements themselves.

4. Global Warming

Global warming is the increase in the average temperature of Earth's near-surface air and oceans since the mid-20th century and its projected continuation. Global surface temperature increased 0.74 ± 0.18 °C between the start and the end of the 20th century. The Intergovernmental Panel on Climate Change (IPCC) concludes that most of the observed temperature increase since the middle of the 20th century was caused by increasing concentrations of greenhouse gases resulting from human activity such as fossil fuel burning and deforestation. The IPCC also concludes that variations in natural phenomena such as solar radiation and volcanism had a small cooling effect after 1950. These basic conclusions have been endorsed by more than 40 scientific societies and academies of science, including all of the national academies of science of the major industrialized countries.

Climate model projections summarized in the latest IPCC report indicate that the global surface temperature is likely to rise further during the 21st century. The uncertainty in this estimate arises from the use of models with differing sensitivity to greenhouse gas concentrations and the use of differing estimates of future greenhouse gas emissions. Some other uncertainties include how warming and related changes will vary from region to region around the globe.

Most studies focus on the period up to the year 2100. However, warming is expected to continue beyond 2100 even if emissions stop, because of the large heat capacity of the oceans and the long lifetime of carbon dioxide in the atmosphere. An increase in global temperature will cause sea levels to rise and will change the amount and pattern of precipitation, probably including expansion of subtropical deserts. Warming will be strongest in the Arctic and will be associated with continuing retreat of glaciers, permafrost and sea ice. Other likely effects include increases in the intensity of extreme weather events, species extinctions, and changes in agricultural yields. Political and public debate continues regarding global warming, and what actions (if any) to take in response. The available options are mitigation to reduce further emissions; adaptation to reduce the damage caused by warming; and, more speculatively, reengineering to reverse global warming.

5. THE CIVIL WAR

Lincoln lost the senatorial race, but in 1860 he and Douglas faced each other again — as the Republican and Democratic candidates for president. By now the tension between North and South was extreme. In 1859, John Brown, as abolitionist zealot, had tried to begin a slave rebellion in Virginia by attacking an army munitions depot. Brown was quickly captured, tried and hanged, whereupon many Northerners hailed him as a martyr. Southern whites, however, now believed that the North was preparing to end slaveros bloody warfare. Douglas urged Southern Democrats to remain in the Union, but they nominated their own presidential candidate and threatened to secede if the Republicans were victorious.

Every Southern and border state voted against Lincoln, but the North supported him and he won the election. A few weeks later, South Carolina voted to leave the Union. It was soon joined by Mississippi, Florida, Alabama, Georgia, Louisiana, Texas, Virginia, Arkansas, Tennessee and North Carolina. These 11 states proclaimed themselves an independent nation — the Confederate States of America — and the American Civil War began.

Southerners proclaimed that they were fighting not just for slavery; after all, most Confederate soldiers were too poor to own slaves. The South was waging a war for independence — a second American Revolution. The Confederates usually had the advantage of fighting on their home territory, and their morale was excellent. They had superb soldiers, cavalrymen and generals, but they were greatly outnumbered by Union (Northern) forces.

Lincoln's first priority was to keep the United States one country; freedom for black people was a secondary objective. But Lincoln realized that by making the war a battle against slavery he could win support for the Union at home and abroad.

6. THE 1848 RUSH FOR GOLD

The discovery of gold had been made in 1848 by James W. Marshall, who was building a mill on Sutter's Creek, about a hundred miles from San Francisco. He tried to keep his discovery a secret, but within a week, everybody in San Francisco knew about it. A few days later, almost all of San Francisco's 800 inhabitants left for Sutter's Mill. The news spread rapidly to the East, and then to Europe and Asia.

Stories of quick and easy money made men forget their jobs, their friends, and their families. Thousands of men quit their jobs, sold their businesses, said good-bye to their families, and joined in the rush for California.

