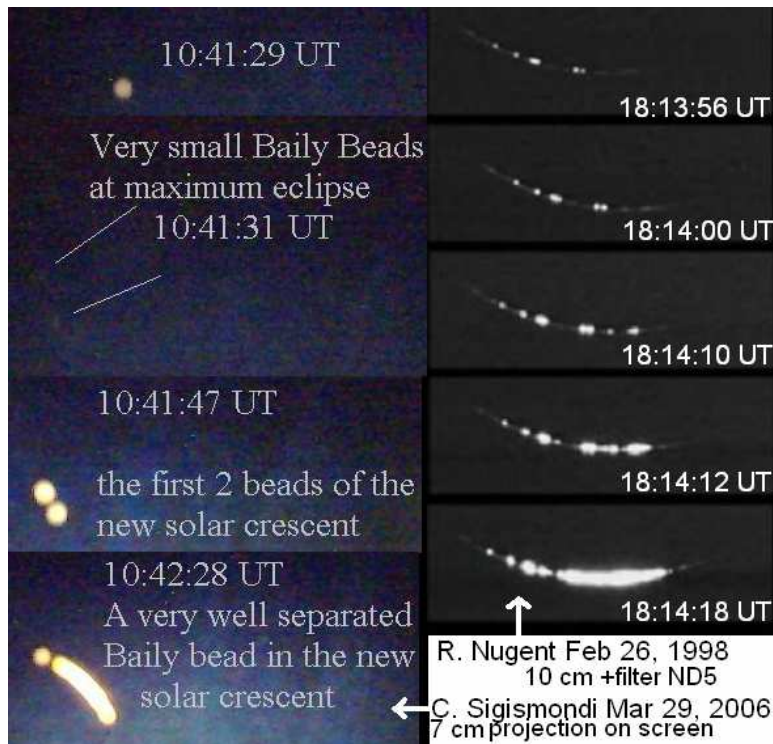


The Quest of Solar Variability with Eclipses

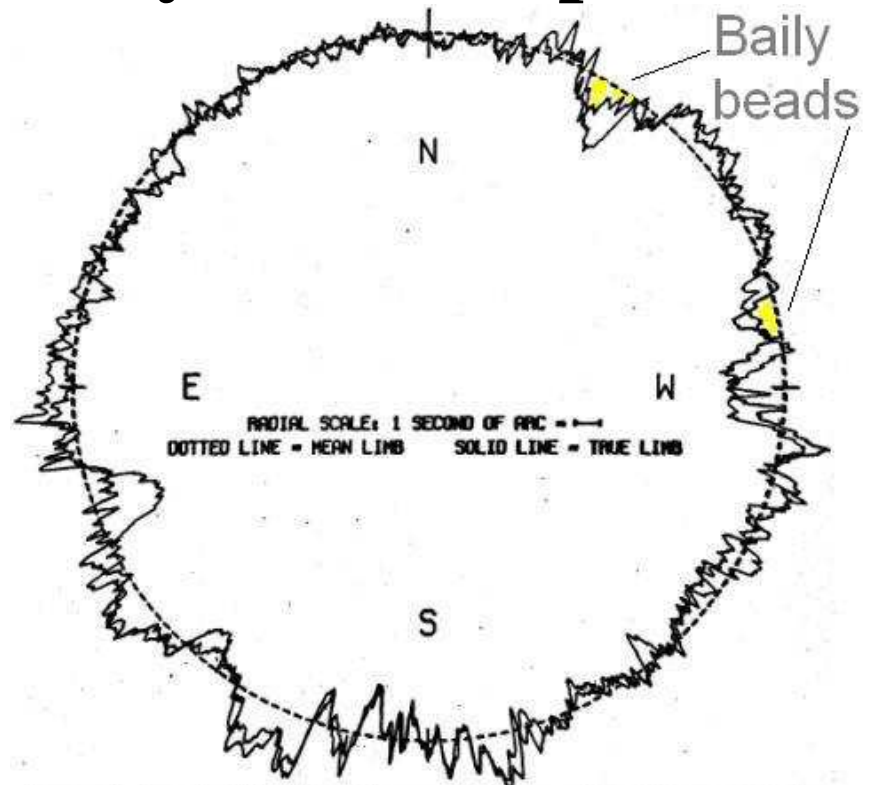


