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Desktop Toys for Educational Seismology -Random or Periodic? Before or After?-

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There are few desktop experiments showing earthquake and fault mechanism in a class room with a few exceptions [1]. The misunderstanding of natural disasters, particularly for earthquakes, is partly caused by the gap between seismologists and public. In this regards, we have developed some teaching toys for high-school and college students in order to demonstrate earthquake characteristics such as power law behaviours, fault dislocations and propagation of seismic waves.

These desktop toys are

1) **Spring-block mode**l; eight thick iron plates lined up on a straight are connected to a surrounding wooden frame with rubber bands (Fig1.). This apparatus is driven manually and is used to count simultaneously slipping blocks. It is a mimic of a fault system driven by a plate motion and shows slips obeying a power law (the Gutenberg-Richter's law) as a whole while each block slips in a quasi-periodic manner. This toy is inspired from the original spring-block model [2].

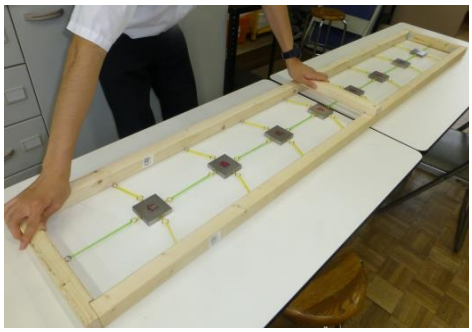

Fig.1 Spring-Block model

2) **Piggy bank as a fault slip model**; vertical stacked two acrylic boxes which consist a model of fault and piling up coins of upper box simulate the stress accumulation by the hanging wall. If all the coin's mass exceeds the maximum friction of glue between two fault planes, the hanging wall begins slipping. The friction between boxes is adjusted with glue material (no figure, now under developing). The model demonstrates a quasi-periodic behaviour of a single fault predicted from "the characteristic earthquake model [3]".

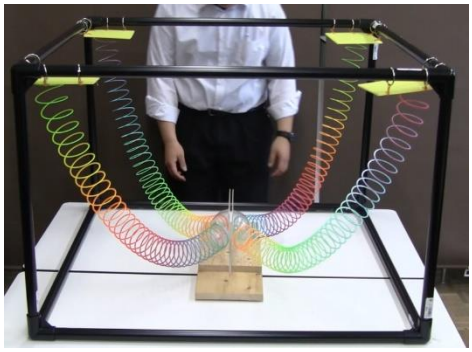

Fig.2 Focal mechanism model

3) **Focal mechanism model showing fault dislocation and wave propagation**; two transparent acrylic plates are dislocated each other and attached to two acrylic

hemispheres which consist a model of a focal plane and focal sphere. Also, four plastic “Slinky” springs attached to both hemispheres show seismic waves propagating radially from the focus (Fig2.). This model simulates four sectored initial phases propagating from the source to the ground surface. Also, it shows a theoretical (wholly predictable) wave propagation after an earthquake shocked.

All models can be made from DIY store materials. Also tools are easily assembled and can be used as a class room demonstration. These toys are useful for students to learn a complicated earthquake process, by discussing the following themes; Are the occurrence of large earthquakes in a single fault system "random or periodic"? Why is the earthquake prediction so difficult? If can, which situation is physics able to describe an earthquake, “before or after”?

References:

[1] Okamoto, Y (1999) :*Nawifuru,* **13**, 7 (in Japanese)

[2] Burridge, R. and L. Knopoff(1967) : *Bull. Seis. Soc. Amer.* **57**, 341

[3] Schwartz, D. P., and K. J. Coppersmith (1984): *J. Geophys. Res*. **89**, 5681–5698.