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Providing an historical overview of impact cratering, not only on the Moon but throughout the Solar System . serve as a practical guide to observing lunar meteoroid impacts and they introduce the serious amateur to a programme of observational work that can truly yield valuable results and allow genuine professional-amateur collaboration. a valuable book on an important ...

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While the era of major impacts is over, lunar meteorites still cause flashes and puffs of gas, vaporized rock, and dust that we can observe. The Moon itself has a fascinating history. It is now thought to have been formed after a Mars-sized object collided with Earth and stripped off a portion of its mass.

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Lunar Meteoroid Impacts and How to Observe Them : Brian ...
Meteorite smashes into moon in largest lunar impact ever recorded. Rock travelling at 61,000 km/h punched a crater 40 metres wide and produced a flash that could be seen from Earth.

Meteorite hits moon in largest lunar impact ever recorded ...
Since 2006, NASA's Lunar Impact Monitoring Program has been routinely observing the moon for flashes caused by meteoroids striking the lunar surface.

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Lunar escape velocity averages 2.38 km/s (1.48 miles per second), only a few times the muzzle velocity of a rifle (0.7-1.0 km/s). Any rock on the lunar surface that is accelerated by the impact of a meteoroid to lunar escape velocity or greater will leave the Moon's gravitational influence.

Lunar Meteorites | Some Meteorite Information | Washington ...

Lunar origin is established by comparing the mineralogy, the chemical composition, and the isotopic composition between meteorites and samples from the Moon collected by Apollo missions. Transfer to Earth. Most lunar meteorites are launched from the Moon by impacts making lunar craters of a few kilometers in diameter or less.

Lunar meteorite - Wikipedia

In a lunar meteoroid impact, the kinetic energy of the impactor is partitioned into (1) the generation of a seismic wave, (2) the excavation of a crater, (3) the ejection of particles, and (4) the emission of radiation. Any of these phenomena can be observed to detect lunar meteoroid impacts.

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Lunar Meteorite Impact Risks 18 A December 4, 2006 CNN.Com news story, based on the research by Bill Cooke, head of NASA's Meteoroid Environment Office suggests that one of the largest dangers to lunar explorers will be meteorite impacts. Between November 2005 and November 2006, Dr. Cooke's observations of lunar flashes (see image)

Lunar Meteorite Impact Risks 18

Lunar origin is established by comparing the mineralogy, the chemical composition, and the isotopic composition between meteorites and samples from the Moon collected by Apollo missions.Most lunar meteorites are launched from the Moon by impacts making lunar craters of a few kilometers in diameter or less. The moon rocks returned by the manned and unmanned missions sent there have told ...

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Lunar Meteoroid Impacts And How To Observe Them

The nearly 80 lunar meteorites are similar in mineralogy and composition to Apollo mission Moon rocks, but distinct enough to show that they have come from other parts of the Moon. Studies of lunar and Martian meteorites complement studies of Apollo Moon rocks and the robotic exploration of Mars.

Meteorite Impacts in History

The genesis of modern searches for observable meteoritic phenomena on the Moon is the paper by Lincoln La Paz in Popular Astronomy magazine in 1938. In it he argued that the absence of observed fashes of meteoritic impacts on the Moon might be interpreted to mean that these bodies are destroyed as luminous meteors in an extremely rarefed lunar atmosphere. The paper suggested the possibility of systematic searches for such possible lunar meteors. With these concepts in mind, I was surprised to note a transient moving bright speck on the Moon on July 10, 1941. It appeared to behave very much as a lunar meteor would except that the poorly estimated duration would lead to a strongly hyperbolic heliocentric velocity. Thus, the idea of systematic searches for both p- sible lunar meteors and meteoritic impact fashes was born. It was appreciated that much time might need to be expended to achieve any positive results. Systematic searches were carried out by others and myself chiefy in the years 19451965 and became a regular program at the newly founded Association of Lunar and Planetary Observers, or ALPO.

The only work to date to collect data gathered during the American and Soviet missions in an accessible and complete reference of current scientific and technical information about the Moon.

The Earth-Moon neighborhood is the scene of a large variety of applications that concern asteroids, lunar exploration and space debris in Earth orbit. In particular, recent efforts by the scientific community have focused on the possibility of extending the human operations beyond the radiation belts; of exploiting in-situ resources, either on the lunar surface or on asteroids retrieved to the vicinity of the Earth; and of mitigating the space debris concern by taking advantage of the lunar perturbation. The characteristic dynamics in the cislunar space represents an opportunity for the mission designer, but also a challenge in terms of theoretical understanding and operational control. This Research Topic covers the Earth-Moon dynamics in its complexity and allure, considering the most relevant aspects for both natural and artificial objects, in order to get a new comprehension of the dynamics at stake along with the operational procedures that can handle it.

