obscure but interesting phenomena before us, and had any one of them followed up his reasoning but one step onwards, he would have anticipated the grand discovery of Kirchhoff which, in 1859, grasped the whole question, and soon laid open to the human mind very much of the material constitution of the sun, the stars, nebulæ, and comets.

What Kirchhoff did was virtually this. He demonstrated experimentally that if the vapour of a metal or a gas, when incandescent, *emits* light of a certain quality, that same metallic vapour or gas, when less heated, *absorbs* precisely the same quality of light. The vapour of sodium, for instance, when sufficiently heated, emits a *bright* yellow light, all of which is coincident with the dark line of the solar spectrum; but if this light be made to pass through vapour of sodium less heated than the emitting vapour, it will be absorbed entirely, and no light at all will be visible. And so with other metals and various gases. Here, then, was not only a clear explanation of the origin of Wollaston's or Fraunhofer's lines, but an insight is thereby given into the material constitution of the sun; and the same remark applies equally to the stars.

The sun, or the star, must be considered as consisting, first, of some nucleus with its solid or liquid surface intensely heated, so that the light emitted from it, like the light from every other intensely heated solid or liquid with which we are acquainted, affords a continuous uninterrupted spectrum. In front of the incandescent surface must be various heated gases and metallic vapours, and each of these stops precisely those qualities of light which, if more intensely heated, it would emit.*

There was but one step more to be taken in order to prove incontestibly that such metals as iron, sodium, magnesium, &c., and such gases as hydrogen, &c., do actually exist in the sun and in the stars. Kirchhoff took this step. Through the lower half of this slit, so often spoken of, he admitted solar light, and obtained its spectrum; through the upper he admitted the light emanating from various incandescent metallic vapours, from *iron*, for instance. Thus the two spectra lay superposed before him, and admitted the most exact comparison. The iron spectrum consisted of thirty or more definite and widely spread *bright* lines, and these were absolutely coincident with as many dark lines in the solar spectrum. This coincidence of so many lines, and of all of them, could not arise from chance, but demonstrated the existence of heated iron vapour absorbing certain qualities of light emanating from the incandescent body of the sun. And in the same manner Kirchhoff obtained the spectrum of incandescent *hydrogen* superposed upon the solar spectrum. The hydrogen spectrum consisted mainly of the bright lines, in absolute coincidence with two of the lines discovered by Wollaston, and marked by Fraunhofer. Hydrogen, therefore, exists in the atmosphere of the sun, and it stops or absorbs the red light, and the bluish green light, which emanates from its incandescent nucleus.

The reader is now in a condition to intelligently understand the evidence upon which we conclude that the remarkable outburst of light in the star which has been described in the former part of this article, probably arose from, or was accompanied by, a conflagration of hydrogen gas. On the night of the morning when the intelligence reached Professor Miller and Mr Huggins, relative to the sudden appearance of the star, they at once viewed its spectrum with the same admirable apparatus which had already conducted them to so many important discoveries connected with the physical constitution of the heavenly bodies. But what a sight was there revealed to the well-practised initiated eye of a philosopher! There lay before them the evidence which suggested the atmosphere of a star, a sun, a world, *on fire*. And the evidence was this: the instrument revealed *two spectra*, the one superposed upon the other; one of them was the usual species of spectrum generally afforded by the stars, viz., a spectrum interrupted as we have seen the solar spectrum is, by numerous *dark* lines, and indicating for the star, an incandescent solid or liquid nucleus, surrounded by an atmosphere containing the vapour of sodium, and it may be iron, or magnesium, or various other elements which are found upon this our earth. But besides this spectrum there was another, and that other full of remarkable significance. It consisted of *four bright lines*, and from their relative position two of them appeared to arise from INCANDESCENT HYDROGEN. This, within their knowledge and experience, was a solecism in the heavens. Of the *dark* lines in the spectra of stars, evidence enough existed; the significance of those lines was hydrogen indeed, but of hydrogen *not heated to extreme incandescence*. Here, however, the dark lines were *brighter* than the contiguous parts of the spectrum, and thus they spoke unmistakably for themselves. But so far the coincidence of two of the *bright* lines with the *dark* lines of Fraunhofer was rather suspected than proved, and consequently these cautious experimentalists put into requisition the exquisite arrangements with which they were provided. They produced the spectrum itself of incandescent hydrogen, and they placed it exactly over the spectrum of the star; the coincidence of two of the bright lines of the star with the two bright lines of incandescent hydrogen was absolute. The other two bright lines of the star are not ascertained as yet to indicate the existence of any element known to the inhabitants of this earth.

Thus the sudden outburst of light in this star, or at all events the light of the star, was in great part owing to *hydrogen*. As the light of the star waned, so the splendor of those bright lines waned, and so also the other continuous spectrum declined in brightness, and we are in a manner forced upon the conviction that the outburst of light was accompanied with the blaze of hydrogen in combustion, which gradually spent itself, and is now nearly extinguished.

But is it possible to make even any plausible guess as to the cause of the outburst of light and heat in this wonderful star! Thoughtful men have already made some guesses, and we shall now venture upon another; it is given simply as a guess and as a mere speculation only, though we hope not wholly an uninstructive one.

