The *LabQuakes* project: from a granular fault to earthquake statistics

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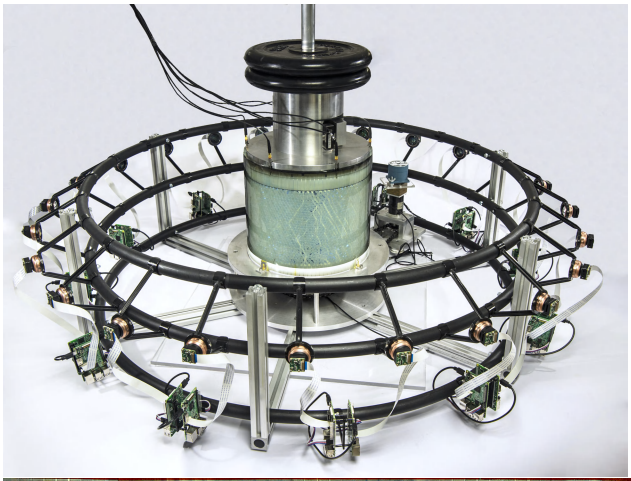
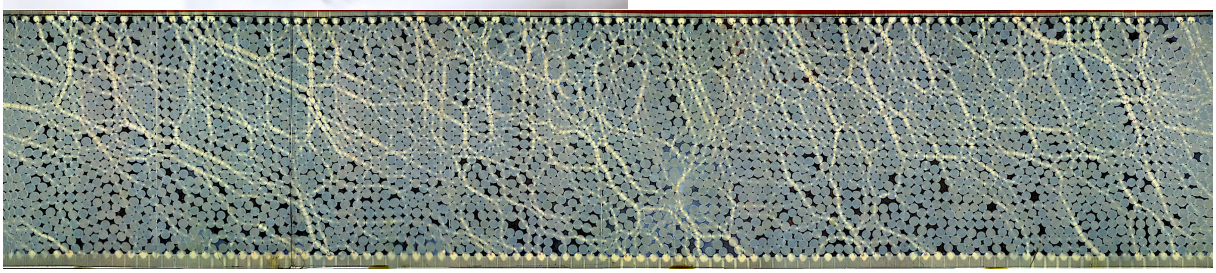
Building analogue experiments that are able to simplify the huge complexity of earthquakes, while capturing the essential ingredients of their dynamics, is a plausible approach to better understand them. In this quest many different experimental systems have obtained statistical relations similar to those that describe seismicity: Gutenberg-Richer (G-R) law, Omori law, interevent time distribution, etc. However, many of these similarities are *qualitative*; for example: the distribution of events' energy follows a power law with an exponent value different to the one of the G-R law. Recently we have developed an experimental system, based on the continuous and slow shear of a compressed granular system that mimics the behaviour of a tectonic fault: elastic energy is slowly stored in the granular structure and liberated by sudden reorganization events accompanied by acoustic emissions. By capturing and analysing a few millions of these laboratory quakes, we are able to reproduce *quantitatively* and simultaneously the main statistical relations describing seismicity [1]. This a strong indication that both systems share a common physics and brings hopes to a better understanding of earthquake physics.

This talk will briefly discuss, with some examples, the relevance of reaching a quantitative agreement in earthquake analogue experiments, then the main results obtained in our experimental system [1], and the challenges we are currently focusing on.





Figures: (top) Simplified image of our setup. (bottom) Granular fault.

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[1] S. Lherminier, R. Planet, V. Levy dit Vehel, G. Simon, K. J. Måløy, L. Vanel and O. Ramos, Continuously sheared granular matter reproduces in detail seismicity laws, Phys. Rev. Lett. 122, 218501 (2019).