This volume contains five articles describing the mission and its instruments. The first paper, by the project scientist Richard C. Elphic and his colleagues, describes the mission objectives, the launch vehicle, spacecraft and the mission itself. This is followed by a description of LADEEs Neutral Mass Spectrometer by Paul Mahaffy and company. This paper describes the investigation that directly targets the lunar exosphere, which can also be explored optically in the ultraviolet. In the following article Anthony Colaprete describes LADEEs Ultraviolet and Visible Spectrometer that operated from 230 nm to 810 nm scanning the atmosphere just above the surface. Not only is there atmosphere but there is also dust that putatively can be levitated above the surface, possibly by electric fields on the Moons surface. Mihaly Horanyi leads this investigation, called the Lunar Dust Experiment, aimed at understanding the purported observations of levitated dust. This experiment was also very successful, but in this case their discovery was not the electrostatic levitation of dust, but that the dust was raised by meteoroid impacts. This is not what had been expected but clearly is the explanation that best fits the data. Originally published in Space Science Reviews, Volume 185, Issue 1-4, 2014.

"This volume contains a sizable suite of contributions dealing with regional impact records (Australia, Sweden), impact craters and impactites, early Archean impacts and geophysical characteristics of impact structures, shock metamorphic investigations, post-impact hydrothermalism, and structural geology and morphometry of impact structures - on Earth and Mars"--

The lunar surface is pockmarked with large and small craters mostly formed due to meteoroid impacts on the Moon. Most of the craters formed are not erased with time due to lack of "weathering" processes such as no atmosphere and little erosion. The main focus of this research is to develop ground-based observational techniques to search for ongoing hypervelocity meteoroid impacts on the lunar surface. Additionally, to design radar observational techniques to detect and map sub-surface structures that have been buried by the lunar regolith.It is hypothesized that the developing, optically-dense hot ejecta cloud associated with the hypervelocity meteoroid impacts produce an associated complex plasma component that rapidly evolves resulting in a highly-transient Electromagnetic pulse (EMP) in the VHF/UHF spectral region. An observational EMP search was conducted in May 2014 for about 5 hours using an overlapping-band (425-445 MHz) at the Arecibo (AO; Puerto Rico) and Haystack-(HO, Massachusetts, USA) observatories simultaneously to track the common visible lunar surface from two different locations on the Earth. Observations from two locations is helpful in eliminating the false impacts. Interleaved radar observations were used to calibrate the timing and synchronize both the AO and HO systems. As the AO/HO UHF EMP search was interference dominated, an alternative search mechanism using the Arecibo L-band ALFA Array that consists of seven beams arranged in the hexagonal manner was conducted in February 2016. During these observations, at any given time few of the receive-beams were on-Moon and few off-Moon thus allowing discrimination against local interference that might resemble the expected EMP signals. While still encountering local out-of-band radar interference, this observational paradigm did yield a few likely lunar impact EMPs.Additionally, to detect the sub-surface lunar structures, high power large aperture - Jicamarca Radio Observatory (JRO) 50 MHz radar located near Lima, Peru was used to map the lunar surface and subsurface features. This was accomplished by developing or refining various calibration and imaging procedures. This radar provides the ability to map the lunar sub-surface because the 6-meter wavelength radar signal penetrates the low-loss regolith and scatters from larger sub-surface structures allowing study of these structures. This analysis further depends on the (de)polarization of the return signals. Interpretation of lunar radar signal polarization is greatly complicated by the double traverse of the ionosphere at or near wavevector near to perpendicular to the geomagnetic field geometry as described. Preliminary radar observations were conducted in October 2015 by transmitting a circular polarized coded pulse during the lunar transit over JRO. The detected lunar echoes of the duration of 13 minutes were then processed to generate the lunar Range-Doppler maps and identify the (sub)surface features. Preliminary science results from the observations are given.Each of the three observational set-up's along with the signal processing paradigms such as Inverse Synthetic Aperture Radar (ISAR) mapping to form the lunar maps and the time-frequency technique to process the collected observational data are explained. Implications of the observed transient EMP events, processed lunar surface maps, characterization of the observed satellite radar echoes and the difficult radio-frequency interference environment (terrestrial-origin, Moon-bounce signals) surrounding these observations are discussed.