COLLOQUIA

UNIVERSITY
OF TRENTO - Italy
Department of Physics

Prof. Enrico Flamini

University of Chieti-Pescara

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Impact Cratering: how to shape a planetary surface

Abstract

The accretion of solid bodies of the system occurred basically in a hierarchical way, passing through various phases such as the formation of intermediate bodies, planetesimals, their growth initiating the formation of planetary embryos and, at last, of the planets as we see them today. Following this initial phase, in the intermediate phase, when a large number of planetesimals were present, stochastic processes such as impacts were extremely frequent and took place aside other, more ordered processes. Impact events, especially larger ones, have played a key role in formation and early history of Solar System.The planetesimals, and later on, the protoplanets were accreted, but also occasionally disrupted, by impacts of various magnitudes. The Earth-Moon system is the consequence of such a large impact between two protoplanets. The understanding that craters on the Moon and other planets of the Solar System are the result of hypervelocity impact events is based on several evidences: abundance on all the surfaces of solid planetary bodies, presence on objects with very different compositions and surfaces of different ages, great variability in size of the observed craters, constant and regular morphology, presence on small bodies such as asteroids and laboratory experiments. The full acknowledgement of the importance of meteorite impacts on Earth comes from the study of other planets and dates around the mid of the past century. The exploration of the Moon with human missions and the Solar System with spacecraft since the 60's has shown that the impacts have been and are the main process of origin and evolution of all solid bodies in the solar system, from Mercury to moons of Neptune and have left their traces on the Earth. The abundance of well-preserved impact craters on planetary surfaces made it possible to use distribution and frequency of craters to determine related geological ages, based on the simple principle that older surfaces have accumulated a greater number of craters. This method was calibrated starting from the two most well-known craters on the Moon, Tycho and Copernicus, dated (using samples collected on the Moon by Apollo mission) 100 million and 1 billion years ago. Last, but not the list, the insurgence of life on Earth occurred soon after the age of the Late Heavy Bombardment when, on the Moon, the Maria were formed. The availability of radar images of all the earth regions has allowed the publication of the first Atlas of all the recognized terrestrial impact craters.

Selected Bibliography

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Contacts:
Department of Physics
Via Sommarive, 14
38123 Povo, Trento
df.supportstaff@unitn.it

Scientific Coordinator:
Prof. Francesco Tommasino
francesco.tommasino@unitn.it