

The Solution

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Very freely and narratively (♩=160)

The rich, red co-lour one ob-serves when view-ing ne-on signs Is ac-tual-ly com-
- posed of i-so - la-ted spec-tral lines, And this was once a mys-te-ry. When New-ton thought to
pass A beam of sun-light in a dar-kened room through be-veled glass, He saw the rain-bow's
co-lours, a con-tin-u-ous ar-ray. But light e-mit-ted from pure gas, un-known in New-ton's
day, When spread out by a pris-m or a gra-ting, it was seen, Forms se-pa-ra-ted,
co-loured bands, with no-thing in be - tween. E - ven-tu - al-ly it was found that
each such spec-trum bears A like-ness of the gaps be-tween re-cip-ro-cals of squares Of
in-te-gers: one fourth, one ninth. A chi-ld, still in school, Could work out all the de-ci-mals but
why was that the rule? What is the phy-sics No-bel prize? Of what does it con-sist? It
is, of course, an hon-our, for one's name goes on a list Of in-flu-en-tial phy-si-cists. The
prize will al-so bring An in-vi-ta-tion to a ban-quet with the Swe-dish king.

Drop half a measure to replace 'qllq' with 'qq' whenever that makes the musical phrasing fit the sense of the text better.

The full lyrics begin overleaf

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The rich, red colour one observes when viewing neon signs
Is actually composed of isolated spectral lines,
And this was once a mystery. When Newton thought to pass
A beam of sunlight in a darkened room through beveled glass,
He saw the rainbow's colours, a continuous array.
But light emitted from pure gas, unknown in Newton's day,
When spread out by a prism or a grating, it was seen,
Forms separated, coloured bands with nothing in between.
Eventually it was found that each such spectrum bears
A likeness of the gaps between reciprocals of squares
Of integers: one fourth, one ninth. A child, still in school,
Could work out all the decimals – but why was that the rule?

In Germany, around the time this question first arose,
The physicist Max Planck became the first one to propose
That radiated energy, as either light or heat,
Exists as quantized packets that are separate, discrete.
This theory gave a good account of how hot objects glow
And forms the basis of the quantum physics that we know.
He later would receive the Nobel Prize and had such fame
The Kaiser Wilhelm institute instead took on his name.
Then Albert Einstein showed the way such quanta could explain
Why, when light strikes a metal plate, electrons might remain
Unmoved by bright red light when even dim blue sets them free.
He earned his Nobel Prize for this, not relativity.

What is the physics Nobel Prize? Of what does it consist?
It is, of course, an honour, for one's name goes on a list
Of influential physicists. The prize will also bring
An invitation to a banquet with the Swedish king.

To isolated spectral lines our tale returns again.
The quantum way of thought appealed to Niels Bohr, a Dane.
Within the atom, he maintained, electrons are not free
To move in orbits having arbitrary energy:
Discretely quantized are the orbits they can occupy.
When energy's emitted or absorbed, it's only by
Transition jumps between these orbits, of which there are few.
Between one pair, the energy might correspond to blue,
Between another, yellow, and the spectrum thus could spread
Up to the ultraviolet, or down to infrared.
For hydrogen, Bohr's formula, within a few percent,
Explained the squared reciprocals found through experiment.

In Copenhagen, in the years between the two world wars,
The best of Europe's physicists were guests of Niels Bohr's.
For some, the stays were brief; they came from Gottingen or Rome
Or Manchester for conferences, and afterwards went home.
The funds for this were plentiful, for profits being accrued
Through sales of the lager that continued to be brewed
By Carlsberg were donated to support the institute.
Some others stayed to study there, experiment, compute,
Discuss, refine, and publish. Many articles were read
That came from Copenhagen, where the laboratory's head
Continued to collaborate, encourage, and advise,
For decades after he himself had won the Nobel Prize.

And, more than a diploma drawn with calligraphic pen,
A Nobel Prize's value can convert to pounds or yen.
Enrico Fermi, with his prize, became an émigré,
Departed fascist Italy, moved to the USA.

If X-rays, though more penetrating, are akin to light,
Then they must have a wavelength, and in consequence they might
Be subject to diffraction by a crystalline array,
Its structure being revealed in the consequent display.
This is the case, for which all crystallographers give thanks,
So Max von Laue was added to the Nobel laureates' ranks.
Electrons barely fast enough to cause emitted light
When bumping into atoms would, if Niels Bohr were right,
Have energy equivalent to that emission line
Produced by the collision, and such light would be a sign
Of energy absorption. For such work supporting Bohr,
James Franck would share the Nobel Prize when he was 44.

The Prize is also tangible, an object one can hold,
A medal, struck in Sweden, that is cast in gleaming gold:
Nobel, the goddess Isis, and a small plate to record
The full name of the physicist receiving the award.

Though Max von Laue, unlike James Franck, remained in Germany
When Nazi persecution had forced scientists to flee,
They both had smuggled out their Nobel medals at a time
When taking gold from Germany had been declared a crime.
The medals were in Copenhagen; each one bore a name,
Which put von Laue in danger when the occupation came,
For if they were discovered, word would certainly be sent
To Germany, which Niels Bohr intended to prevent.
He knew that they would not corrode if buried in the ground,
But that would be too dangerous: the medals might be found.
So he devised a better plan with Georg de Hevesy,
Who never won the physics prize – his came in chemistry.

An atom, not a molecule, gold cannot be destroyed
By ordinary means, and for that reason is employed
In surfaces and circuits where it's vital to resist
Corrosion and reaction, but there is a tiny list
Of liquids in which gold dissolves. The one I'll bring to mind
Is *aqua reg'*, in which strong nitric acid is combined
With hydrochloric acid, and this foaming, yellow brew
Was used by Georg de Hevesy in Copenhagen to
Disguise two Nobel medals, each one as a separate jar,
Unlabelled, of black liquid. When the horrors of the war
Had ended, and the danger of discovery had passed,
The gold was sent to Sweden, where new medals would be cast.

References

The essentials of both the quantum physics discoveries and the Nobel medal preservation are in Richard Rhodes' book *The Making of the Atomic Bomb* (Simon & Schuster, 1986), among other sources. He states, however, that "the Nobel Foundation recast [the dissolved medals] and returned them to their owners", while in 2002 the Foundation's own web site at <http://www.nobel.se/nobel/medals>* stated that "The Nobel medals had been kept in the chemical substance in such a way that the Royal Mint in Stockholm preferred to strike new medals instead of trying to get them out of their wrapping." The Nobel Foundation's current (2021) page about the medals at <https://www.nobelprize.org/prizes/about/the-nobel-medals-and-the-medal-for-the-prize-in-economic-sciences/> mentions the new medals but does not mention the problem recovering the gold from the original ones. George [de] Hevesy's collected papers, *Adventures in Radioisotope Research* (Pergamon Press, 1962), state only that "the gold was recovered and the Nobel Foundation generously presented Laue and Franck with new Nobel medals", a statement consistent with either interpretation.

*Archived at <https://web.archive.org/web/20020414171857/http://www.nobel.se/nobel/medals/>

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