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METHOD FOR SOLAR OXYGEN ABUNDANCE DETERMINATIONS FROM STOKES-V OBSERVATIONS OF THE QUIET SUN MAGNETIC ELEMENTS

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Oxygen is the third most abundant element in the Universe. However, there is only few possible spectral lines in the solar spectrum that can be used for the oxygen abundance determination, all of them are either formed under the conditions of the non-local thermodynamical equilibrium or blended by lines of other elements. That makes the solar oxygen abundance (SOA) determination particularly sensitive to the model atmosphere and atomic data. The use of the realistic 3D hydrodynamical models of the solar photosphere caused a downward revision of the abundance by a factor of 2 (Asplund et al, 2004). However, more recently, the SOA values measured by different groups using different methodologies showed a considerable scattering between the "old" (high) and the "new" (low) value.

A novel approach for the measurement of the SOA was proposed by Centeno and Socas-Navarro (2008). They used the wavelength shift and different sensibility to magnetic field of the Stokes-V profiles of the forbidden oxygen line at 6300 Åand the blending nickel line to evaluate the relative O/Ni abundance from spatially averaged sunspot observations. In this contribution we test a possible application of their method to spatially resolved observations of the quiet sun magnetic elements. An ad-hoc 3D model of the magnetic elements is obtained by inversion of the nearby Fe I 6302 Ålines. That model is then used to compute the O/Ni blend in Stokes-V that can be compared, pixel-by-pixel, to the simultaneous observation of that feature. We use snapshots from highly-realistic 3D radiative magnetohydrodynamics simulations to mimic such an observation with a telescope analogous to the SP/SOT onboard Hinode. The result of our test shows that this approach can provide a reliable value of the SOA. Moreover, through the spatial variation of the observed profiles, it provides additional information on the sensitivity of the O/Ni blend to the magnetic field, velocity, temperature and their relative abundance.