

CHAPTER XV.

HYPERBOLA OR PARABOLA.

Our readers will probably be astonished that Barbicane and his companions were so little occupied with the future in store for them in their metal prison, carried along in the infinitude of ether. Instead of asking themselves where they were going, they lost their time in making experiments, just as if they had been comfortably installed in their own studies.

It might be answered that men so strong-minded were above such considerations, that such little things did not make them uneasy, and that they had something else to do than to think about their future.

The truth is that they were not masters of their projectile--that they could neither stop it nor alter its direction. A seaman can direct the head of his ship as he pleases; an aëronaut can give his balloon vertical movement. They, on the contrary, had no authority over their vehicle. No manoeuvre was possible to them. Hence their not troubling themselves, or "let things go" state of mind.

Where were they at that moment, 8 a.m. during that day called upon earth the sixth of December? Certainly in the neighbourhood of the moon, and even near enough for her to appear like a vast black screen upon the

firmament. As to the distance which separated them, it was impossible to estimate it. The projectile, kept up by inexplicable forces, has grazed the north pole of the satellite at less than twenty-five miles' distance. But had that distance increased or diminished since they had been in the cone of shadow? There was no landmark by which to estimate either the direction or the velocity of the projectile. Perhaps it was going rapidly away from the disc and would soon leave the pure shadow. Perhaps, on the contrary, it was approaching it, and would before long strike against some elevated peak in the invisible atmosphere, which would have terminated the journey, doubtless to the detriment of the travellers.

A discussion began upon this subject, and Michel Ardan, always rich in explanations, gave out the opinion that the bullet, restrained by lunar attraction, would end by falling on the moon like an aërolite on to the surface of the terrestrial globe.

"In the first place," answered Barbicane, "all aërolites do not fall upon the surface of the earth; only a small proportion do so. Therefore, if we are aërolites it does not necessarily follow that we shall fall upon the moon."

"Still," answered Michel, "if we get near enough--"

"Error," replied Barbicane. "Have you not seen shooting stars by thousands in the sky at certain epochs?"

"Yes."

"Well, those stars, or rather corpuscles, only shine by rubbing against the atmospheric strata. Now, if they pass through the atmosphere, they pass at less than 16 miles from our globe, and yet they rarely fall. It is the same with our projectile. It may approach very near the moon, and yet not fall upon it."

"But then," asked Michel, "I am curious to know how our vehicle would behave in space."

"I only see two hypotheses," answered Barbicane, after some minutes' reflection.

"What are they?"

"The projectile has the choice between two mathematical curves, and it will follow the one or the other according to the velocity with which it is animated, and which I cannot now estimate."

"Yes, it will either describe a parabola or an hyperbola."

"Yes," answered Barbicane, "with some speed it will describe a parabola, and with greater speed an hyperbola."

"I like those grand words!" exclaimed Michel Ardan. "I know at once what you mean. And what is your parabola, if you please?"

"My friend," answered the captain, "a parabola is a conic section arising from cutting a cone by a plane parallel to one of its sides."

"Oh!" said Michel in a satisfied tone.

"It is about the same trajectory that the bomb of a howitzer describes."

"Just so. And an hyperbola?" asked Michel.

"It is a curve formed by a section of a cone when the cutting plane makes a greater angle with the base than the side of the cone makes."

"Is it possible?" exclaimed Michel Ardan in the most serious tone, as if he had been informed of a grave event. "Then remember this, Captain Nicholl, what I like in your definition of the hyperbola--I was going to say of the hyperhumbug--is that it is still less easy to understand than the word you pretend to define."

Nicholl and Barbicane paid no attention to Michel Ardan's jokes. They had launched into a scientific discussion. They were eager about what curve the projectile would take. One was for the hyperbola, the other for the parabola. They gave each other reasons bristling with x's.

Their arguments were presented in a language which made Michel Ardan

jump. The discussion was lively, and neither of the adversaries would sacrifice his curve of predilection.

