**ANSWERS TO COMMENTS ON THE MANUSCRIPT [29]**

**(“BREAKING SPAGHETTI”, BELARUSIAN IYPT TEAM)**

**Answers to reviewer 1:**

*Q1.* *The term „frequency of breaking” should have a very clear definition mentioned in*

*text. It is now unclear. Provide a definition.*

A1. Added it in the “Stochasticity of the phenomenon” chapter.

*Q2.* *Let’s assume that the very central part of spaghetti isn’t stretched whenever*

*spaghetti is curved and has length L0. → why can we do such an assumption?*

A2. If spaghetti is bent the inner side will be compressed, while outer will be stretched. Obviously, somewhere between two sides will be a layer which isn’t deformed at all. For the simplest case we can assume that it’s central layer. This is rather common assumption; I’ve added a reference, where same approximation is used.

*Q3.* *Maybe it would be better to consider the ratio between length and diameter next to*

*the mass in the analysis?*

A3. It could have been better for quantitative analysis; however, since we only show qualitative dependence of frequency on length and diameter, it seems to me that considering ratio will make article less understandable.

*Q4.* *Why a standing wave with such a wavelength occurs? (why exactly 1 cm is the*

*placement of the first antinode?) Consider a clarification.*

A4. If you ask about why wave has such a wavelength, then it’s defined by the spaghetti’s and impact’s parameters. Unfortunately, we havn’t built a mathematical model to find quantitative dependences.

If you ask why *we think* wave has such a wavelength, and why *we think* 1 cm is placement of the first antinode, then it’s a combination of experimental fact and logical conclusions: experiments show that spaghetti is most likely to break in this 1 cm point; at the same time we know that spaghetti should break at the place with maximal stress; respectively, at the place with maximal curvature. And it appears to be the place of the first antinode. So, 1 cm is the place of the first antinode. In case this conclusion seems disputable, I’ve added reference to an article, where this fact is proven.

**Answers to reviewer 2:**

*Q1.* *The conclusion of the paper is still not quite to the point of describing a critical e.g.*

*height, where the breaking probability e.g. goes below 50% for specific settings.*

A1. Well, the main problem about it is that it’s completely not obvious where this border should be set. For every situation it will be different; for example, if we are using spaghettis to construct something, and we need to know what stress our structure can withstand, than we should consider 0% frequency of breaking as border between conditions of breaking and not-breaking. And since in each case we have to put this border in different place, I think the best thing to do is to leave it up to the reader to decide where it should be.

**Answers to reviewer 3:**

*Q1.* *In fig. 1, you should rather plot height as a function of t2 instead of t. Then the*

*relation becomes linear and you clearly see any deviations. Why are there no*

*measurement errors in the graph? A linear function fitted to your data would then*

*have the slope g/2 and you could easily verify your measurements.*

A1. Added error bars. But in my opinion even this plot shows rather good, that dots are close to the theoretical line; at the same time, linearization will make plot less understandable.

*Q2.* *Please fix the vector signs in your first formula.*

A2. I’ve decided just to remove them.

*Q3.* *Define the Young’s modulus in the text, in case the Reader is not familiar with elastic coefficients..*

A3. Well, I don’t think that it’s really necessary; Young’s modulus is widely and commonly used coefficient and usually it is used without defining it in the work itself.

*Q4.* *When introducing ε, it is in my opinion necessary to illustrate it in a figure, i.e. a*

*schematic drawing. Otherwise it is very hard to follow your model.*

A4. I’ve added definition of the *ε* to the text; adding a whole figure for this doesn’t seem necessary.

*Q5.* *What actually happens in fig. 4? Comment on it briefly.*

A5. Added a small explanation in the “Stochasticity of the phenomenon” chapter.

*Q6. While figs. 5 & 6 have measurement errors, figs. 7-11 don’t. Why is this? Please*

*include them or emphasize the magnitude of errors in another way.*

A6. I was (and still am) extremely concerned about overall understandability of this plots (especially fig.10 & 11). And adding error bars was making everything even worse. So, in the revised article I’ve added average error of experiments (it’s in figures’ captions).

*Q7.* *No references at all. On the other hand, it could be useful for the Reader to know the current state-of-the-art.*

A7. I have added a couple of references, in the places where they really are connected to our task. As of the Audoly and Neukirch’s article, it solves a bit different problem; now-referenced “Dynamic Buckling” article describes effects much closer to what happens in our case.