

A cypress pollen solar corona observed in Rome

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Submitted February 21st 2024, revised & accepted Feb 29th

Abstract Coronae are photometeors formed around the Sun and the Moon because of light diffraction; the angular extensions of the red rings have been measured with the help of a solar ghost image on focus, to the nearest arcminute of accuracy, on the day of 21 February 2024 in Rome. The determination of the pollen diameter $21.8 \pm 0.3 \mu\text{m}$ was obtained from the photos using the formulae of Laven (2015) computed with Mie Scattering theory and angular solar diameter 0.5° : $\theta = 16/r$ and $\theta = 31/r$, when θ is measured in degrees and r in μm . The first observation was under a cypress, shaking a branch with open cones, and this was used as calibration for the observations in the center of Rome, where the corona was visible on the top of Palazzo Venezia. This was a consequence of the injection in the atmosphere of 1500 to 4500 grains/ m^3 (100 is the threshold for intense allergy symptoms) of the Cupressus Sempervirens pollens, which happens in peaked occurrences and specific places and hours in the city.

Sommario Le corone sono fotometeore che capitano attorno al Sole e alla Luna e sono prodotte dalla diffrazione della luce attorno alle particelle, di dimensione uniforme, sospese in atmosfera. Il 21 Febbraio 2024 è stata filmata una corona pollinica prodotta dallo scuotimento, contro-Sole, di un ramo di Cupressus Sempervirens, carico di coni polliniferi appena aperti, e successivamente ne è stata fotografata un'altra sopra i merli di Palazzo Venezia. L'ampiezza angolare delle due corone è uguale, e coincide con quella predetta per pollini da $21.8 \pm 0.3 \mu\text{m}$ di diametro, secondo lo scattering di Mie, calcolato da Philip Laven (2015) per il diametro del Sole pari a 0.5° . Questo dimostra che a Roma ci sono le condizioni per avere corone polliniche intense, dovute alla presenza in atmosfera tra 1500 e 4500 grani/ m^3 di pollini di Cipresso (bastano 100 grani/ m^3 per scatenare intense reazioni allergiche nei soggetti sensibili). Queste condizioni si presentano a ondate con picchi altissimi in alcuni giorni della stagione, e fortemente dipendenti dai luoghi e dagli orari.

Keywords: Atmospheric Corona, Mie Scattering, Diffraction, Cupressus Sempervirens, Pollen, Aerobiology.

Introduction: Pollens Coronae have been first detected in Finland by amateur astronomers, and subsequently observed and studied also in other latitudes (Mims, 1998); they are not associated with altocumulus or cirrocumulus clouds (Lock and Yang, 1991) which produce also solar coronae, not to be confused with the outer part of the solar atmosphere because

of the same name: they belong to the photometeors. The effect of uniform particles scattering can also evidence ellipticities due to the microscopic form of the pollens (Tränkle and Mielke, 1994) at different solar altitudes, with the largest effect at lower altitudes. The pollens of *Cupressus Sempervirens* have spherical symmetry, unlike the Pines, and do produce spherical coronae, like the pollens of *Juniperus*.

The amount of grains producing a visible corona modified the Aerosol Optical Thickness from 0.05 to 0.06 at 680 nm (Mims, 1998) during the pollens' display of 29 december 1996 in Texas, in Rome the cypress pollens' peaks range from 1500 to 4500 grains/m³ Sigismondi & Ricciardi (2020), Charpin et al. (2022)¹.

Observations: fig. 1 is from a video² taken just 1 m below a pollen-laden branch of cypress, shaken in the moment.



Fig. 1 Corona under the cypress, shaken a few seconds before. The other images are from below Palazzo Venezia, from Via

¹ [Conifers - Recent Advances | IntechOpen](#)

² [C. Sigismondi \(2024\) https://youtu.be/4yJB6LwlB3s](#)

del Corso in Rome at more than 50 m of distance, same day.



Fig. 2 Corona over Palazzo Venezia. 21 feb 2024 h 14:26, ISO 80 and 1/14323 s exposition, 2048x1152 px (below 1/35807 s).

In the video the ghost image of the Sun appeared without changing magnification, the same was made for the photos under Palazzo Venezia, for a precise angular reference.

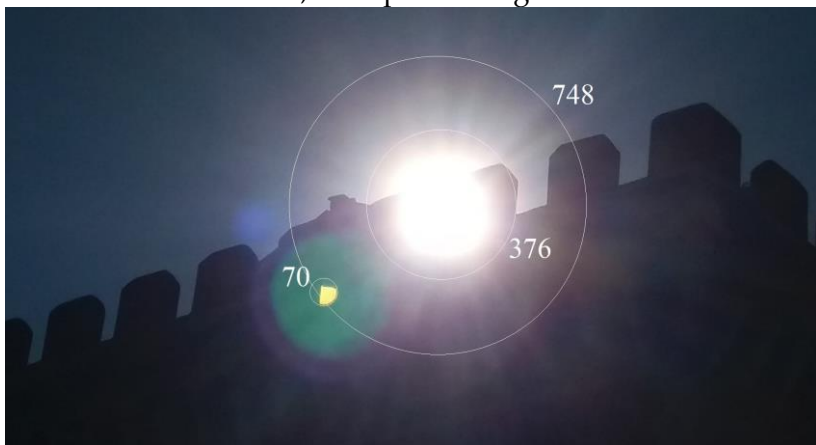


Fig. 3 Two rings (diameter in pixel) of the pollens corona and part of the ghost images of the Sun (70 pixel diameter=32.3').

Meteorological conditions METAR LIRU Rome Urbe Airport

211050Z 33003KT 280V040 CAVOK 16/02 Q1024 39% rel. hum.

211150Z VRB04KT CAVOK 17/00 Q1024 32% rel. hum.

211250Z VRB02KT CAVOK 19/03 Q1023 35% rel. hum.

211350Z 27007KT 240V350 CAVOK 18/04 Q1022 40% rel. hum.

The sky was clear and the relative humidity was exceptionally low LIRA 211350Z 23004KT 150V300 CAVOK 17/00 Q1023 LIRF 211350Z 26008KT CAVOK 16/06 Q1023 NOSIG for all the roman area. The corona around the Sun was of pollens' origin.

Conclusions The two rings clearly recorded either under the cypress and over the palace have the same angular extent to the nearest arcminute: the cypress pollens are the responsible of both corone, with statistical evidence. Their average diameter is $21.8 \pm 0.3 \mu\text{m}$, in very good agreement with microscopic observations (Travaglini, 2014). The amount of pollen grains is of the order of magnitude of thousands 1.5-4.5 per m^3 (Charpin et al. 2005, Sigismondi and Ricciardi 2020). The photo at the solar corona were made in other places of Rome in the same day (starting from Piazza della Repubblica to Piazza Venezia) and on 25 february with less allergic symptoms (experienced by the author) than 21 february 2024 and same serene day, finding clearly the corona only in the discussed cases. This is the first documented case for Rome.

Acknowledgments: to Alessandro Travaglini, Aerobiology, Tor Vergata University, Rome.

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