How To Know
The Starry Heavens

DEDICATED

TO ALL TRUE CITIZENS OF THE GREAT COSMOS

AND

TO ALL WHO WISH TO BECOME SUCH

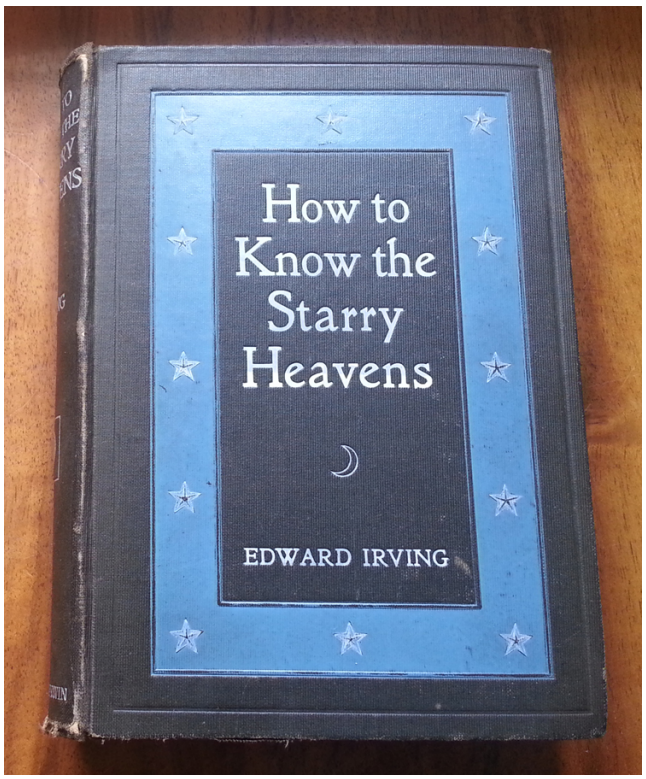
A Homage to Edward Irving

by

Robert Good

Introduction

'A bird's-eye view of the celestial forest'
- Edward Irving



How To Know the Starry Heavens is an attempt to distill the magical sense of wonder that is contained in Edward Irving's book of the same name. As such it is both unshamedly a homage to the quality and clarity of Irving's writing, and an attempt to revive his work for a new generation.

Written in 1905, the original *How To Know the Starry Heavens* is a book of astronomy for the layman that explains the vastness of the universe and the workings of the stars carefully and authoritatively, whilst always maintaining an almost childlike sense of wonder and marvel. Dedicated to "all true citizens of the Great Cosmos" it is a celebration of "the greatest of all the dramas".

