

## Development of ground and space based radar astronomy

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The use of radar to explore the solar system from the ground has seen a slow but steady development from the early 1960's till today. A main reason for the slow development stems from the high cost involved in establishing a facility with meaningful capability, and only few observatories have been able to take part in this development. More recently the application of radar techniques from space based platforms have been spectacularly successful and have in some cases replaced the ground based observations. The present talk reviews the experiments which can be carried out, and shows results from them. The methods of measuring distance leading to the current value of the astronomical unit, the measurement of reflectivity constraining the range of values of the dielectric constants, the method whereby the roughness of the reflecting surface, and the mapping using side-looking radar are all explained. The application of these methods to explore the Moon, Mercury, Venus, the Galilean satellites, Titan, Saturn's rings, asteroids and comets are illustrated by observational results and by interpretation of some of these results. Some of the techniques have also been employed in observations from spacecraft, and spectacularly impressive mapping results are shown from Venera 9 and Venera 10, and from the Magellan spacecraft. Recently low frequency radar systems have been planned and implemented for Mars observation of subsurface interfaces which can be interpreted in terms of mater or ice layers.