Costantino
Sigismondi

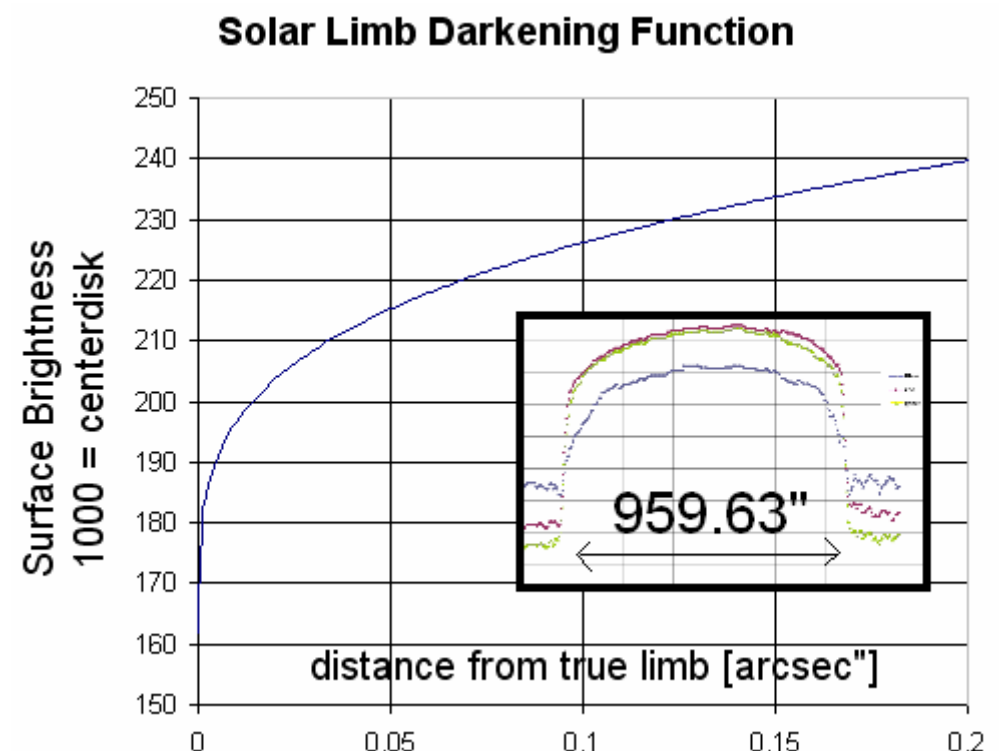
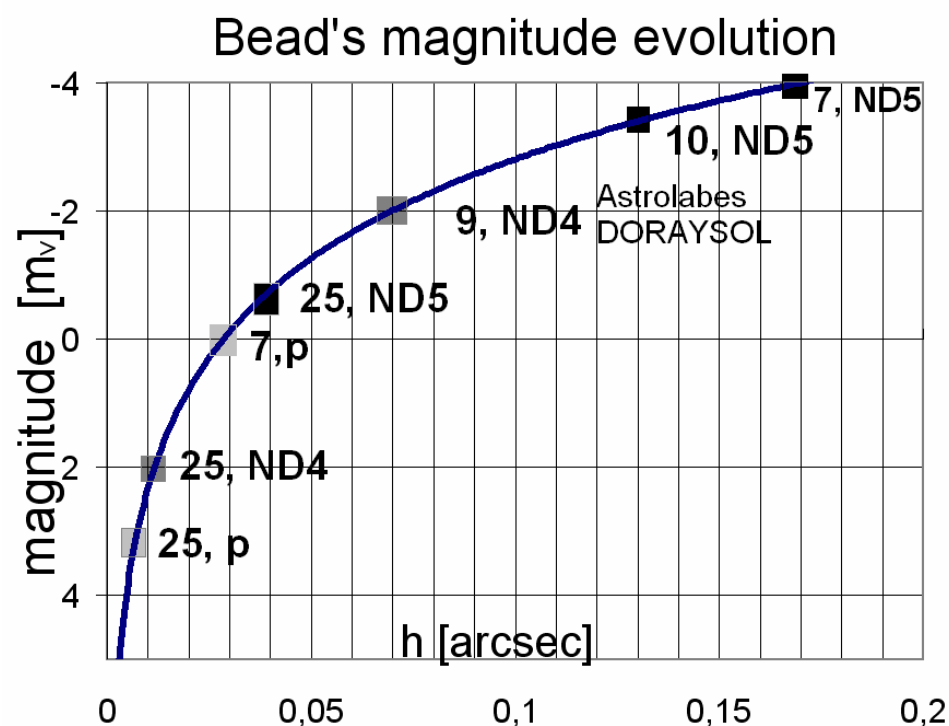
Sapienza
University of Rome