This scientific dispute was prolonged until Michel Ardan became impatient, and said--

"I say, Messrs. Cosine, do leave off throwing your hyperbolas and parabolas at one's head. I want to know the only interesting thing about the business. We shall follow one or other of your curves. Very well. But where will they take us to?"

"Nowhere," answered Nicholl.

"How nowhere?"

"Evidently they are unfinished curves, prolonged indefinitely!"

"Ah, savants! What does it matter about hyperbola or parabola if they both carry us indefinitely into space?"

Barbicane and Nicholl could not help laughing. They cared for art for its own sake. Never had more useless question been discussed at a more inopportune moment. The fatal truth was that the projectile, whether hyperbolically or parabolically carried along, would never strike against either the earth or the moon.

What would become of these bold travellers in the most immediate future? If they did not die of hunger or thirst, they would in a few days, when gas failed them, die for want of air, if the cold had not killed them first!

Still, although it was so important to economise gas, the excessive lowness of the surrounding temperature forced them to consume a certain quantity. They could not do without either its light or heat. Happily the caloric developed by the Reiset and Regnault apparatus slightly elevated the temperature of the projectile, and without spending much they could raise it to a bearable degree.

In the meantime observation through the port-lights had become very difficult. The steam inside the bullet condensed upon the panes and froze immediately. They were obliged to destroy the opacity of the glass by constant rubbing. However, they could record several phenomena of the highest interest.

In fact, if the invisible disc had any atmosphere, the shooting stars would be seen passing through it. If the projectile itself passed through the fluid strata, might it not hear some noise echoed--a storm, for instance, an avalanche, or a volcano in activity? Should they not see the intense fulgurations of a burning mountain? Such facts, carefully recorded, would have singularly elucidated the obscure question of the lunar constitution. Thus Barbicane and Nicholl, standing like astronomers at their port-lights, watched with scrupulous patience.

But until then the disc remained mute and dark. It did not answer the multifarious interrogations of these ardent minds.

This provoked from Michel a reflection that seemed correct enough.

"If ever we recommence our journey, we shall do well to choose the epoch when the moon is new."

"True," answered Nicholl, "that circumstance would have been more favourable. I agree that the moon, bathed in sunlight, would not be visible during the passage, but on the other hand the earth would be full. And if we are dragged round the moon like we are now, we should at least have the advantage of seeing the invisible disc magnificently lighted up."

"Well said, Nicholl," replied Michel Ardan. "What do you think about it, Barbicane?"

"I think this," answered the grave president: "if ever we recommence this journey, we shall start at the same epoch, and under the same circumstances. Suppose we had reached our goal, would it not have been better to find the continents in full daylight instead of dark night? Would not our first installation have been made under better circumstances? Yes, evidently. As to the invisible side, we could have visited that in our exploring expeditions on the lunar globe. So,

therefore, the time of the full moon was well chosen. But we ought to have reached our goal, and in order to have reached it we ought not to have deviated from our road."

"There is no answer to make to that," said Michel Ardan. "Yet we have passed a fine opportunity for seeing the moon! Who knows whether the inhabitants of the other planets are not more advanced than the savants of the earth on the subject of their satellites?"

The following answer might easily have been given to Michel Ardan's remark:--Yes, other satellites, on account of their greater proximity, have made the study of them easier. The inhabitants of Saturn, Jupiter, and Uranus, if they exist, have been able to establish communication with their moons much more easily. The four satellites of Jupiter gravitate at a distance of 108,260 leagues, 172,200 leagues, 274,700 leagues, and 480,130 leagues. But these distances are reckoned from the centre of the planet, and by taking away the radius, which is 17,000 to 18,000 leagues, it will be seen that the first satellite is at a much less distance from the surface of Jupiter than the moon is from the centre of the earth. Of the eight moons of Saturn, four are near. Diana is 84,600 leagues off; Thetys, 62,966 leagues; Enceladus, 48,191 leagues; and lastly, Mimas is at an average distance of 34,500 leagues only. Of the eighteen satellites of Uranus, the first, Ariel, is only 51,520 leagues from the planet.

