CONCEPT OF AN INNOVATIVE PHOTOLUMINESCENT SENSOR FOR RADIATIVE HEAT FLUX MEASUREMENT DURING SUPER-ORBITAL RE-ENTRY. L. Conte[1], E. Trifoni[2], F. De Filippis[2] and L. Marraffa[3], [1]CNR-IMM, Via Pietro Castellino 111, Napoli, Italy [2]Centro Italiano Ricerche Aerospaziali, Via Maiorise, Capua, Italy, [3]ESA/ESTEC, Aerothermodynamics Section, Keplerlaan 1, PO Box 299, 2200AG, Noordwijk, NL.

Introduction: In a super-orbital re-entry, such as of a sample return mission, the radiative heat flux to the capsule surface is predicted to be stronger than in a re-entry from low Earth orbit and no more negligible if compared to the convective heat flux.

The collection of experimental data of radiative heat flux in super-orbital re-entry conditions in-flight and on-ground testing is crucial for the design of thermal protection system of future sample return capsule.

In particular the vacuum ultraviolet (VUV) radiation, whose spectrum covers wavelengths from 10 to 200 nm, originated from the hot shock layer upstream to the capsule is predicted to be the major contribution to the radiative heat flux.

Unfortunately the VUV radiation is hard to be measured due to absorption by atmospheric gases and optical materials.

In this work is presented the idea, the physical principle and a first layout of an innovative sensor capable to collect the VUV contribution to radiative heat flux both for onboard flight measurements and plasma wind tunnel tests.

The sensor is based on the physical phenomenon of the photoluminescence. The VUV radiation is absorbed by a photoluminescent material and re-emitted as visible light. The intensity of the re-emitted visible light is easily measured by a photodetector or a spectroscope and it is directly proportional to the intensity of the incident VUV radiation. The proportional factor is evaluated with a dedicated calibration setup and procedure. All the sensor components are commercially available.

The possibility to use advanced materials to discriminate the contribution of the single wavelength components of the VUV radiation is also discussed.