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RECENT INVESTIGATION OF GLOBAL LOOPING ON MAGNETIC FIELD IN MARS

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Abstract

Mars looked a lot like Earth a million years ago. This planet had a large ocean with enough oxygen to sustain life. Mars' magnetic fields abruptly vanish, leaving it unable to deflect solar winds, causing the planet's habitability to be swept out of the solar system. We had the choice of making Mars habitable again, and if we did so, we would have a chance to live. Long-term discussions have begun on putting a large magnetic dipole between the sun and Mars. As a result of its placement, this magnetic dipole aids Mars in deflecting solar winds. Currently, the experiment with a magnetometer on board the American Maven spacecraft is producing new data, although the map distribution of magnetic field and photographs of the magnetic field are still being developed.

Introduction

Mars' intrinsic magnetic field was first studied in conjunction with trips to other planets. The features of Mars' intrinsic magnetic field could be crucial in understanding the planetary dynamo process, which is sensitive to crust evolution.The stability and core of the planets inside the terrestrial group. Overall distribution of magnetic fields, as well as their influence on the properties of the Martian atmosphere and ionosphere, as well as the characteristics of their interactions with the solar wind, has been determined. However, there are several considerations to consider, like as

A.)Mars geodesy, rotation and gravity.

B.)Magnetic properties experiments on mars exploration rover mission.

C.)An planetary electromagnetic and gravity.

D.)Crustal magnetic field of mars.

These were the few issues that I gone state in my review.

