SAMPLE

Earth's Sky: The Hertzsprung-Russell Diagram

The Most Important Graph in Astronomy

Aira Astralis

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Conclusion

This free sample contains the Introduction and Chapter 1. The complete book contains the full contents above.

Introduction

The stars having been counted before anyone understood what the counting meant: the shepherds having kept their lists for omens, the navigators having kept theirs for roads, and the astronomers having kept theirs for the honor of the keeper's name, the name being the oldest reason a catalog exists. The counting having changed character in the second decade of the twentieth century, the change having been made by two clerks in two countries, and the clerks having thought to ask a second question of the same stars, the question being not only how bright and not only what color, but both at once, and the both-at-once having been the whole revolution, the revolution having fit on a sheet of paper.

The sheet being the census this volume walks through. The entries having been the stars, the columns having been their brightness and their color, and the marks having fallen into bands the way a crowd sorts itself at a station without being told where to stand, the sorting having been the discovery. The diagonal band having carried the crowd of ordinary stars, the giant country of the upper right, and the cellar of the lower left having carried the small burned-out remnants, the remnants having been filed in their own drawer and the drawer having been the twentieth century's strangest stellar address.

The two takers being the volume's subjects in the way a census's subjects are its householders rather than its houses: the Dane having plotted the stars first and having published quietly in a journal of the photographic trade, the American having plotted them in ignorance of the Dane and having published loudly in the academy's own journal, and the loudness having gotten the joint name onto the sheet, the sheet having carried both surnames and the surnames having shared the hyphen in alphabetical peace ever since. The volume being the shelf's account of how the sheet was made, what the sheet taught, and what the sheet still collects, the collecting being continuous because the census never closes, the closure being refused by the sky itself.

The room being the series' usual room: the facts having been kept in the house arithmetic, the arithmetic carrying the whole account, and the account having been trusted because the takers earned the trust first. The browser being invited to walk the rooms in order or to enter by the door that interests them, the doors all having been left open, and the volume having been written at the shelf's pace: fourteen rooms and a single evening's walk, the walk having been unhurried and the unhurriedness having been the point.

The browser being handed the map before the walk begins: the rooms ahead carrying the two takers and their precursors, the arithmetic of the two axes,

the instruments of the three generations, the bands and their meanings, the century of context, the modern grammar of the interiors, the campaigns of the cluster counters, the discoveries the sheet forced, the honest difficulties, the widening future, the collection of curiosities, and the closing ledger, the ledger being the final door and the door having been kept for the reader who finishes the corridor. The volume confessing its one economy for fairness: the census having been told through its householders because a census of methods alone is a phone book, the phone book having been refused as a model, and the refusal being the series' standing decision on every subject it keeps.

The census's two takers being introduced properly before the walk begins: the Dane having been a chemist who taught himself the trade through the photographic plates, the American having been a hereditary astronomer who inherited the parallax column and made it his own, and the two having shared nothing but the conviction that brightness and color belong on one sheet, the conviction being the volume's whole thesis, the thesis being tested in every room ahead. The browser being handed one warranty at the door: no fact being carried that the census cannot support, the support being the takers' own standard, and the standard being kept in the house arithmetic from the first paragraph to the last, the keeping being the shelf's only luxury and the luxury being affordable.

The walk's length being posted at the door for the readers who budget their evenings: roughly fifteen thousand words in fourteen rooms, the rooms having kept the series' order, and the order having been kept from the first book on the shelf, the keeping being the shelf's one concession to custom, the custom having kept the reader comfortable. The volume confessing the census's own bias for honesty: the science having been told through its householders because the facts wear their sources better than their abstractions, the abstractions having been given their rooms later in the walk, and the later rooms having repaid the patience, the patience being the shelf's own estimate of the reader and the estimate being generous.

The reader being offered the volume's thesis in one paragraph for the impatient: the stars having been found to fall into bands, the bands having been found to have grammar, the grammar having been found to be physics, and the physics having been found to be readable by anyone with two columns and a sheet, the anyone being the 1910s' own discovery and the discovery being the census's gift to the ordinary reader, the gift having been wrapped in magnitudes and letters, the wrapping being the takers' own, and the takers having been the volume's subjects, the subjects being introduced at the door and followed through every room, the following being the shelf's method and the method having been applied without exception in this as in

every volume on the shelf.

The volume keeping the census's own definition for the browsers who want the word before the walk: a census having been a count of households with their particulars, the households having been the stars, the particulars having been the brightness and the color, and the sheet having been the ledger the particulars were entered in, the entry having been the 1910s' whole invention, the invention being the two-axis interview that turned the sky's scatter into a population, the population having been the subject of every room ahead, and the reader being invited to carry the definition through the volume as the shop carries its scale through the day, the scale being checked each morning and the checking having been done here for the record, the record being the paragraph the reader has just finished, the finishing being the last of the volume's front matter and the walk beginning at the next door.

Chapter 1: The Discovery of The Hertzsprung-Russell Diagram

The discovery having been four discoveries wearing one name: the first taker having worked in Copenhagen over photographic plates, the second having worked at a German observatory over the same kind of plates, the third having worked in Princeton over a typewriter and a card catalogue, and the fourth having been the sheet itself, the sheet having outlived the rivalry and the rivalry having been manufactured later by the historians, the historians being the only parties who ever wanted a quarrel.

