Berichte aus der Astronomie

Carolin Früh

Identification of Space Debris

Shaker Verlag
Aachen 2011

Bibliographic information published by the Deutsche Nationalbibliothek
The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at http://dnb.d-nb.de.

Zugl.: Bern, Univ., Diss., 2011

Printed in Germany.

ISBN 978-3-8440-0516-5
ISSN 0947-7756

Shaker Verlag GmbH • P.O. BOX 101818 • D-52018 Aachen
Phone: 0049/2407/9596-0 • Telefax: 0049/2407/9596-9
Internet: www.shaker.de • e-mail: info@shaker.de

Zusammenfassung:

This work addresses the difficulty to identify space objects in geostationary (GEO) and high eccentricity orbits (HEO) regimes by means of ground based optical observations. The identification is understood here in the widest sense, the aim is to collect information related to an object by investigating all data, which is available via optical observations, including orbit and object properties.

Single observation frames are investigated, which contain, apart from the unresolved imaged of space debris objects, stars, hot pixels and so-called cosmic ray events. Cosmic filters operating on the single observation frames are introduced and tested.

A new algorithm is introduced and tested to link the possibly many unresolved single object images of unknown newly detected objects in an observation series without a priori information.

The accuracy of the Two Line Element (TLE) catalog provided by the US Strategic Command are investigated in GEO and HEO by means of high accuracy optical observations. A new algorithm for catalog correlation has been developed, powerful enough to even correlate observations of GEO objects in clusters.

Orbit determination using only very sparse optical observations have been investigated and the prediction accuracy of such orbits are evaluated. The orbital evolution of objects with high area-to-mass ratio has been investigated using a normalized orbit determination setup. Variations in the area-to-mass ratio can be observed.

The possibilities for supplementing an orbital element catalogue with light curve measurements are investigated and the light curves of objects with high and low area-to-mass ratio are compared.

All algorithms are tested with observations of the ESA Space Debris Telescope (ESASDT), located on Tenerife, Spain, and the Zimmerwald Laser and Astrometry Telescope (ZIMLAT) located close to Bern, Switzerland.