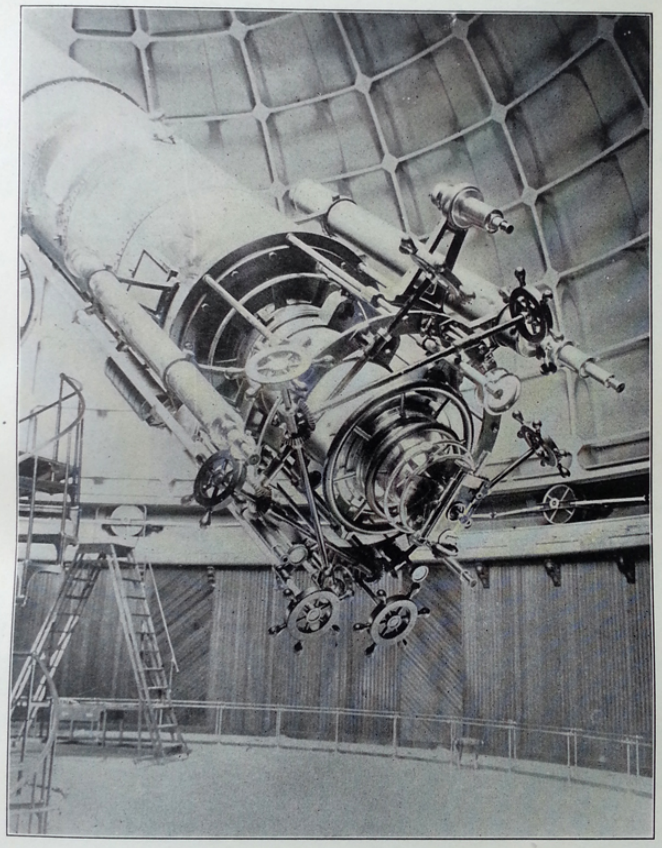


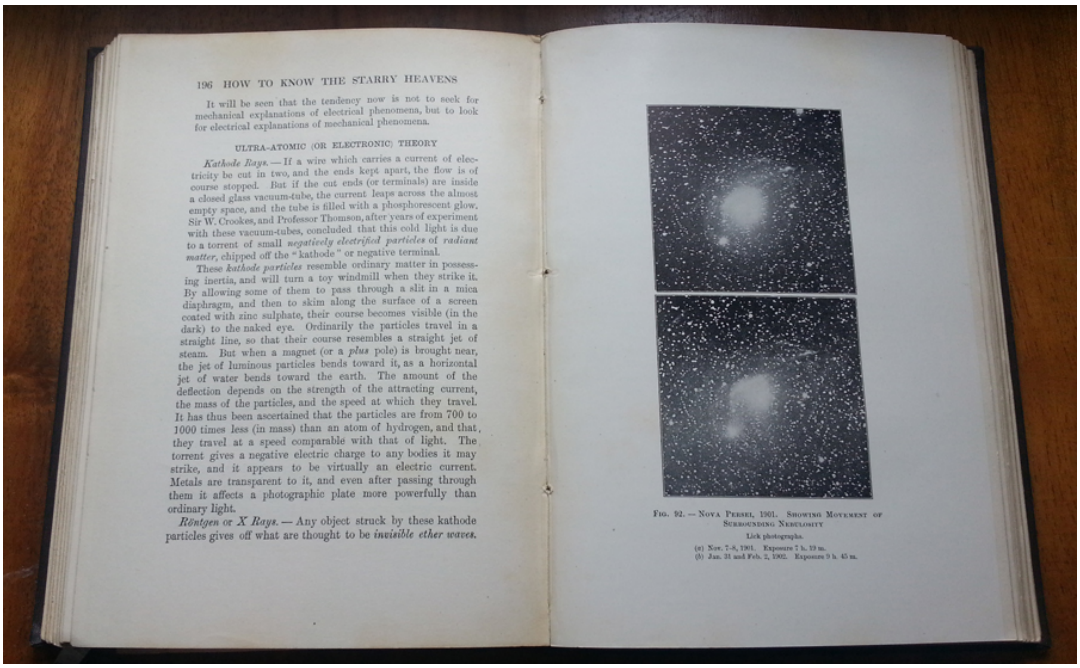
Fig. 44. — Eye-piece of the Great Lick Telescope

I found my copy of the book in a the corner of a junk shop, discarded and unloved, but it was immediately obvious that this was a special find. The pictures alone transported me to another place and time - both back to the elegance of the Edwardian era and across to the outermost reaches of the known universe. But it is the language that is so evocative, so painterly. On any page he may be talking not just about far distant galaxies and the speed of light, but also about the priests of Odin, the eruption of Krakatoa or Eruptive Calcium Flocculi. Who could fail to be mesmerised by talk of stars "strewn through space like the blinding snowflakes of a Western blizzard" or "clinging together like Siamese twins"?

So Irving's book and his use of language situates the study of astronomy firmly within the context of the mind-boggling absurdity of our human existence. By using imagery, narrative and quotation alongside hard, uncompromising scientific fact (although the book is in places imaginatively descriptive he never once plays down the primacy of the scientific method), Irving goes beyond cold data to place us firmly but minutely within the night sky that he illuminates so well, and encourages us to share in his sense of wonder, excitement and possibility.

Approach

My approach has been to extract snippets of text from the book that catch my eye, capturing something of the essence and flavour of Irving's writing. I found the text so resonant that I wanted as far as possible to let it (almost literally) "speak for itself". I have therefore simply formatted the snippets as white text on black background, aiming to create the impact of a dense night sky sparkling with stars.



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It will be seen that the tendency now is not to seek for mechanical explanations of electrical phenomena, but to look for electrical explanations of mechanical phenomena.

ULTRA-ATOMIC (OR ELECTRONIC) THEORY

Kathode Rays. — If a wire which carries a current of electricity be cut in two, and the ends kept apart, the flow is of course stopped. But if the cut ends (or terminals) are inside a closed glass vacuum-tube, the current leaps across the almost empty space, and the tube is filled with a phosphorescent glow. Sir W. Crookes, and Professor Thomson, after years of experiment with these vacuum-tubes, concluded that this cold light is due to a torrent of small *negatively electrified particles* of *radiant matter*, chipped off the "kathode" or negative terminal.