General issue reviews of magnetic force of attraction in mars

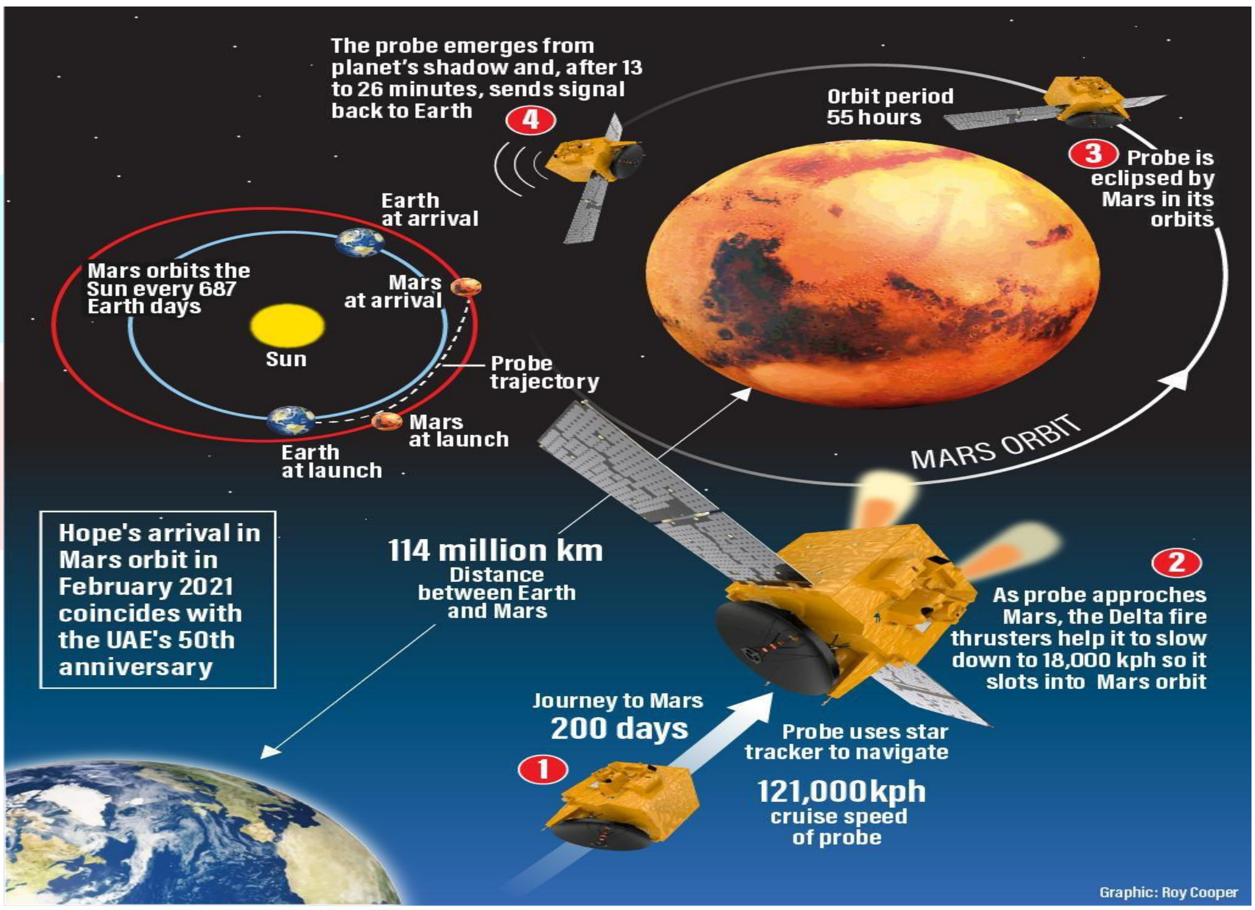
A.) Mars geodesy, rotation and gravity

This review through Pascal Rosenblatt and Veronique Dehant explains how radio science data from a surface of the planet orbiter or the portion of its surface can be used to address geodesy, rotation, and gravity.As stated in this evaluation,

#Global static gravitational field

The gravitational field would be equivalent to that at a point of mass if the planet is homogenous and spherical, and the orbital motion of the spacecraft due to gravitational field would follow kepleria motion.

When a spacecraft is in orbit around a planet, it feels the gravitational field of the planet, as well as the gravitational fields of the Sun and the moon orbiting the planet, and to a lesser extent, the gravitational field of the Sun and the moon orbiting the planet.



See, there are other worlds. All of the masses inside the planet contribute to the gravitational field. The gravitational field of a homogeneous and spherical planet is equivalent to that of a point mass, and the orbital motion of the spacecraft due to this gravitational field follows Keplerian motion. A planet like Mars, on the other hand, is not spherical, has heterogeneously distributed masses, and spins. The most practical depiction of the planetary gravitational potential is as a series of spherical harmonics written at each point on the planet's perimeter.

MASSES OF PHOBOS AND DEIMOS

The small moons Phoebes and Deimos have an effect on a spacecraft's orbit around Mars. The mass of Phoebes, in particular, causes a small secular drift of the spacecraft orbit. The accumulation of long data-arcs of observations enables the determination of this secular drift and, as a result, the mass of Phoebes. Furthermore, if the spacecraft is orbiting close to the little moon, the acceleration will be high enough to see this effect directly in the Doppler tracking data. A flyby of this type lasts a few minutes, and Doppler tracking data collected during the one hour preceding the closest approach is analysed to determine the mass. Taking advantage of the higher elliptical Mars Express orbit, it is possible to apply both approaches in order to estimate Phoebes’ GM. Both flyby and secular approaches are needed to fit the spacecraft dynamical model to tracking data. Together with the volume, the value of the mass of Phoebes will allow for deriving the mean density of Phoebes, which gives some hints, constraints on its origin. The result indicates macro-porosity inside Phoebes.

GRAVITY INDUCED BY PARTICULAR TARGETS

At the low-altitude perimeter pass of the Mars Express spacecraft, a spacecraft orbiting Mars may pass over a large edifice, such as the volcano Olympus Mons. Because of the large mass anomalies associated with the edifice, the trajectory of these passes deviates significantly. The study of this deviation allows the region to be characterized in terms of the degree of compensation of the topography, the top and bottom loading of the underlying lithosphere, and the density of the topographic load. The mass of large volcanoes on Mars' surface, in particular, causes significant gravitational anomalies. Standing on the surface of Mars for an extended period of time, combined with properties that allow compensation, the mass of the volcano would be completely compensated by a counterpart root of the edifice, with almost no gravitational anomaly observed above the Martian surface. In practice, however, the signatures of many topographic features on Mars can be seen in gravitational effects. A volcano's gravitational anomaly, such as Olympus Mons, is only partially compensated by contributions from additional lithosphere flexure caused by the volcano. The bending of the lithosphere is determined by its stiffness, stress, and material properties. The presence of a hot spot or a large magma chamber beneath the volcano may also cause additional gravitational effects. The comparison of gravity and topography allows for the characterization of crustal, lithosphere, and density anomalies beneath the surface.

