

The ACES Mission

Salomon, Ch.1; Cacciapuoti, L.2; Dimarcq, N.3

**1Laboratoire Kastler Brossel, ENS, FRANCE;
2ESA Research and Scientific Support Department,
NETHERLANDS;
3LNE-SYRTE,, Observatoire de Paris, FRANCE**

The ACES mission aims at operating ultra stable atomic clocks on board the International Space Station and comparing them to ground clocks located all around the world in the 2010-2011 time frame [1,2]. The expected performances of ACES space clocks (frequency stability and accuracy at the 10^{-16} level) and of the dedicated microwave link (time stability better than 6 ps in 1 day) will be of great interest for time and frequency metrology (comparison of primary frequency standards with a frequency resolution better than 10^{-16}), for fundamental physics studies (tests of Einstein's theory of general relativity, search for a drift of fundamental constants), and for other applications in positioning and geodesy. In this paper, we will present the main characteristics of ACES instruments and discuss the mission's scientific objectives. An update of the development status of the mission will also be presented.



Figure 1: the ACES mission. A cold atom cesium clock PHARAO (developed by CNES) combined with a space hydrogen maser SHM (developed by Neuchatel Observatory) provide an ultra-stable time and frequency reference on board the International Space Station. This reference is compared to an ensemble of ground clocks through a high performance two way time and frequency transfer system. [1] C. Salomon, C. Veillet, Proc. of the first symposium on the utilisation of the international space station, ESA special publication SP 385, 295, 1997. ACES: Atomic Clock Ensemble in Space [2] C. Salomon et al., "Cold Atoms in space and atomic clocks: ACES", C. R. Acad. Sci. Paris, t.2 Série 4, pp. 1313-1330, October 2001