The cheapest way to the West was by land. It took longer and was far more dangerous than other ways, but it was the most popular route for the average man. By land, it was more than three thousand miles from the East to California. High mountains, broad rivers, thick forests, and hot deserts lay between the two coasts. But greed overcame the fear of danger, and men left their homes with no regrets.

Nine out of every ten persons who went to California were men. A few courageous women went too. One of the women was a ninety-year-old grandmother, who made the long trip by foot and on horseback, and arrived in perfect health. People from all walks of life who went west quickly learned that travel in the wilderness is not easy. Some were killed by Indians, others starved, and many turned back when they had no more food. Yet thousands reached California safely, following the trails of the mountain men.

A very few became rich. Some of the earliest miners made thousands of dollars a month. A few averaged a few hundred dollars a week for many months. One or two men mined as much as \$5,000 in a single day. But by 1850, the ordinary miner could expect only about \$15 a day for his labors.

7. THE GREAT DEPRESSION

On October 24, 1929, — “Black Thursday” — a wave of panic selling of stocks swept the New York Stock Exchange. Once started, the collapse of share and other security prices could not be halted. By 1932, thousands of banks and over 100,000 businesses had failed. Industrial production was cut in half, farm income had fallen by more than half, wages had decreased 60%, new investment was down 90% and one out of every four workers was unemployed.

The Republican president, Herbert Hoover, asked employers not to cut wages, and he tried to reduce interest rates and support farm prices. In 1932, he approved the creation of the Reconstruction Finance Corporation, which loaned money to troubled banks.

But these measures were inadequate to deal with the economic collapse, and Hoover resisted proposals for federally funded relief and work projects. He believed that he could end the Depression by balancing the national budget and by restoring business confidence. He assured the public that recovery was “just around the corner,” but the economy continued to decline. To masses of unemployed workers, Hoover seemed uncaring and unable to help them. In the 1932 election, he was resoundingly defeated by Democrat Franklin D. Roosevelt, who promised “a New Deal for the American people.”

Roosevelt’s New Deal programs did not end the Depression. Although the economy improved as a result of this program of government intervention, full recovery was finally brought about by the defense build-up prior to America’s entering the Second World War. Many Americans, young and old, still feel great affection for Franklin D. Roosevelt, the president who remembered “the forgotten man at the bottom of the economic pyramid.”

8.PEARL HARBOR ATTACK

The surprise aerial attack on the US naval base at Pearl Harbor, Hawaii, by the Japanese, which took place on December 7, 1941, precipitated the entry of the US into World War II. The Attack climaxed a decade of worsening relations between the US and an increasingly expansionist and militaristic Japan.

Admiral Isoroku Yamamoto, the commander in chief of Japan's combined fleet, had planned the attack against the US Pacific Fleet with great care. Once the fleet was out of action, Japan's road to Southeast Asia and the Pacific Islands would be open. On November 23 a Japanese fleet, including 6 aircraft carriers, 2 battleships, 3 cruisers and 11 destroyers, sailed to a point 440 km North of Hawaii. From there, about 360 planes were launched.

The assault began at 7:55 AM (local time). The anchored ships in the harbor made perfect targets, and since it was Sunday morning (a time chosen by the Japanese for maximum surprise) they were not fully manned. The Japanese torpedo planes, especially, hit the US battleships with deadly effect. The "Arizona", "California" and "West Virginia" were sunk, and the "Oklahoma" capsized. A second wave of planes swept over Pearl Harbor about 45 minutes later, inflicting heavy damage on battleships "Maryland", "Nevada", "Tennessee" and "Pennsylvania". Ten other ships were sunk or severely damaged, and more than 150 aircrafts were destroyed. Military casualties totalled more than 3,000, including over 2,000 killed. The Japanese lost only 29 planes and 5 midget submarines.

The Pearl Harbor attack severely crippled US naval and air strength in the Pacific. The "date which will live in infamy", as US President Franklin Roosevelt termed it, united the US public and swept away any earlier support for neutrality. On December 8, Congress declared war on Japan with only one dissenting vote.