MARS ROTATION AND ORIENTATION

Radio science data may show the rotation of Mars beneath a spacecraft orbiting Mars and carrying a Lander or rover. The observation from Earth allows the determination of Mars rotation and orientation in space because the Very Long Baseline Interferometer knows almost perfectly where the Earth is in space. The uniform rotation of the planet must be subtracted from the Doppler measurements, as well as the known parts of Mars' orientation. The residuals are then analyzed in terms of Mars interior physics.

Polar Motion

Polar motion is the movement of a planet around its rotation axis, or, more precisely, the movement of the mean rotation axis around the figure axis in a frame tied to Mars. It is caused by the atmosphere and is related to the exchange of angular momentum between the atmosphere and the solid planet in terms of length-of-day variations. One-fourth of the atmosphere is involved in the sublimation and condensation of CO2 in the ice caps. As a result, the components of polar motion exhibit a seasonal timescale. Furthermore, because the rotation axis is not always coincident with the figure axis, Mars may wobble. The so-called Chandler Wobble spans a period of around 200 years. The Chandler Wobbles' contribution to pole motion could be a few metres, depending on the dissipation within the globe, because atmospheric behaviour is not perfectly harmonic and noise can occur. Polar motion can only be observed via radio links between a Lander or rover on Mars' surface and Earth if the Lander is located at a high latitude; the contributions to the Doppler shift from an equatorial Lander are too minor to be detected.

An planetary electro-magnetism and gravity

This review by Ashwini Kumar lal provides a study of the interiors of various terrestrial planets. The study's findings suggest that the earth's gravitational attraction may be attributed to magnetic coupling experienced between the earth's electromagnetism and objects electrically charged or uncharged on Mars. More specifically, terrestrial gravity is thought to be the result of the planetary electromagnetism's bound state. According to Ashwini Kumar Lal's review, Mars accepts all possibilities for the core. Stevenson favours a completely fluid core because it predicts a cosmochemically plausible sulphur content of 15% or more by weight and also explains the absence of a significant magnetic field. In 2003, NASA jet propulsion laboratory researchers

After analysing three years of radio tracking data from the Mars Global Surveyor spacecraft, scientists reported in Science that Mars' interior is made up of either a completely liquid core with a solid inner core or a completely liquid core with a solid inner core. Data from Mars had previously revealed no sign of a current magnetic field, prompting scientists to regard the planet as geologically dead. The 2003 discoveries concerning Mars' interiors backed up Stevenson's 2001 forecast that Mars will have a liquid, conductive outer core and a solid inner core like Earth.

According to Stewart, if a liquid metal travels around a solid core, it can form a dynamo similar to the one found in the earth's core. In all likelihood, a functional dynamo within the Martian core, along with electrically conducting core materials at high temperatures and pressures within the core, is responsible for the generation of electromagnetism within the Martian interiors, similar to how electromagnetism is generated in the earth's interiors.

