Infrared Laser Ranging to Space Debris – a Chance for ILRS. G. Kirchner[1], F. Koidl[1], [1]Austrian Academy of Sciences, Institute for Space Research, Lustbuehelstrasse 46, 8042 Graz, Austria. Georg.Kirchner@oeaw.ac.at; Franz.Koidl@oeaw.ac.at

Introduction: Space debris is an increasing threat to all near-Earth space activities; however, debris orbit predictions – based on routine radar measurments – are in many cases not accurate enough for e.g. scheduling of collision avoidance maneuvers. To better handle the resulting problems, more accurate debris orbit predictions are essential.

One method to improve debris orbit predictions at least for selected targets is the use of laser ranging to such uncooperative targets [1], [2], [3]; using multi-static laser ranging, even sparse laser ranging data can improve orbit predictions by up to one order [4] – a promising method e.g. in case of conjunctions predicted for only few days ahead.

Most ILRS laser ranging stations are operating at the green (532 nm) laser wavelength, and are not able to range to uncooperative targets with this configuration. However, using the fundamental wavelength (1064 nm), which is available in frequency doubled systems anyway, should provide a significant improvement – up to a factor of 10 to 50, depending on elevation [5] - in the overall debris laser ranging efficiency. SLR Graz will implement and test this in the next few months, using our standard 2 kHz laser at 1064 nm (0.8 mJ / pulse). If successful, this alternative use of the fundamental wavelength – which is low-cost and technologically easy to achieve - would allow a significant number of ILRS stations to join the growing debris laser ranging club, at least for larger targets – with radar cross section of a few m2 - in LEO orbits; it would put ILRS into an important role within future operational laser-based debris ranging and tracking systems.

References:

[1] Greene B, (2002) *Laser tracking of space debris.* Proceedings of 13th International Workshop on Laser Ranging Instrumentation, Washington

[2] Zhang Z.P., Yang, F.M., Zhang, H.F., Wu, Z.B., Chen, J.P., Li, P., Meng, W.D. (2012): *The use of laser ranging to measure space debris.* Res. Astron. Astrophys. 12(2), 212-218

[3] Kirchner, G., Koidl, F., Friederich, F., Buske, I., Voelker, U., Riede, W., (2013) *Laser measurements to space debris from Graz SLR station.* Adv. Space Res. 51, 21-24.

[4] Wirnsberger, H., Baur, O., Kirchner, G. (2014) *Space debris orbit predictions using bi-static laser observations. Case study: ENVISAT.* 19th International Workshop on Laser Ranging, Washington.

[5] Voelker, U., Friederich, F., Buske, I., Hampf, D., Riede, W., Giesen, A. (2013): *Laser based observations of space debris: Taking benefits from the fundamental wave.* Proceedings of the 6th European Conference on Space Debris, Darmstadt, Germany, 22-25 April 2013