

REVIEWS ON THE MANUSCRIPT [22]

Reviewer 1:

The description of the experimental setup is quite good. The photos of the investigated patterns also look quite representing the phenomena.

As I see, the main attention in this article is paid to the catastrophe theory. However no information except the link to the article [4] is given on the connection between optical part of the problem and catastrophe theory.

It would be very interesting to see clearly which physical parameters of this system are involved in equations. For example: it looks like the parameters (a and b) of your *Cusp catastrophe* are somehow connected with coordinates of the caustic on the screen. The x argument of potential function also looks connected with coordinate of the incident beam, and so on.

Describing this connection would be a perfect addition to your work. May be it is possible to include some information from the article [4].

Adding two images for comparison of experimental caustics and theoretical curve from catastrophe theory would look very nice.

The overall impression is good. Solution looks well prepared. It involves uncommon physical theory.

A further connection of theoretical and experimental parts of the solution would improve it even more.

Reviewer 2:

Throughout the whole article it is far from clear what is author's own contribution, and what he just copied. There are citations and references occasionally, but I do not believe they cover nearly half of places, where author base his article on another men's work.

If I guess correctly, author's biggest contribution is

- a) he took nice pictures with fine apparatus
- b) classification of these pictures with respect to catastrophe theory
- c) general overview of known facts about catastrophe theory

In the current state, b) and c) are performed quite poorly. c) is confusing and insufficient, b) is reduced to few sentences of a type „2B is cusps“ (without single supporting argument).

Author scores high in category a) (I like pictures), but I dare say, that just nice pictures are not sufficient to publish this article.

Sadly, I can not recommend publication of this article in it's current state and I'm afraid that no minor changes can change this. However, I see some strong points in the work and I believe that a lot of reasonable effort was put to this task. I also

believe, that if I had the chance to have a word with the author, I would discover that he had done a lot of interesting scientific work which is worth publishing; sadly, only very small portion of this is contained in the present paper (author should realize, that writing is one-way communication and what is not in the paper does not count). Therefore, I would recommend to rewrite and resubmit this article. Author should put more emphasis on explaining, defining and citing (where using already known results) and significantly expand part which covers his own results (bottom of page 4).

Reviewer 3:

The presented manuscript is a unique combination of a nice and interesting experimental setup (though not described precisely enough from the point of view of taking photographs) and a completely unconnected theory.

In the manuscript, author claims a connection between “Theory of catastrophes” and images formed by laser light illuminating a water droplet. I do not feel competent enough to judge whether such connection can be justified or not – however I do feel the manuscript itself does not provide such a justification.

The presented experimental results are pretty nice, but it would be much better if further details would be presented, such as the way the photographs were taken (especially for the dynamic case Fig2e). I do not understand why no results were presented also for the red laser, if that would be used. Comparison of results for these two laser could help in decision about nature of some effects (whether ray optics is sufficient or not to explain the effect). I also lack quantitative data from experiment, meaning the dimensions of the figures compared to the droplet – it is hard then to judge about specific effect.

I would definitely expect somewhere in the paper at least a simple theory about multiple reflections and refractions. Only by using this theory the author could possibly come to mathematical description which would bring him to problems related to the catastrophe theory. But it seems that author did judge his conclusion only by visual comparison of images seen in the experiment coming out from the theory. This is under my consideration somewhat superficial and insufficient.

Therefore unfortunately I have to suggest to the editors to reject this manuscript, unless the author would be able to include into the manuscript a theoretical part connecting the physics of the experiment (rays and optics) with the theory presented.

Editorial decision

We agree to the prevailing opinion of all reviewers that the link between the observed patterns and the alleged mathematical description is not justified in the manuscript.

In result, the entire paper is missing the logical justification or explanation of its claims and conclusions.

We acknowledge, however, the innovative and vibrant experimental approach to visualize the patterns on the screen. We believe that such a result itself is bringing a value to the manuscript.

We consider that the serious and justified concerns of all reviewers may be resolved upon a thorough overhaul of the manuscript and providing a logical, not necessarily exhaustive, justification of the link between optics and catastrophe theory in the investigated system.

The concerns of the Reviewer 2 that some parts of the manuscript are not of own work need to be rebutted or resolved.

Please refer to any previous publication in the field to better support and explain your conjectures, e.g.:

M. V. Berry. Elliptic umbilic diffraction catastrophe. Phil. Trans. Royal Soc. London A 291, 453 (1979)

P. L. Marston. Hyperbolic umbilic diffraction catastrophe and rainbow scattering from spheroidal drops. Nature 312, 529 (1984)

After thorough consideration and evaluation of the reviews and of the manuscript, we take the editorial decision to invite resubmission and to encourage the author to promptly and fully resolve the concerns of each reviewer.