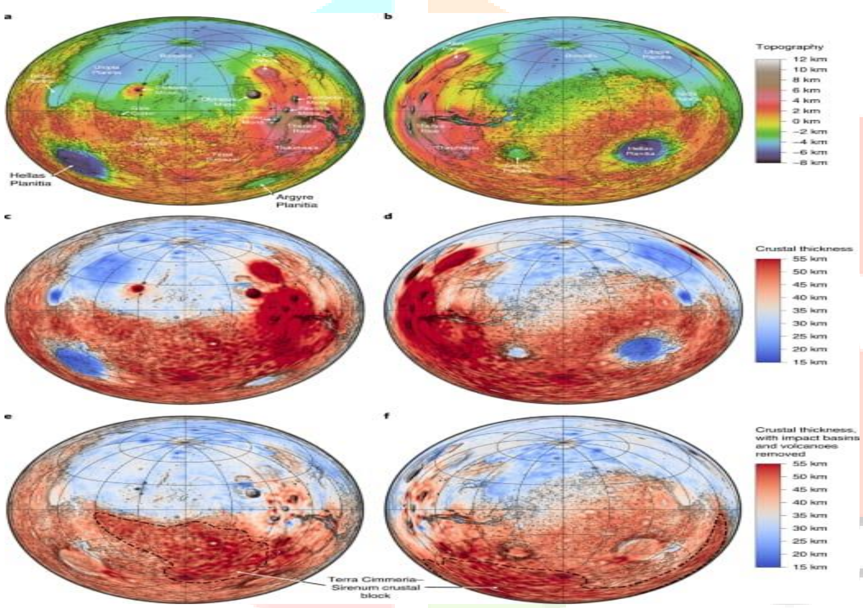
Crustal Magnetic Field Of Mars

From # B.langlasis (NAS/ NRC at geodynamics),

M.E. Purucker (Raytheon ITSS at geodynamics),

M.Mandea (institut de physique du globe, Paris)

The study's principal goal is to develop a new model of the Martian magnetic field. This model is intended to forecast the three components of the Martian magnetic field at altitudes ranging from 173 kilometers, our models mean horizontal resolution, to 430 kilometers, the height at which the MGS readings we utilised in our model reached their greatest altitude In the next lines, I'll go through some basic modelling strategies. I present the low altitude and high altitude data sets, which are evaluated for consistency before being used to create independent models.

