Has Modern 1-Chip DLP Projector Technology Eliminated the "Rainbow Effect"?

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Study commissioned by Epson America, Inc. 2019

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Introduction

> *With both brightness and resolution going up, and prices coming down, projectors are making their way into the basements, patios, and living rooms of an ever-increasing number of consumers.*

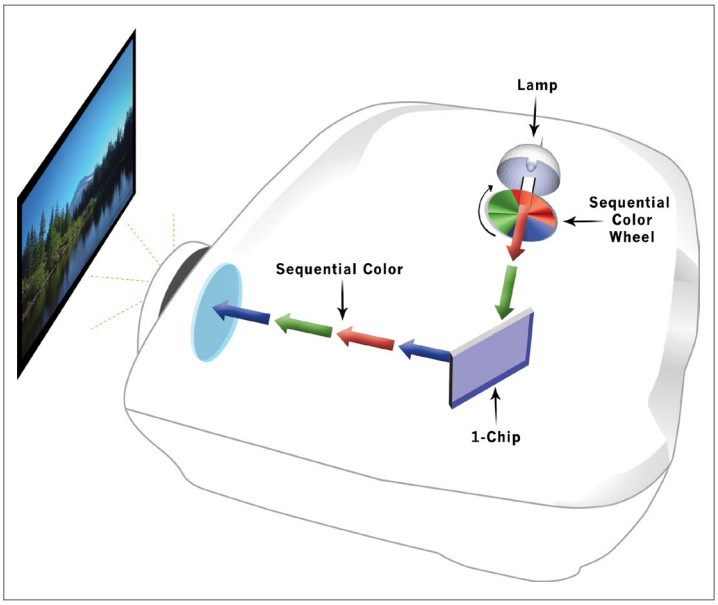
There is no denying that projectors aren't just for PowerPoint slides anymore. With both brightness and resolution going up, and prices coming down, projectors are making their way into the basements, patios, and living rooms of an ever-increasing number of consumers.

Consumers shopping for a projector can find published specifications and professional reviews to help them choose the right model, but one topic that may bewilder them is the "Rainbow Effect," commonly described as flashes of red/green/blue that can appear in high contrast scenes with fast motion. Online information on the topic is confusing and conflicting: some manufacturers claim that modern projector technology has virtually eliminated it. And while some people report being highly sensitive to the Rainbow Effect, others don't seem to notice it at all.

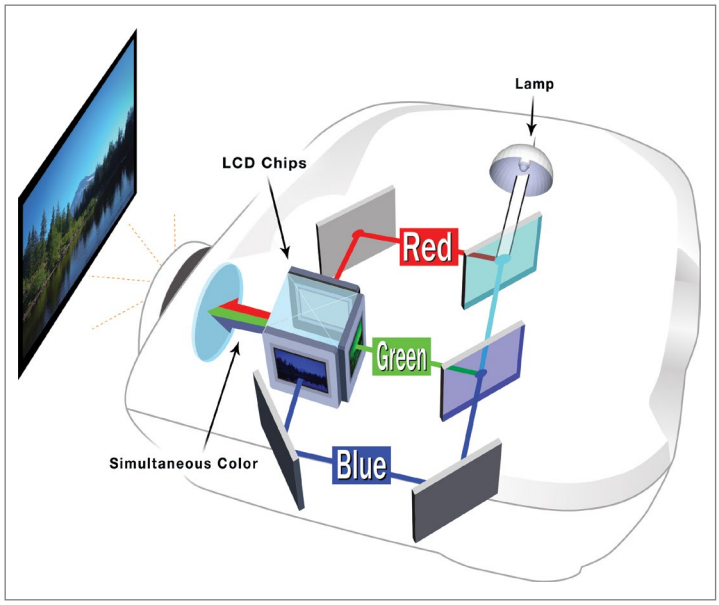
Imagine if you were to go through the considerable effort to set up a home theater room or clear a big wall in your living room, buy a projector, and mount it on the ceiling, only to discover during your first viewing that you, a family member, or a friend are in that "highly sensitive" group? You may assume that all projectors would be the same and give up on the idea of a big screen home theater. Of course, you can always return the projector to try another one, but wouldn't it be better if you had known in advance what to look for?

To this end we set out to try to answer a few basic questions.

1-Chip System Equals Sequential Color



3-Chip System Equals Simultaneous Color



Part I: What types of projectors produce the Rainbow Effect?

