Dangers from space:

Understanding very small (<200 m in diameter) and small (<1.5 km in diameter) impact craters on Earth to determine the degree of environmental damage induced by such events by studying their proximal ejecta blankets

Impact cratering is the most important geologic process in our solar system. Collisions of Earth with minor planetary bodies changed our history: single large asteroid ended up the age of dinosaurs. Luckily those large events are very rare. Small asteroids (<50 m in diameter) that are large enough to reach the Earth's surface and form an impact crater, represent the most likely hazard. It is because smaller bodies are much more common than large ones, and positions of small meteoroids are not efficiently tracked by the current Near Earth Objects search programs (neo.jpl.nasa.gov). The formation of Carancas crater in Peru in 2007 and the fall of Chelyabinsk meteor over Russia in 2012 that injured >1500 people are examples of recent events of this kind that were not foreseen by any of these programs. Despite the importance of those small-impact events, our understanding of them is quite poor.

The aim of this project is to better understand the environmental effects induced by formation of very small (30-200 m in diameter) and small (<1.5 km) impact craters on Earth. This will allow us to answer questions such as: "how hot exactly are surroundings of the small impact craters?" or "how the shock wave induced by such cosmic collisions is interacting with living organisms". Clarifying those issues will help us to better prepare for asteroidal collisions in the future, e.g., by better estimating evacuation area.

We are going to perform a range of field studies within proximal ejecta deposits: Kaali and Ilumetsa strewn filed (both in Estonia), Morasko (Poland), Whitecourt (Canada), Camo del Cielo (Argentina), Tswaing (Republic of South Africa) as well as Odessa and Barringer craters (both in USA). Each site was selected in order to answer a specific research question. For example, Whitecourt was selected as one of the sites because it is one of the youngest, freshest impact crater on Earth developed in unconsolidated material with only a minimal anthropogenic disturbance (as it is in the middle of Canadian taiga) and because it is the best spot to study undisturbed proximal ejecta and impact charcoals layer. We will also perform a set of laboratory experiments that model formation of impact craters in a controlled environment (at the Hypervelocity Impact Facility and Environmental Simulation at the Open University, UK and at the Laboratory for Experimental Impact Cratering at Centro de Astrobiología (INTA-CSIC), Spain).

Formation of an impact crater in laboratory conditions (in Spain) as seen by a high- speed camera.