Therefore, upon the surface of those three stars, an experiment

analogous to that of President Barbicane would have presented less difficulties. If, therefore, their inhabitants have attempted the enterprise, they have, perhaps, acquainted themselves with the constitution of the half of the disc which their satellite hides eternally from their eyes. But if they have never left their planet, they do not know more about them than the astronomers of the earth.

In the meantime the bullet was describing in the darkness that incalculable trajectory which no landmark allowed them to find out. Was its direction altered either under the influence of lunar attraction or under the action of some unknown orb? Barbicane could not tell. But a change had taken place in the relative position of the vehicle, and Barbicane became aware of it about 4 a.m.

The change consisted in this, that the bottom of the projectile was turned towards the surface of the moon, and kept itself perpendicular with its axis. The attraction or gravitation had caused this modification. The heaviest part of the bullet inclined towards the invisible disc exactly as if it had fallen towards it.

Was it falling then? Were the travellers at last about to reach their desired goal? No. And the observation of one landmark, inexplicable in itself, demonstrated to Barbicane that his projectile was not nearing the moon, and that it was following an almost concentric curve.

This was a flash of light which Nicholl signalised all at once on the

limit of the horizon formed by the black disc. This point could not be mistaken for a star. It was a reddish flame, which grew gradually larger--an incontestable proof that the projectile was getting nearer it, and not falling normally upon the surface of the satellite.

"A volcano! It is a volcano in activity!" exclaimed Nicholl--"an eruption of the interior fires of the moon. That world, then, is not quite extinguished."

"Yes, an eruption!" answered Barbicane, who studied the phenomenon carefully through his night-glass. "What should it be if not a volcano?"

"But then," said Michel Ardan, "air is necessary to feed that combustion, therefore there is some atmosphere on that part of the moon."

"Perhaps so," answered Barbicane, "but not necessarily. A volcano, by the decomposition of certain matters, can furnish itself with oxygen, and so throw up flames into the void. It seems to me, too, that that deflagration has the intensity and brilliancy of objects the combustion of which is produced in pure oxygen. We must not be in a hurry to affirm the existence of a lunar atmosphere."

The burning mountain was situated at the 45th degree of south latitude on the invisible part of the disc. But to the great disappointment of Barbicane the curve that the projectile described dragged it away from

the point signalled by the eruption, therefore he could not exactly determine its nature. Half-an-hour after it had first been seen this luminous point disappeared on the horizon. Still the authentication of this phenomenon was a considerable fact in selenographic studies. It proved that all heat had not yet disappeared from the interior of this globe, and where heat exists, who may affirm that the vegetable kingdom, or even the animal kingdom itself, has not until now resisted the destructive influences? The existence of this volcano in eruption, indisputably established by earthly savants, was favourable to the theory of the habitability of the moon.

Barbicane became absorbed in reflection. He forgot himself in a mute reverie, filled with the mysterious destinies of the lunar world. He was trying to connect the facts observed up till then, when a fresh incident recalled him suddenly to the reality.

This incident was more than a cosmic phenomenon; it was a threatening danger, the consequences of which might be disastrous.

Suddenly in the midst of the ether, in the profound darkness, an enormous mass had appeared. It was like a moon, but a burning moon of almost unbearable brilliancy, outlined as it was on the total obscurity of space. This mass, of a circular form, threw such light that it filled the projectile. The faces of Barbicane, Nicholl, and Michel Ardan, bathed in its white waves, looked spectral, livid, blafard, like the appearance produced by the artificial light of alcohol impregnated with

salt.

"The devil!" cried Michel Ardan. "How hideous we are! Whatever is that wretched moon?"