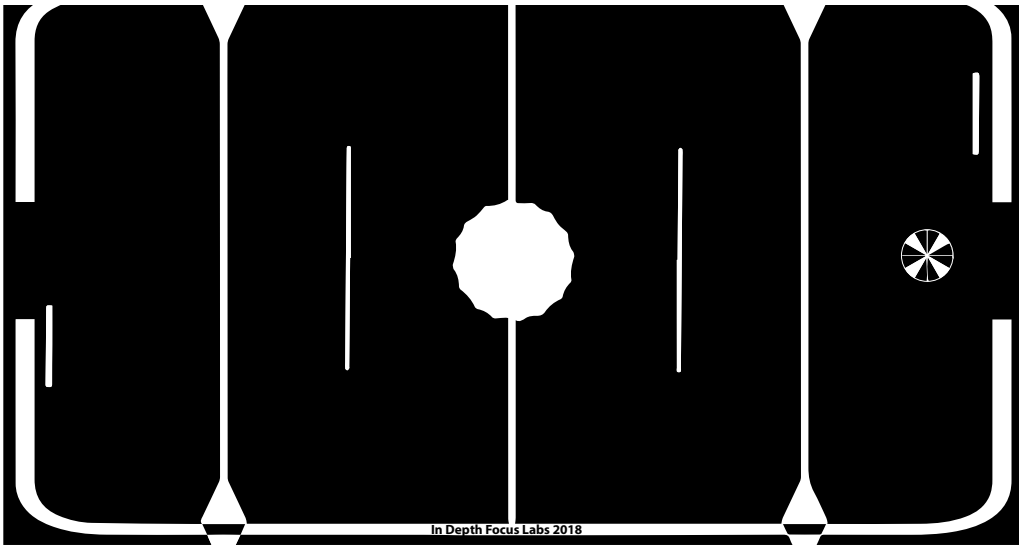
The answer to this question is simple and based on the technical architecture of the projector. Some projectors – including many popular consumer models and nearly all commercial theater projectors – use 3 chips to display all colors simultaneously. Other projectors use a single chip and add a spinning color wheel to project only one color at a time. It's this quick flashing of color that people are seeing when they say "Rainbow Effect," and it can only be produced by 1-chip projectors.

Part II: Do current, popular 1-chip projector models suffer from this defect?

"For those who notice it, do they find it distracting or annoying?"

Do current, popular 1-chip projector models suffer from this defect? If so, what proportion of typical consumers notice the rainbow effect? For those who notice it, do they find it distracting or annoying?

Online forums and polls have tried to quantify the percentage of people who can see the Rainbow Effect, but these polls rely on a self-selecting pool of A/V enthusiasts who don't reflect the general population of consumers. Taking a more scientific approach, Epson America, Inc. commissioned an independent market



In-Depth Focus Labs Created a Video to Test Consumer Sensitivity to the Rainbow Effect on Leading 1-Chip DLP Projectors

"Respondents viewed the video either on one of three top-selling 1-chip home entertainment projectors, or on an Epson 3-chip 3LCD projector as a control."

research company to conduct a study. As part of the study, 374 general population consumers were invited to a focus group facility in suburban Los Angeles to watch a black and white test pattern video (designed by an outside expert as a "stress test" for the Rainbow Effect). Respondents viewed the video either on one of three top-selling 1-chip home entertainment projectors, or on an Epson 3-chip 3LCD projector as a control. In selecting the 1-chip projectors we made sure to include models with a variety of color wheels, resolutions, and price points.

The study results:

Model	Technology	Resolution	Color Wheel Design	Color Wheel Speed	Price	Percent who noticed the Rainbow Effect (net of control)	Percent who noticed who also found it distracting and/or annoying
Optoma HD143x	1-Chip DLP	1080p	RYGCWB	Not published	$549	**36%**	**39%**
BenQ HT2050	1-Chip DLP	1080p	RGBRGB	6x	$799	**18%**	**54%**
Optoma UHD60	1-Chip DLP	4K UHD	RGBCY	Not published	$1799	**42%**	**36%**

> *The Optoma UD60, the most expensive 1-Chip DLP projector tested, had the highest incidence of reported Rainbow Effect Results in your own home watching your favorite movies will likely be different*

The three tested 1-chip DLP projector models, all of which are top-sellers in their respective categories, produce the Rainbow Effect to an extent that a meaningful proportion of consumers noticed it while watching the black and white test pattern video that lasted only 90 seconds. And, while the universe of tested projectors isn't large enough to state definitively that one type of color wheel, resolution, or price point is more - or less - likely to be subject to the Rainbow Effect, it is worth noting that the Optoma UHD60, the most expensive 1-Chip DLP projector we tested, had the highest incidence of reported Rainbow Effect.

Conclusion

Results in your own home watching your favorite movies will likely be different. However, this study shows that you should be skeptical of articles that purport the Rainbow Effect has been eliminated from 1-chip projectors. Further, you shouldn't assume that by purchasing a higher-end 4K UHD model that you'll be less likely to notice the Rainbow Effect. Perhaps the best way to guarantee that you won't experience the Rainbow Effect is to purchase a projector that uses 3-chip technology, such 3LCD or 3-chip DLP.

Sources

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To learn more, visit The Rainbow Effect.
https://epson.com/projector-no-rainbow-effect-visual-artifacts

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