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# *Hidden Figures: The American Dream and the Untold Story of the Black Women Mathematicians Who Helped Win the Space Race*; *Rise of the Rocket Girls: The Women Who Propelled Us, from Missiles to the Moon to Mars* FREE

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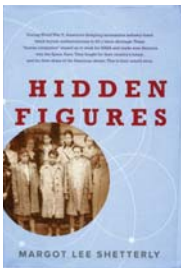
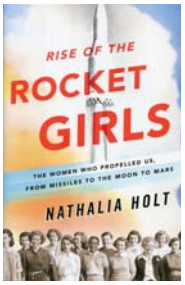



# Hidden Figures

## The American Dream and the Untold Story of the Black Women Mathematicians Who Helped Win the Space Race

**Margot Lee Shetterly**

William Morrow, 2016, $27.99 (368 pp.). ISBN 978-0-06-236359-6




# Rise of the Rocket Girls

## The Women Who Propelled Us, from Missiles to the Moon to Mars

**Nathalia Holt**

Little, Brown and Co, 2016, $27.00 (352 pp.). ISBN 978-0-316-33892-9

At perhaps no other moment in US history would stories of the first female mathematicians and engineers at NASA resonate as they do following the 2016 presidential election. Both Nathalia Holt and Margot Lee Shetterly describe the lives of previously obscure women "computers" who worked for NASA during the earliest phases of America's space program. Shetterly's *Hidden Figures: The American Dream and the Untold Story of the Black Women Mathematicians Who Helped Win the Space Race* tells the story of African American computers at the Langley Memorial Aeronautical Laboratory in Hampton, Virginia. Holt's book, *Rise of the Rocket Girls: The Women Who Propelled Us, from Missiles to the Moon to Mars*, focuses on women at the Jet Propulsion Laboratory (JPL) in southern California. Both books slant toward popular, nonacademic audiences; a film adaptation of Shetterly's book receives nationwide release this month (*Hidden Figures*, 20th Century Fox, 2016).

Shetterly and Holt are part of a growing contingent of journalists and historians seeking to peel back the veneer of existing institutional histories of NASA facilities and give insight into the lives of the hundreds of thousands of workers who propelled the space program from floundering rocket development to the Sea of Tranquility and beyond. Each author found inspiration for her work in personal experiences. Shetterly was inspired by her own life in the African American community around Hampton. Holt found her subject by a more unusual path; she learned about one of the JPL engineers while searching online for name ideas for her first child.

*Rise of the Rocket Girls* and *Hidden Figures* offer moving glimpses into the growing pains of professional development for women in the post–World War II and Cold War technical workplace. Women computers at Langley and JPL forged their own career paths, frequently walking fine lines between their expected roles as wives and mothers and their desire to gain personal fulfillment through their careers.

The computers' experiences, however, were markedly different on the two sides of the country, particularly in terms of the racial and gender barriers they faced. Racial barriers were less overt at JPL, where women of multiple races and ethnicities worked in the same offices. In contrast, Langley was not integrated until the creation of NASA in 1958. Furthermore, at JPL, computer positions were not necessarily limited to women, whereas at Langley, computer positions were gender specific. But whether internally or externally enforced, at both locations women were pigeonholed into the role of computers, and they lacked advocates at management levels who might have made career advancement possible.

Both authors make excellent use of primary sources, including oral histories, NASA documents, and newspaper articles. When scholarly works are cited, however, it appears they are only used for technical information. In drawing back the curtain on their stories, neither Shetterly nor Holt takes advantage of the significant work by scholars of race and gender studies; doing so would have bolstered their narratives.

Shetterly and Holt also do not dig to the level of internal NASA policy, as Margaret Weitekamp did with her research on female pilots tested for astronaut training in *Right Stuff, Wrong Sex: America's First Women in Space Program* (Johns Hopkins University Press, 2004), or relate the experiences of the female computers to the challenges faced by nonwhite males working at NASA's Marshall Space Flight Center, as Richard Paul and Steven Moss do in their book *We Could Not Fail: The First African Americans in the Space Program* (University of Texas Press, 2015). Shetterly and Holt, unfortunately, miss the opportunity to use their stories to investigate bigger questions about the perception of and reaction to race and gender at NASA or movements for racial and gender equality.

As a woman historian, it was impossible not to feel thrilled and enlightened by the women in *Hidden Figures* and *Rise of the Rocket Girls*. Katherine Johnson, a passionate and talented mathematician whom Shetterly profiles, persisted in overcoming preconceptions of what women could contribute to human spaceflight. Susan Finley, a major figure in Holt's book, continues to shape planetary exploration projects at JPL and inspires women professionals at the lab despite her lack of formal education.

Unfortunately, both authors tend to jump from personal to professional stories, and the sudden topic changes can be confusing and difficult to follow. Shetterly also does not distinguish clearly between the experiences of the characters she profiles and those of other women at Langley. Admittedly, telling the story of all women at Langley was not one of Shetterly's goals, but the reader might wonder how common or uncommon the experiences of Johnson and the others were.

