

MICROGRAVITY SCIENCES AND PROCESSES (A2)  
Gravity and Fundamental Physics (1)

Author: Prof. Ludwig Combrinck  
South Africa, ludwig@hartrao.ac.za

DEVELOPMENT OF A SATELLITE AND LUNAR LASER RANGER AND ITS FUTURE  
APPLICATIONS IN SOUTH AFRICA**Abstract**

The international network of Satellite Laser Ranging (SLR) stations is under represented in the Southern Hemisphere. Currently there are only three Lunar Laser Ranger (LLR) stations globally, all located in the Northern Hemisphere. We are in the process of developing a combined satellite and lunar capable laser ranger utilising a one metre optical telescope. A complete description of the link budget to the Moon, required electronic hardware, optics, laser system and integrated software for this new LLR is presented. Research work undertaken utilising data from the global network is described. Future work, which will include data from the newly developed Lunar Laser Ranger, is discussed. In particular the application of SLR and LLR to evaluate General Relativity Theory (GRT) is discussed. Results obtained evaluating parameterized post Newtonian parameters  $\gamma$  and  $\beta$  through the precise orbit determination of the LAGEOS satellites are presented. These results are brought into context with other published work utilising different instrumentation and techniques. Limitations in testing GRT are described. These limitations result from modelling deficiencies, satellite and lunar laser ranging inaccuracies and imperfect analysis strategies.