"It is a bolis," answered Barbicane.

"A bolis, on fire, in the void?"

"Yes."

This globe of fire was indeed a bolis. Barbicane was not mistaken. But if these cosmic meteors, seen from the earth, present an inferior light to that of the moon, here, in the dark ether, they shone magnificently. These wandering bodies carry in themselves the principle of their own incandescence. The surrounding air is not necessary to the deflagration. And, indeed, if certain of these bodies pass through our atmosphere at two or three leagues from the earth, others describe their trajectory at a distance the atmosphere cannot reach. Some of these meteors are from one to two miles wide, and move at a speed of forty miles a second, following an inverse direction from the movement of the earth.

This shooting star suddenly appeared in the darkness at a distance of at least 100 leagues, and measured, according to Barbicane's estimate, a diameter of 2,000 metres. It moved with the speed of about thirty leagues a minute. It cut across the route of the projectile, and would

reach it in a few minutes. As it approached it grew larger in an enormous proportion.

If possible, let the situation of the travellers be imagined! It is impossible to describe it. In spite of their courage, their sang-froid, their carelessness of danger, they were mute, motionless, with stiffened limbs, a prey to fearful terror. Their projectile, the course of which they could not alter, was running straight on to this burning mass, more intense than the open mouth of a furnace. They seemed to be rushing towards an abyss of fire.

Barbicané seized the hands of his two companions, and all three looked through their half-closed eyelids at the red-hot asteroid. If they still thought at all, they must have given themselves up as lost!

Two minutes after the sudden appearance of the bolis, two centuries of agony, the projectile seemed about to strike against it, when the ball of fire burst like a bomb, but without making any noise in the void, where sound, which is only the agitation of the strata of air, could not be made.

Nicholl uttered a cry. His companions and he rushed to the port-lights.

What a spectacle! What pen could describe it, what palette would be rich enough in colours to reproduce its magnificence?

It was like the opening of a crater, or the spreading of an immense fire. Thousands of luminous fragments lit up space with their fires. Every size, colour, and shade were there. There were yellow, red, green, grey, a crown of multi-coloured fireworks. There only remained of the enormous and terrible globe pieces carried in all directions, each an asteroid in its turn, some shining like swords, some surrounded by white vapour, others leaving behind them a trail of cosmic dust.

These incandescent blocks crossed each other, knocked against each other, and were scattered into smaller fragments, of which some struck the projectile. Its left window was even cracked by the violent shock. It seemed to be floating in a shower of bullets, of which the least could annihilate it in an instant.

The light which saturated the ether was of incomparable intensity, for these asteroids dispersed it in every direction. At a certain moment it was so bright that Michel dragged Barbicane and Nicholl to the window, exclaiming--

"The invisible moon is at last visible!"

And all three, across the illumination, saw for a few seconds that mysterious disc which the eye of man perceived for the first time.

What did they distinguish across that distance which they could not estimate? Long bands across the disc, veritable clouds formed in a very

restricted atmospheric medium, from which emerged not only all the mountains, but every relief of middling importance, amphitheatres, yawning craters, such as exist on the visible face. Then immense tracts, no longer arid plains, but veritable seas, oceans which reflected in their liquid mirror all the dazzling magic of the fires of space. Lastly, on the surface of the continents, vast dark masses, such as immense forests would resemble under the rapid illumination of a flash of lightning.

Was it an illusion, an error of the eyes, an optical deception? Could they give a scientific affirmation to that observation so superficially obtained? Dared they pronounce upon the question of its habitability after so slight a glimpse of the invisible disc?

By degrees the fulgurations of space gradually died out, its accidental brilliancy lessened, the asteroids fled away by their different trajectories, and went out in the distance. The ether resumed its habitual darkness; the stars, for one moment eclipsed, shone in the firmament, and the disc, of which scarcely a glimpse had been caught, was lost in the impenetrable night.