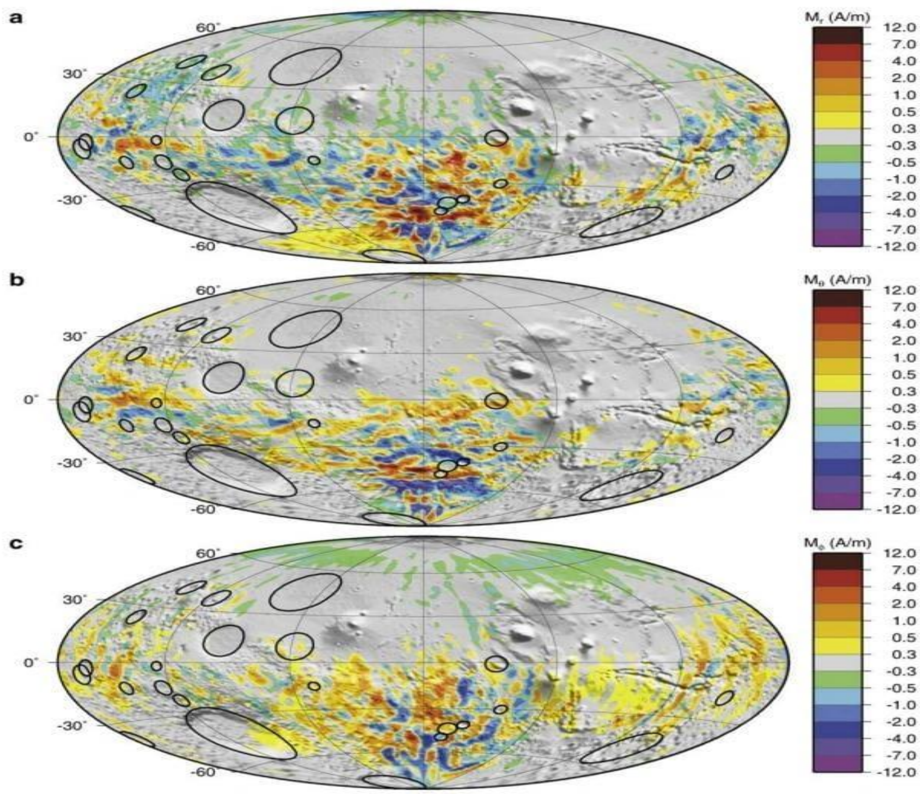


At 200 km altitude, the three components of the magnetic field predicted the M23/20/14 model. Nearly everywhere north of the crustal dichotomy, the magnetic field is feeble. Only two features can be found north of the crustal dichotomy. Terra cimmeria and terra sirenum have the most significant magnetic abnormalities. Both the huge impacts and the giant volcanic features occurred after the Martian dynamo was turned off in the first scenario. Because of the heat and seismic impacts, the lithosphere would have been demagnetized. The impacts and volcanic edifices occurred before the Martian dynamo went on in the second scenario. However, the latter scenario is more feasible, because both the massive impacts and the major volcanic edifices are likely younger than the terrenes of the terra cimmeria and terra sirenum zones, where the highest magnetic anomalies can be found.

The magnetization ranges for Mr, Mq, and Mf, respectively, are 9.0/+11.5, 7.8/+11.3, and 6.2/+6.7 A/m, based on our assumptions (40-km thick iso-volume blocks of homogeneously magnetised material). Of course, due to the non-uniqueness of the situation, these numbers are not absolute, but they are typical of the expected magnetization differences in the Martian lithosphere. Surprisingly, these statistics are extremely similar to the ones calculated byParker. He calculated the minimal magnetization responsible for some of the largest magnetic fields in his research.

On Mars, there are anomalies. The magnetism intensity would be at least 4.76 A/m if the magnetised layer was 50 kilometres thick. Purucker computed lower radial magnetization values, but their model relied solely on a low-altitude, geographically sparse data set. They limited their model to simply radial magnetization, did not attempt to simulate horizontal magnetic components, and employed a binned version of the model.

the data set AB They also used a 1.9 mean spacing for the dipoles, resulting in magnetic bodies that were smaller than ours (thus leading to larger magnetizations). The three components of magnetization from the M23/ 20/14 models are depicted in. The magnetization map and the anomaly are in good agreement. With the exception of the negative Mf circular structure near 70 North latitude, high magnetization values are typically seen south of the crustal dichotomy. This is most likely the result of exogenous magnetic fields or their generated equivalent. We overlaid the locations of circular crater rims with diameters more than 300 km on magnetization maps. A list of the craters, along with their coordinates and radius. Impacts, as seen on the Moon, are likely to have demagnetized the Martian lithosphere [Halekas et al., 2002, and references therein]. The relationship between the crater radius and the excavation depth is well known, however it is affected by the crater's complexity or geological arrangement. For non-polar,Garvin et al. report a mean depth-todiameter ratio of 0.053 0.04 relatively small impact features. Of fact, this mean ratio does not apply to the biggest craters. Hellas, a 2000-kilometer-diameter crater, is just 9 kilometers deep. Furthermore, this ratio does not correspond to the demagnetization depth. It is very likely that the negative consequences will



continue.

The impact extends below the depth of the crater. Although some terrestrial craters are also characterised by shock and/or thermal reminisce, such phenomena have been observed on Earth. Nimmo and Gilmore used a 0.06 demagnetization depth-to-diameter ratio in their research. This value is comparable to, but higher than, that provided by Garvin et al. The depth of demagnetization is at least equal to the depth of excavation. Nimmo and Gilmore discovered an apparent weaker magnetic field associated with craters larger than 500 km in diameter and calculated a demagnetized layer thickness of 35 km (or for the thickness of the magnetic crust). Our magnetization model appears to suggest a link between weakly magnetised regions and craters with diameters of 300 km or greater. Because of the size of our initial dipole mesh, we didn't expect to see exact, circular signatures of the crater rims in the magnetization map. The largest craters, Hellas, Argyre, Utopia, and Isidis, are not strongly magnetized Mitchell. used MGS Electron Reflect metre measurements to show that the magnetic field above the Hellas basin was weak but not zero. Our model does not appear to support this hypothesis, but we cannot rule it out. There are some small magnetised features above only one large impact crater, particularly near its Southern rim. However, in comparison to the size of the crater, the scale of these anomalies is very small. Nimmo and Gilmore discovered that no radial magnetic features could be associated with preliminary AB data.