These *kathode particles* resemble ordinary matter in possessing inertia, and will turn a toy windmill when they strike it. By allowing some of them to pass through a slit in a mica diaphragm, and then to skim along the surface of a screen coated with zinc sulphate, their course becomes visible (in the dark) to the naked eye. Ordinarily the particles travel in a straight line, so that their course resembles a straight jet of steam. But when a magnet (or a *plus* pole) is brought near, the jet of luminous particles bends toward it, as a horizontal jet of water bends toward the earth. The amount of the deflection depends on the strength of the attracting current, the mass of the particles, and the speed at which they travel. It has thus been ascertained that the particles are from 700 to 1000 times less (in mass) than an atom of hydrogen, and that they travel at a speed comparable with that of light. The torrent gives a negative electric charge to any bodies it may strike, and it appears to be virtually an electric current. Metals are transparent to it, and even after passing through them it affects a photographic plate more powerfully than ordinary light.

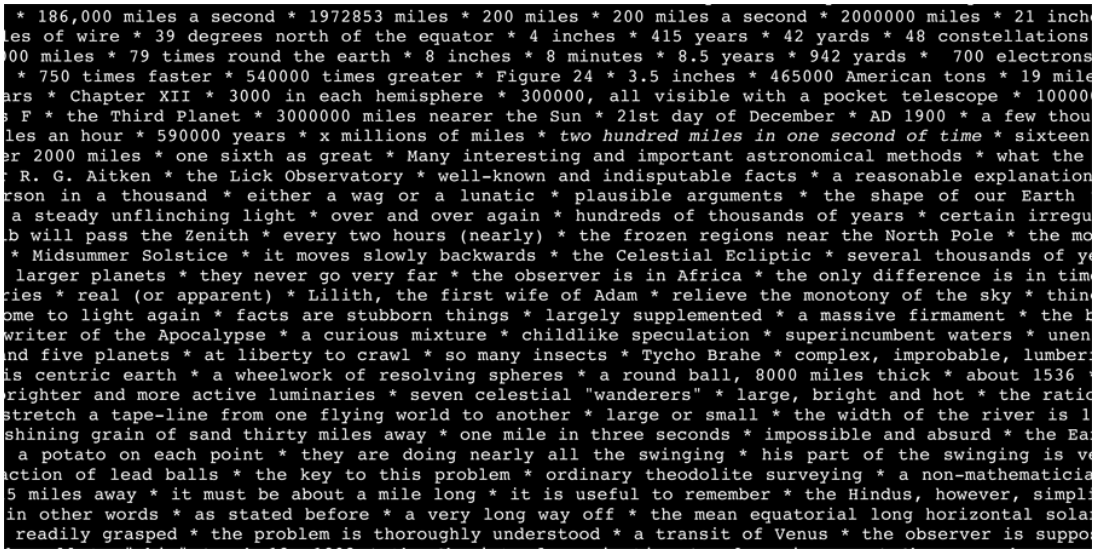
Röntgen or *X Rays.* — Any object struck by these kathode particles gives off what are thought to be *invisible ether waves.*

FIG. 92. — NOVA PERSEI, 1901. SHOWING MOVEMENT OF SURROUNDING NEBULOSITY

Lick photographs.

(a) Nov. 7–8, 1901. Exposure 7 h. 19 m.
(b) Jan. 31 and Feb. 2, 1902. Exposure 9 h. 45 m.

I am hoping that the effect will be beautiful and alluring, a pleasing visual hit; yet at the same time it will create an unexpected encounter. In amongst the mundane and everyday, it provides the viewer with a jolt; a momentary chance to escape out-of-this-world and into the realms of thought, daydream and possibility.