The first household being the Harvard counting house: Miss Maury having classified the peculiar spectra in the 1890s, the peculiarities having been widths and the widths having been the first hint that stars of one color came in two sizes, the hint having been left in the appendix because the appendix is where the trade keeps its futures. The Dane having read the appendix, the reading having been the seed of everything this volume contains, and the seed having been planted by a chemist who had wandered into astronomy through photography, the chemistry having turned out to be the better training and the training having never been admitted by the observatories of his era.

The Dane being Ejnar Hertzsprung, a chemist by degree, a photographer by trade, and an astronomer by conversion: the conversion having been completed in Copenhagen by 1905, the completion having produced the paper that separated the red stars into the bright and the dim, the separation being the giants and the dwarfs, and the names having entered the language before the diagram carried them, the language having been ready and the diagram having followed. The Dane's plotting having waited until 1911, the wait having ended with the Pleiades, the Pleiades having been plotted with color against brightness, and the plot having shown the diagonal plainly, the plainness being visible to anyone who had the sheet and the sheet having been printed in a photographic journal, the journal having been read by few astronomers and the few having included the German.

The German being Hans Rosenberg, whose 1910 sheet having preceded even the Dane's Pleiades plot: the Pleiades having been drawn magnitude against spectral class, the drawing having shown the diagonal before anyone named it, and the priority having been Rosenberg's by a year, the year having been conceded by the volume without diminishing anyone, the diminishment being refused as a policy of this shelf. The third taker being Henry Norris Russell of Princeton, the Princeton man having approached the same country from the

parallax side, the side having supplied the distances that turn apparent brightness into true brightness, and the true brightness having been the census's second column from the start of his version, the version having been read by everyone because the academy's journal having been the trade's public square.

Russell's 1913 paper having carried the full argument: the giants and dwarfs having been laid out in two families, the families having been separated by a hundredfold in brightness at the same color, and the argument having been wrong about the direction of travel, the wrongness being the greatest misreading in the trade's history and the misreading being preserved here honestly, the honesty being the shelf's own policy. The two men having met and having agreed on the shared name in time, the name having been hyphenated by the trade itself, the trade being the true author of the diagram's title and the title having been earned jointly regardless of the ledger's dates, the dates having been Rosenberg 1910, Hertzsprung 1911, Russell 1913, and the order being recorded once and then set aside, the setting aside being the census's own courtesy.

The discovery room keeping the appendix's full story for the record: Miss Maury having been the niece of the Harvard director, the directorship having supplied her the plates, the plates having been classified by a system finer than the official one, the finer system having been shelved by the committee, the committee's shelving having been recorded by the Dane as an error, the error having been the seedbed of the giants, and the seedbed having been fertilized by the least thanked woman in the trade's history, the history being amended here by the census's own bookkeeping.

The Dane's route into the trade being kept for the record: the chemistry degree having been taken in Copenhagen, the engineering having been practiced abroad for a house of optics, the optics house having been the actual employer when the first papers were written, and the papers having been signed by an amateur whose employer never suspected the surname would outlive the firm, the firm being gone and the surname being on every sheet. The American's route being the trade's main road: the Princeton doctorate having been earned on the twin star problem, the problem having supplied the masses that later anchored the diagonal's theory, the anchoring having been the career's quiet thread, the thread having run from the twins of his youth to the textbook of his age, the age having been spent as the trade's organizer-in-chief and the office having been filled without rival.

The discovery room keeping the 1913 sheet's own description for the record:

the paper having carried the plots for the near stars, the stars having

numbered three hundred, the three hundred having been plotted as circles and crosses for the two families, and the families having been labeled by hand with the words that became the trade's vocabulary, the vocabulary being the giants and the dwarfs, the dwarfs being the ordinary and the ordinary having been named from the small end of the ledger. The room adding the quiet journal's irony: the Dane's first separation of the families having been printed in a magazine of the photographic clubs, the clubs having been the professionals' cousins, the cousins having read the paper before the observatories, and the reading order being the census's own joke against the hierarchies, the joke being recorded here at the room's closing because the census being the trade's most democratic instrument from its first week, the week having been spent in the darkrooms rather than in the halls.

The discovery room's final ledger entry being the plates' own census: the Dane having exposed his own glass, the developing having been done in the household bathtub, the bathtub being the first observatory of the giants and dwarfs distinction, and the distinction having been drawn in the chemistry's own medium, the medium being the connection between the chemist's trade and the astronomer's, the connection being the discovery room's closing exhibit, the exhibit being the reminder that the great instruments of science having often been made by hands trained elsewhere, the elsewhere being the chemistry bench, the bridge, and the patent office in the trade's other stories, the stories being the shelf's own recurring plot and the plot having been honored here in the census's room, the room being closed with the plates' thanks, the thanks being given in silver and the silver being the glass.

The room adding the timing: the three sheets having appeared within four years of one another on two continents, the simultaneity having been the signal that the idea's time had come, and the arrival having been the work of the parallax surveys, the spectral catalogues, and the photographic standards maturing at once, the once being the 1910s' own gift to the trade.

End of free sample. The full book is available at putrabooks.github.io

ABOUT THE AUTHOR

Aira Astralis is a science writer specializing in astronomy and space exploration. Her work spans the full breadth of humanity's relationship with the cosmos -- from the earliest naked-eye observations to the engineering marvels of modern space missions.

Her books are built on a foundation of primary sources: peer-reviewed research, mission archives, and direct engagement with the scientific community. She writes for readers who want to understand not just what we know about the universe, but how we came to know it.

She believes that the most important frontier is not out there but in the gap between what scientists discover and what the public understands. Her books exist to close that gap.