

~THE LIMIT OF GAUSSIAN ACCELERATOR~

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1. Research motive

We came across "Gaussian accelerator" when we were studying physics. The Gaussian accelerator is a device that accelerates iron balls and makes them collide with the device that connects iron balls and neodymium magnets. It was unknown if the speed of iron balls would increase forever or reach the limit somewhere by connecting many of them, so we started to study it.

2. Research procedure

(1) the experiment of condition of maximum speed

① the relationship between the number of iron balls and the speed of iron balls. ② the relationship between the size and the speed of iron balls. ③ the relationship between the number of magnets and the speed of iron balls.

(2) experiment with or without limit



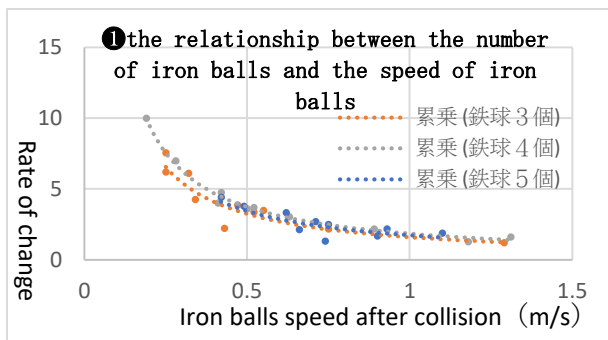
We hypothesized that the iron balls will increase in speed when there are many small balls and many magnets.

And we thought there is a limit.

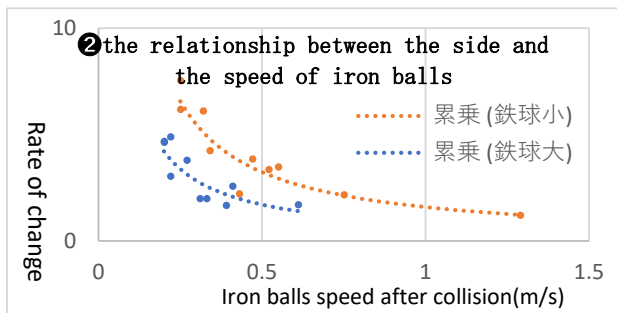
3. Research contents

3.(1). The most speedy condition

We let go of the iron ball without applying force from the same height, and we gauged the former speed and later speed ten times. Also, we regarded the number of magnets as the strength of magnets.



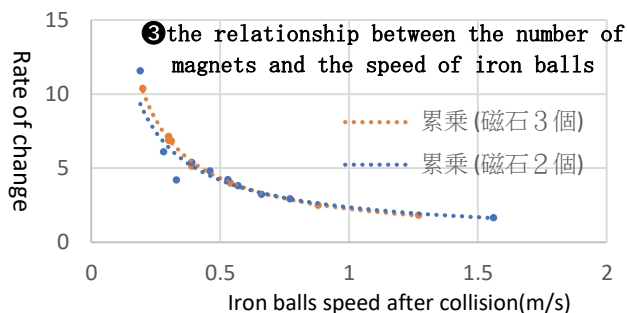
① The relationship between the number of iron balls and the speed of iron balls. According to this graph, we found the condition with the most speed was the device with 4 iron balls.



② The relationship between the number of magnets and the speed of iron balls.

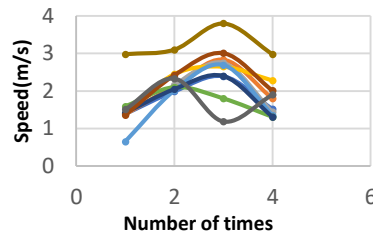
According to this graph, we found the most speedy condition was the device with small balls.

③ The relationship between the number of magnets and the speed of iron balls. According to this graph, we found the condition with the most speed was the device with a strong magnetic force.



3.(2) the limit of Gaussian accelerator

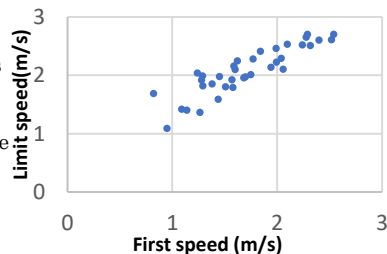
best condition (m/s)	1st	2nd	3rd	4th
1st	1.39	1.99	2.39	1.52
2nd	1.38	2.13	2.83	1.8
3rd	2.16	2.75	1.44	
4th	1.4	2.45	2.65	2.28
5th	0.65	2.01	2.69	1.35
6th	1.59	2.1	1.8	1.31
7th	1.42	2.05	2.4	1.31
8th	1.36	2.42	3.01	2.01
9th	1.51	2.33	1.19	1.9
10th	2.98	3.1	3.8	2.98



According to this graph, we can say that there is a limit because there is a point where speed decreases in the process of speed increase. In addition, we thought the speed of the limit had something to do with other conditions, and we did an experiment.

(extra experiment)

The figure on the right shows the relationship between the initial speed during the experiment and the limit in the experiment. We found the higher the speed, the greater the limit of the Gaussian accelerator.



4. Consideration

If there are many balls, the distance between the first ball and the magnets will be separated and the speed will decrease. If there are few, the distance is close and the ball is pulled in the opposite direction of travel and the speed decreases. The bigger the ball, the greater the energy used to launch. The more magnets. The greater the power to attract the balls. The reason why the limit comes is that the acceleration of the ball on the magnet increases, the slower the speed, and if the speed continues to increase, it will eventually not accelerate.

5. Introspection

Because of the failure and breakdown of tools, We want to improve the point and compare other conditions and do experiments at several conditions reference: [17kensobun_papers_physics.pdf\(hyogo-c.ed.jp\)](http://17kensobun_papers_physics.pdf(hyogo-c.ed.jp))