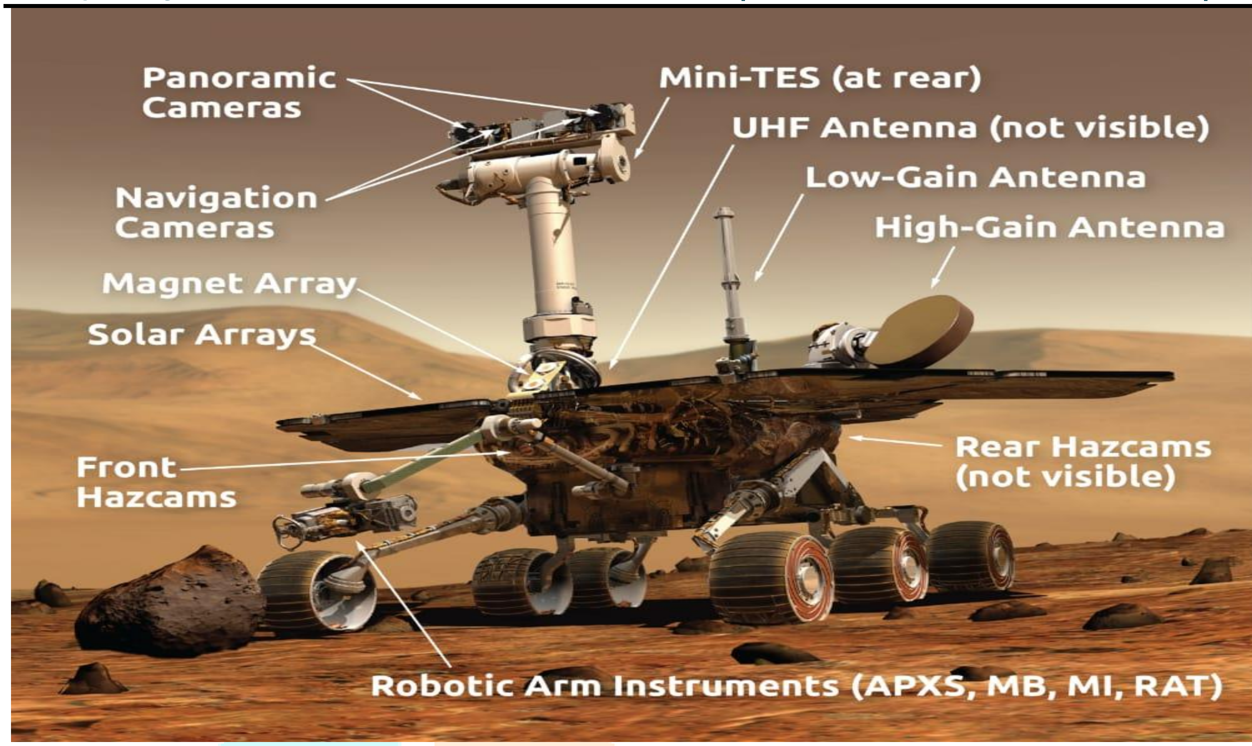
With craters measuring more than 500 kilometres in diameter. There is a clear link between non-magnetized and impact areas on the magnetization map, especially over some of these craters, such as Schroeter (especially for Mr on its South rim), Newton (Mr and Mf), Copernicus (Mr and Mq), Herschel, Kovalsky, and Tikhonravov (Mr, Mq and Mf). A finer dipole mesh would be required to further estimate these correlations or to provide actual metrics on these correlations (down to 1.9 or so). The above relationships have implications for the thickness of the magnetised layer as well as the depth of demagnetization. It may also aid in better understanding of the shock demagnetization process. Large impact craters appear to be connected with locally weaker magnetic crust. We get a depth-to-diameter ratio of 0.11 to 0.17 if we assume a magnetic thickness of 35 to 50 km, which is more than double the mean value of 0.06 utilised by Nimmo and Gilmore. Their figure implies an 18-kilometer magnetised layer, bringing the magnetization range to 26.6 A/m.