For narratives built on such a large number of oral histories, it was surprising not to hear more from other employees at NASA, particularly the engineers who supervised the women. The voices of those who benefited from their work would have added depth to the authors' descriptions of the NASA work environments. Women mathematicians and

engineers at Langley and JPL faced incredible odds in pursuing personal and professional goals simultaneously, but I never got a sense of what either set of women meant to the programs for which they worked. What is quite apparent is the remarkable strength of the communities the women built to support each other inside and outside the workplace.

Although neither Holt nor Shetterly engages with the breadth of existing scholarship on race and gender issues at NASA or its predecessors, they forge new pathways for additional investigations. Taking a multibiographical approach does complicate their narratives, but those complications are necessary to relate the stories. The female technical experts, well aware of their uniqueness in their fields and in their places of employment, played important roles in human and robotic spaceflight, despite decades of being hidden from public view. Uncovering and telling such stories will hopefully lead to deeper scholarly examinations that will enrich our understanding of what women of all backgrounds meant to NASA and what NASA continues to mean to young women interested in careers in science, technology, engineering, and mathematics.

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## Group Theory in a Nutshell for Physicists

**A. Zee**

Princeton U. Press, 2016. $90.00 (632 pp.).
ISBN 978-0-691-16269-0

Many books have been written about group theory's applications to physics. Some have an arid, mathematically rigorous style that often obscures physical insight. Other, less formal presentations usually cannot deliver the necessary know-how for practical applications. In *Group Theory in a Nutshell for Physicists*, Anthony Zee, a physicist at the University of California, Santa Barbara, combines clarity of presentation with mathematical detail at a level of rigor acceptable to physicists. The result is a tour de force that guides readers through the universe of group theory and leads them to recent applications in particle physics, cosmology, and condensed matter.


The book is unique in its laid-back presentation. It is peppered with colorful stories about famous mathematicians and physicists and includes frequent interjections from fictitious characters. Particularly helpful are the mutterings of Dr. Feeling, who supplies intuitive understandings of formal definitions or theorems, and the observations by Confusio, who (not surprisingly) points out issues of possible confusion. The book is ideally suited to accompany a graduate course on symmetries in physics because of its pedagogical approach, the detail of its illustrative examples, and its many exercises. Readers need to be familiar with the basics of quantum mechanics, but little other advance knowledge is required since the book starts with a brief review of linear algebra and a reminder of the properties of matrices.

After its mathematical refresher, the book turns to a detailed presentation of the representation theory of finite groups and the introduction of Lie groups. Early on, Zee introduces Lie algebras by way of three-dimensional rotations; the classification of those algebras by roots, weights, and Dynkin diagrams comes later. The book's mathematically detailed material is interspersed with group theoretical applications to physical systems. Given the author's distinguished career in particle physics, it is not surprising that most of the examples come from that field, but Zee occasionally ventures out to other areas with examples relevant to condensed-matter and atomic physics.

The book makes only a single mention of group theory applied to atomic nuclei (my field of expertise), and that appears as a footnote when Zee discusses the Elliott model. James Philip Elliott's application of $SU(3)$ is admittedly of less fundamental importance than the application of that group to particle physics, but the mathematics behind Elliott's application is more sophisticated. After reading about how the finest minds in the particle-physics community struggled to get the eightfold way right, I can only admire Elliott's achievement even more, as he developed the $SU(3)$ model of nuclei essentially by himself.

The book does not comprehensively discuss the representation theory of the symmetric group of permutations, and the author even advises readers to stay clear of the diagrammatic machinery of Young tableaux. That may be sensible advice when one is dealing with low-dimensional representations. However, as the dimension of the representation increases, as is the case, for example, in quantum many-body physics, Zee's treatment in terms of either totally symmetric or totally antisymmetric tensors rapidly becomes cumbersome, and Young tableaux are called for.

Eugene Wigner, who introduced group theory into quantum mechanics and is therefore one of the heroes of the book, famously wrote about the "unreasonable effectiveness" of mathematics. In the final chapters of his text, Zee forcefully makes the case for the unreasonable effectiveness of group theory and buttresses his case with many compelling examples. Group theory can generate everything from the Dirac equation for the electron to the equations that describe the expanding universe. Indeed, all known particles can be unified within the framework of the Lie group $SU(5)$.

With *Group Theory in a Nutshell for Physicists*, Zee convincingly demonstrates that group theory governs the physical universe, and he gives aspiring physicists the tools to understand its applications to their work.

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## Strange Glow

### The Story of Radiation

**Timothy J. Jorgensen**

Princeton U. Press, 2016. $35.00 (512 pp.).
ISBN 978-0-691-16503-5

Timothy Jorgensen's *Strange Glow: The Story of Radiation* has two purposes: to educate the lay public about the various real and imagined health risks radiation poses to humans and to tell "the story of radiation," as his subtitle has it, from x rays to mobile phones. An accomplished radiation biologist, Jorgensen succeeds as a communicator of the current state of the fraught and fluid field in which he works. *Strange Glow*'s historical account is less adept, however. General audiences will likely struggle with an overabundance of detail, while histori-