

# A dancing coin

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## 1. Introduction

After some time a coin placed on the neck of a strongly cooled bottle starts moving and making sound. The subject of my paper is to explain this phenomenon and to investigate how the relevant parameters affect the dance of coin.

## 2. Research Methods

I research such parameters of coin dance as quantity of jumps the coin does, height the coin jumps on, time between neighboring jumps, presence or absence of rotation motion. In theory the quantity (n) can be calculated by the formula:

$$n = \left\lfloor \log_{\frac{p_1}{p_0}} \frac{T_{out}}{T_{in}} \right\rfloor \quad (1)$$

Where  $p_1$  is the pressure inside the bottle on which the coin jumps,  $p_0$  is pressure outside the bottle,  $T_{out}$  and  $T_{in}$  are the primordial temperatures outside and inside the bottle. A real quantity of jumps coin does is determined by observation.



Fig. 1 Experimental setup for 20 L. volume bottle.

The time between neighboring jumps can be found by using consequence of Newton – Richman law .

$$t_i = - \frac{\ln \frac{T_i - T_{out}}{T_{in} - T_{out}}}{k} \quad (2)$$

Where  $T_i$  is the temperature inside the bottle, on which the coin jumps

$$k = \frac{\alpha S}{C} \quad (3)$$

Where  $\alpha$  is the heat transfer coefficient, S is the square of interface between the bottle and the air outside the bottle, C is a thermal capacity of the bottle.

The height coin jumps on is determined by viewing a record of a coin jump in deceleration in Tracker.

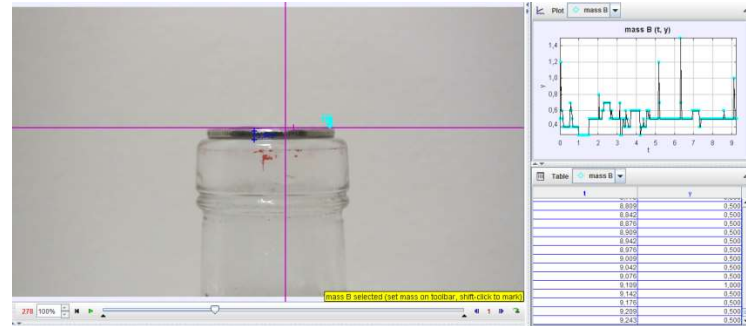
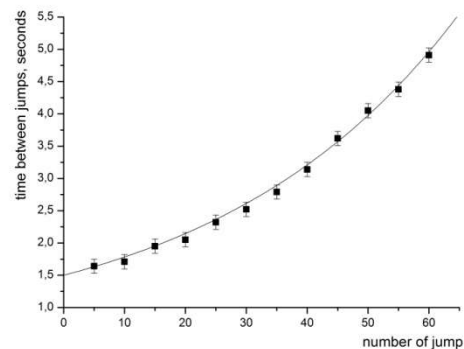


Fig. 2 Experimental setup for high measurement.

## 3. Results

Graph 1 shows how the time between neighboring jumps changes.



Graph 1 – The dependence of the time between neighboring jumps by the number of a jump.

It can be clearly seen from the graph that the time between neighboring jumps exponentially rises as number of jump increases.

## 4. Conclusion

In this paper I have explained the phenomenon of a dancing coin and I have investigated the parameters and their effect on the dance of coin.

## 5. References

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