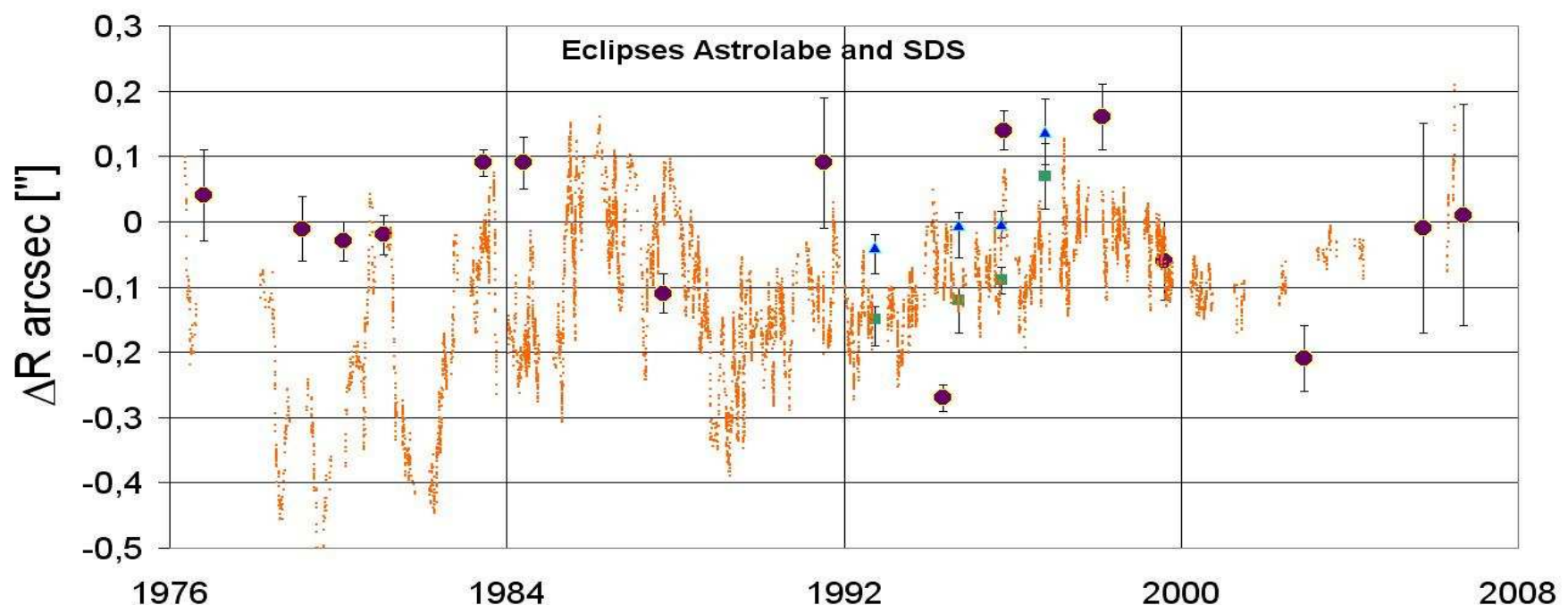
sigismondi@icra.it
www.icra.it/solar



Baily beads are produced by the light of photosphere passing through lunar valleys at the limb. In eclipse video each bead is labelled with UTC time of its dis/appearance. In these photo we see the end of totality, with the evolution in luminosity of some Baily beads. The digitized photographic atlas of lunar limbs (Watts 1962; Herald, 2007; Winocult 4.0 software) is used to recover the position on the Moon of the lunar valleys where the Sun is setting or rising, like those of 18:13:56 UT. The random uncertainty on lunar profiles is $\sigma=0.20''$. A large number N of Baily beads (on eclipse shadow limits), allows an accurate determination of angular solar radius correction ΔR to its mean value at unit distance $R=959.63''$. $\Delta R=0.16''(13/N)^{0.5}(\Delta t/0.025s)$.



The luminosity [mv] of a bead depends on solar limb darkening function and it is represented as function of its depth [arcsec]. The whole Sun is $mv=-26.4$. The last bead detectable for 7, 9, 10 and 25 cm telescope is shown by projection on a screen (p) and with ND4 (10^{-4} transmittance, used for DORAYSOL) and ND5 ($t=10^{-5}$, used for Laclare's Astrolabe). The corresponding depth h is the perceived solar limb correction (negative) which is not real. 7 cm with projection is the sept. 22, 2006 annular eclipse (Sigismondi, 2008). Other eclipses published do not have filters indications and consequently no corrections. Videos with projected Sun during eclipses see beads longer than filtered telescopes, ΔR is closer to real value. Atmospheric turbulence does not affect eclipses observations (data are light from beads ON/OFF). Measured solar radius corrections are of order $\Delta R/R \approx 10^{-5}$.



Data on corrections to mean solar radius from total and annular solar eclipses (black circles, Dunham 2005 + Sigismondi 2008); from Solar Disk Sextant (triangles and squares; balloon borne observations, Egidi et al. 2006 and 2008) and solar astrolabe at Calern (Laclare 2006). The difference between astrolabe data and eclipse can be due to the filters: e.g. there is a systematic difference between true limb and observed one due to LDF: $\Delta R=-0.04''$ for (7,projected) and $\Delta R=-0.13''$ for (10, ND5 Astrolabe).