* 186,000 miles a second * 1972853 miles * 200 miles * 200 miles a second * 2000000 miles * 21 inch
les of wire * 39 degrees north of the equator * 4 inches * 415 years * 42 yards * 48 constellations
00 miles * 79 times round the earth * 8 inches * 8 minutes * 8.5 years * 942 yards * 700 electrons
* 750 times faster * 540000 times greater * Figure 24 * 3.5 inches * 465000 American tons * 19 mile
ars * Chapter XII * 3000 in each hemisphere * 300000, all visible with a pocket telescope * 10000
F * the Third Planet * 3000000 miles nearer the Sun * 21st day of December * AD 1900 * a few thou
les an hour * 590000 years * x millions of miles * *two hundred miles in one second of time* * sixteen
er 2000 miles * one sixth as great * Many interesting and important astronomical methods * what the
R. G. Aitken * the Lick Observatory * well-known and indisputable facts * a reasonable explanation
rson in a thousand * either a wag or a lunatic * plausible arguments * the shape of our Earth
a steady unflinching light * over and over again * hundreds of thousands of years * certain irregu
b will pass the Zenith * every two hours (nearly) * the frozen regions near the North Pole * the mo
* Midsummer Solstice * it moves slowly backwards * the Celestial Ecliptic * several thousands of y
larger planets * they never go very far * the observer is in Africa * the only difference is in tim
ries * real (or apparent) * Lilith, the first wife of Adam * relieve the monotony of the sky * thin
ome to light again * facts are stubborn things * largely supplemented * a massive firmament * the
writer of the Apocalypse * a curious mixture * childlike speculation * superincumbent waters * unen
nd five planets * at liberty to crawl * so many insects * Tycho Brahe * complex, improbable, lumber
is centric earth * a wheelwork of resolving spheres * a round ball, 8000 miles thick * about 1536
righter and more active luminaries * seven celestial "wanderers" * large, bright and hot * the ratio
stretch a tape-line from one flying world to another * large or small * the width of the river is 1
shining grain of sand thirty miles away * one mile in three seconds * impossible and absurd * the Ea
a potato on each point * they are doing nearly all the swinging * his part of the swinging is v
ction of lead balls * the key to this problem * ordinary theodolite surveying * a non-mathematicia
5 miles away * it must be about a mile long * it is useful to remember * the Hindus, however, simpl
in other words * as stated before * a very long way off * the mean equatorial long horizontal sola
readily grasped * the problem is thoroughly understood * a transit of Venus * the observer is suppo

Irving and Dark Matter

Irving wrote *How To Know the Starry Heavens* in 1905, the same year that Einstein revolutionised our thinking on Space and Time. As such, he is writing before our current modern age of astrophysics and so makes no direct references to such concepts as Relativity, the Big Bang, black holes, quantum mechanics, the existence of the planet Pluto or indeed Dark Matter.

It is fascinating to read, therefore, of how the universe was described in his time, which was an age that had rejected creationist myths and yet had no clear scientific consensus on how to replace them. Irving does not duck the big questions, however. For example, in a paragraph entitled "Outside Universes" Irving suggests something perhaps akin to what we would now call a multiverse:

> The study of the visible Universe shows that it is composed of ascending series of similar systems. For example: (1) *atoms* appear to be spheroidal "star-clusters" of still smaller particles in motion; (2) *suns* and *worlds* are rotating spheroids built up of these atoms; (3) *stellar systems* are rotating speroids built up of suns and worlds; (4) the visible *Universe* appears to be a rotating spheroid built up of a Milky Way of stellar systems.
>
> It is possible that this largest spheroid, which we call the Universe, may only be one out of innumerable similar spheroids, rotating at practically infinite distances from each other, and forming a still vaster rotating spheroid.

Irving writes under the heading "Immortality of the Universe" that "we now recognise no beginning and acknowledge no end", something that we would probably want to dispute and replace with a Big Bang and possible Big Crunch. And likewise Irving has no clear conception of Dark Matter as we now understand the term. However, in considering why the night sky is dark (and not lit up by an infinity of stars), Irving notes:

> "... unless some cause produces a loss of light, the whole sky will be as bright as the Sun. As this is very far from being the case, ... it is not impossible that light itself may be intercepted by dark bodies in its way to us... "

Irving is always careful not to over-claim; you sense that he is trying to see his way in a fog that he is not sure will lift. As he says at the end of his discussion on "Outside Universes":

> These speculations could be extended *ad infinitum*... It would, however, be a waste of time to consider them seriously, they only serve to show how little we really know of the great "Riddle of the Universe".

Future Projects

I have just started my investigations into Edward Irving: I would like to find out more about him and his work: not so much the detail of what he studied or what he might have discovered, but about his approach to the subject and his love of it. This has so far proved tricky as Irving worked in Berkeley, California (and I assume was an American), and I have had limited success so far in making connections with his former places of study.

I would also like to carry out further projects that explore the linguistic aspects of science writing. Where can similar expressions of wonder be found today, and how might such writing differ to Irving's?

Focussing specifically on the study of Dark Matter, I would like to investigate the language used and the way(s) in which the concepts that underpin Dark Matter are described and elucidated.

Finally, I would like to do further iterations of *How To Know the Starry Heavens* in other suitable locations. There is a large billboard directly opposite the British Interplanetary Society HQ in London, for example...