Magnetic properties experiments on mars exploration rover mission

M.B.Madsen, W.goetz, C.s.binau, M.olsen, F.Folkmann, H.p.gunnlaugsson, K.m.kinch, J.n Knudsen, J.merrison, P.nornberg, S.w squyres, A.s yen, J.d rade macher, S.gorevan, According to their review, each of the Mars exploration rovers carries a set of magnetic properties experiments. designed with the following goals in mind: identifying magnetic minerals in Mars' dust, soil, and rocks, determining whether magnetic material is present in the form of nanosized superparamagnetic crystallites embedded in micrometer-sized airborne dust particles, and determining whether magnets are present. selection of extremely magnetic particles or if almost all airborne dust particles are sufficiently magnetic to be drawn by magnets The Mars Exploration Rovers each include a set of permanent magnets of various strengths and sizes to fulfil these aims.

Permanent magnets of varying strengths and diameters are carried by each Mars Exploration Rover. Capture magnets, Filter magnets, Sweep magnets, and Rock Abrasion Tool (RAT) magnets are the names given to the magnets. The magnetic force attracts dust particles to the magnets.

The form and location of the magnetic material regulate the force. Each magnet has its own design and function, which are briefly discussed here.



Capturing and filtering magnets The Capture and Filter magnets are located in the front of the rovers. The three instruments on the Instrument Deployment Device will study it once enough dust has been attracted to the magnets.

The Mossbauer Spectrometer, the Alpha Particle X-ray Spectrometer , and the Microscoped Imager are three different types of spectrometers. The IDD can bring these three instruments as close as possible to the Capture and Filter magnets. The Capture and Filter magnets are created in a similar manner. The active magnetic material employed in the magnets has a circular symmetry. At room temperature, Sm2Co17 has a magnetization of M = 8.75, 105 AM 1, and a Curie temperature of TC = 1190 K. The magnets are integrated in an aluminium framework, with a high-purity aluminium foil covering the active surface where the dust is attracted. The Sm2Co17 portion of each magnet is 25 mm in diameter, whereas the aluminium framework is 45 mm in diameter. The metal frame has been stripped of any superfluous material.

Each component of the Magnetic Properties Experiment will be subjected to unique rover operations. Those for the Sweep magnet are the simplest.

This magnet is right next to the Pan cam calibration target, and every photograph of the target will contain the Sweep magnet. Every main Pan cam imaging sequence will contain images of the target for calibration reasons, generally through a variety of colour filters. During typical operations, a good time baseline of high-resolution colour imagery of the Sweep magnet will be collected. Before and after each usage of the RAT, the magnets will be photographed. In a typical grinding process, the IDD is used to position the IDD so that the RAT magnets can be seen by Pan cam with the greatest spatial resolution feasible.

The RAT will be used to remove material from the rock after images are collected using each Pan cam colour filter. The IDD will return the RAT to the same imaging location after grinding, and the multispectral imaging procedure will be restarted. Magnet operations using the Filter and Capture magnets will be the most difficult. As soon as feasible after landing, they will be photographed using all Pan cam colour filters to create a baseline for their dust-free appearance under Martian light. They will then be photographed every few sols using at least two bandpass filters with widely spaced wavelengths to track the accumulation of dust on their surface.

Conclusion:

The notion of the magnetic force of attraction on Mars is getting increasingly serious as a result of these many scientific endeavours. The development of these new technical approaches may necessitate collaboration across all nations' research agencies, government, and business sector to get better outcomes. With adequate funding and support, future missions will be ahead of the magnetic force of attraction on Mars. However, unless artificial magnetic field mitigation regulations and guidelines are widely implemented, the dangers to space system operations in the near-Mars will continue to rise.

Reference:

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W. Goetz, C. S. Binau, M. Olsen,F. Folkmann,H. P. Gunnlaugsson,K. M. Kinch, J. M. Knudsen, J. Merrison,P. Nørnberg, S. W. Squyres,A. S. Yen, J. D. Rademacher,S. Gorevan, T. Myrick, and P. Bartlett

b.) **On Planetary Electromagnetism and Gravity**

Ashwini Kumar Lal Town & Country Planning Organisation, New Delhi, India