On referring to the Royal Observatory, Greenwich, it was soon discovered that this star, now called T Coronæ Borealis, is *not a new star*, but was very probably observed by Sir W. Herschell, and by Mr Wollaston; and certainly it is in the catalogue of M. Argelander, and is there marked as a star of between the ninth and tenth magnitude; just the feeble brilliance to which it has now sunk. If this star be like other suns, there will be worlds circling round it, and these worlds may like our earth have satellites. Now it is the settled opinion of some cautious philosophers that in the lapse of ages, that is after the lapse of many millions of years—we do not say *millions of* millions of years—the sun will have lost the greater part of its heat and light, and our earth and its satellite will at length approach it nearer and nearer, and ultimately will rush into the great darkened luminary; then utter indeed will be the ruin, and vast the outburst of light from the crash thereof. There is nothing chimerical, nothing unphilosophical in the belief or the expectation of this phenomena. But the time is not yet.

Now it may have been that the outburst of light in T Coronæ may have arisen from the falling into it, first of a world like our own, and subsequently of its satellite. Such an hypothesis is somewhat consistent with the greater, and with the lesser outburst which succeeded the former. If the world in collision was provided with a great ocean like our own, then *there* is the source of the *hydrogen*; and if, as it cooled somewhat, it recombined with the oxygen, we can account for that peculiar blue tinge which Mr Baxendell observed, and which blue tinge may be seen in perfection when the wind blows over and provides a supply of oxygen for an illumination by gas. Such a state of things would go far to explain the great variability in the colour of the star. The collision of an *occultus* satellite would consistenly account for the second and smaller outburst. But we are confessedly in the region of speculation, and there let us leave the subject, or at all events this truly hypothetical part of it.

In the course of this article we have been speaking of many things, in the contemplation of which it is difficult to silence the imagination, and sometimes equally so to suppress a rising emotion. What are we to say, for instance, of the evidence which such researches have brought to light, of that scattering of material substances in *patches* as it were throughout the universe, just as, in like patches, we find metallic substances scattered in various parts over our own earth? Some stars, we have seen, afford evidence of the existence of iron and *lime*, and others do not, most of those hith to examined contain magnesium, and almost all of them sodium. Of gold, and of silver, so far, they contain not a trace, shall we here then repeat the remark which centuries ago Tacitus made regarding the ancient Germans:—"*aurum et argentum, dii irati an propitii negaverint, dubito.*"

And lastly, there is another thought regarding this Stella Mirabili, which we have already touched on, and with it we shall conclude. It has reference to the inconceivable *distance* of a body of whose material constitution we nevertheless make, and reasonably make, such confident assertions, and regarding a possible catastrophe in which we have ventured, though not without reserve, to speculate. The thought is this. the conflagration in this atmosphere of a star was first *observed* on the 12th of May, 1866; but when did it actually *occur*? If this star is as near to this our world as is the nearest yet known of the stars, which proximity nevertheless we have no reason to suppose, then the increased outburst of the combustion of hydrogen must have taken place at least three years before it was visible at Tuam and interpreted at Tulse Hill. But if, as is far more probable, this star is among the more distant orbs which shine with a light so pale as to be visible only in our more powerful telescopes, then the conflagration, of which the first tidings have reached us only to-day, must have actually waxed and waned for its little week, not now, nor yesterday, but it may be even hundreds of years ago. The imagination shrinks within itself at the thought, how the bright light from that evanescent ephemeral outburst, winged its way, leaping century through century, from world to world, and telling successively the tale of its glory (it may be) to creatures nobler and more intelligent than ourselves, at length reaches the little speck of our mortal abode, in its course onward we know not whither. But let us remember it is not the prism, it is not the electric heat, it is not the telescope, which reveals these things to the initiated eye, but the knowledge comes to us through the dutiful appliance of that subtle irrepressible spirit in the human mind, which was breathed into man from the Spirit of the Eternal.

* It is important here to observe that the *less intensely heated vapours* themselves *emit* some rays of the same quality or refrangibility as those which they have wholly absorbed; but these are so *feeble* as to appear *dark*, when contrasted with the adjacent lights in the spectrum.

TEXT BOOKS IN LOWER CANADA.

As the resolution for the Council of Public Instruction for Lower Canada touching the books to be used in the public schools is to take effect on the 1st July next, we would again impress upon school corporations and all concerned, the importance of giving their earnest attention to this subject. This resolution passed on the 9th May last, fixed the 1st of July 1866, the day from and after which no other books than those authorized by the Council shall be used in the schools; however at a subsequent meeting of the Council, held on the 11th April 1866, the day on which the resolution shall take effect was postponed until the 1st July 1867.—*Journal of Education for Lower Canada.*

EDUCATIONAL INTELLIGENCE.

AT HOME.

(From the British Colonist.)

MARKED as the progress has been in all the branches of the public service during the past year, in none have the results been so striking as in the department of Public Education. Here the progress has certainly been extraordinary. The number of public schools in operation during the year was, for the winter term 907, and for the summer term 1170, an increase of 144 and 181 respectively over the number of public and other schools in operation during the previous year. The number of pupils attending school was for the winter term 45,131, an increase of 9,980, or 28 per cent. over the number in 1865, in which year the number