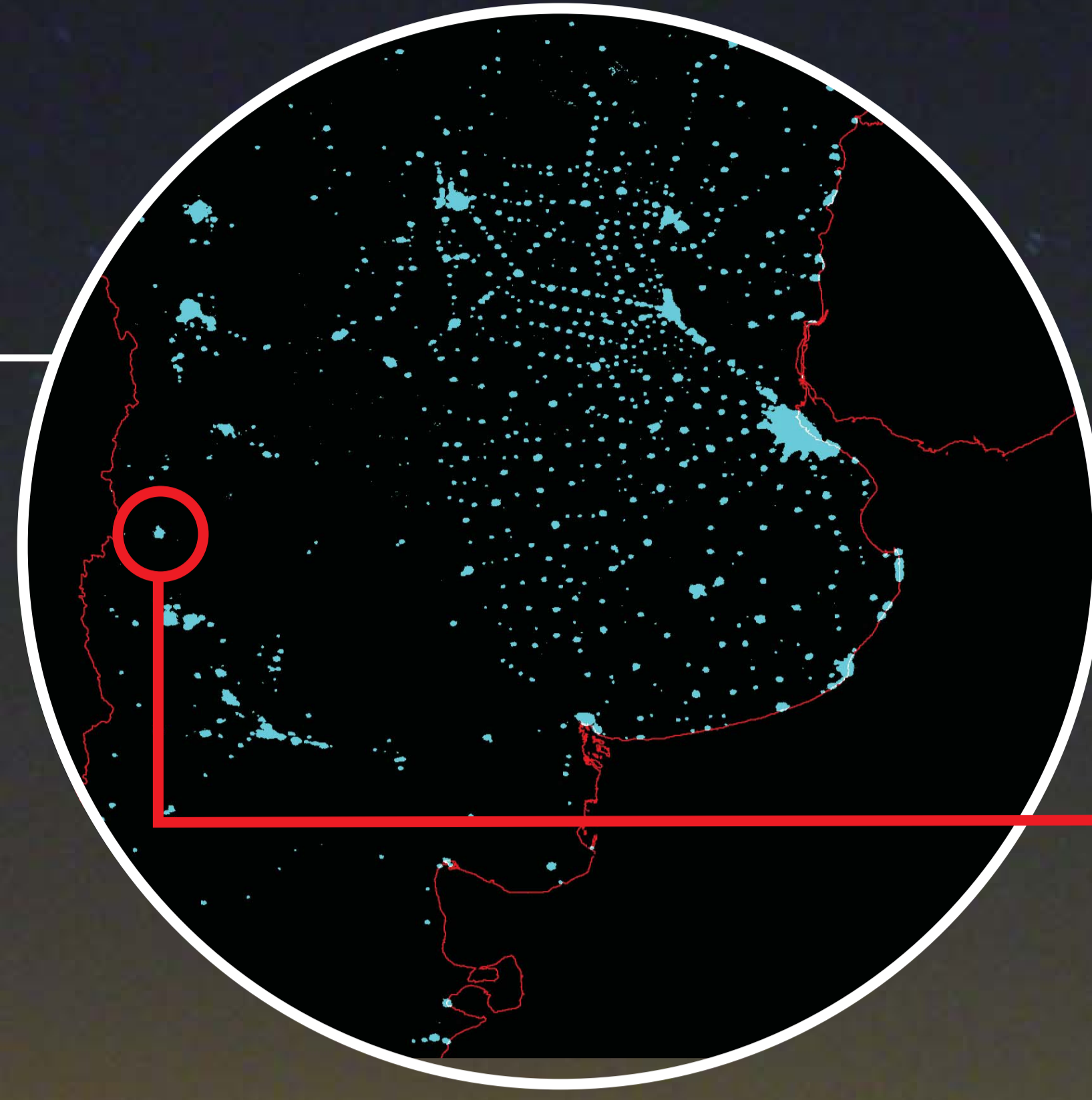


MALARGÜE LIGHT POLLUTION

A STUDY CARRIED OUT BY MEASURING REAL CASES

B. García, A. Risi, M. Santander, A. Cícero - bgarcia@frm.utn.edu.ar
 UTN Regional Mendoza y San Rafael-CONICET, Observatorio Pierre Auger-Malargüe
 A. Pattini, M.A. Cantón, L. Córca, C. Martínez, M. Endrizzi, L. Ferrón - apattini@lab.cricyt.edu.ar
 LAHV, INCHUSA, CRICYT-CONICET



- In the city of Malargüe, in the south of the Mendoza province, an ordinance was approved on April 14th, 2005 by which the sky is protected.
- South Mendoza houses the Pierre Auger Observatory due to the unique natural conditions of its sky. The development of Malargüe during the last years has increased the amount of light projected towards the sky, due to inefficient illumination, for which it is of the utmost importance to keep constant the quantity of light generated or, even better, to diminish it.
- Declaring this region as light contamination protected even represents another tourist attraction that strengthens the ecological tourism and its related activities.
- The ordinance**
 The regulation is included in the compromise of healthy policies assumed by the Department of Malargüe according to the Universal Declaration of the Right of the Future Generations, signed by the UNESCO: "the persons of the future generations have the right to a uncontaminated and untouched planet Earth, including the right to a pure sky".
 In this sense, the Argentine National Constitution states in its 44th Article: "All the inhabitants have the right to a healthy environment, balanced and able to support human development. They have the right for their productive activities to satisfy current needs without compromising that of the future generations".

In the Darkness, Malargüe Paid Tribute to Einstein. April 18th 2005



As the tower clock of Malargüe city center struck 22, the streetlights, the lights of the Pierre Auger Observatory and those of several houses and stores were switched off, and even the broadcasting of radio and TV programs was interrupted to join last Monday's worldwide commemoration of the 50th anniversary of Albert Einstein's death. This voluntary blackout lasted only ten minutes.

While discussing the aims pursued by the blackout, Domingo, a nine-year-old student, stated "It's due to the death of a man who invented many things", and went on "My mum told me that."

Meanwhile, at the restaurant of the Río Grande Hotel, the guests were surprised to learn that their tables were going to be candlelit for a few minutes. "It's a very nice idea," said Luis while enjoying a dinner with some workmates. A group of employees of an oil company -until then unaware of the event- showed enthusiasm, too. "I find it very original," said José, and Alberto added, "I do not know much about Einstein, but this makes me feel compelled to learn more."

The Long-awaited Day

It was Monday midday and the clouds began to hide the sun, but the villagers' enthusiasm did not decline in the least: there had been several days of preparation to enjoy watching the constellations without the difficulties posed by artificial lighting.

Both the City Council and the Pierre Auger Observatory implemented a plan to inform and encourage the population to participate -together with the most important cities in the world- in the tribute that started in Princeton, USA, and went on all over the world.

The event was much publicized on TV and radio programs. In addition, brochures were distributed at schools, stores and kiosks. These brochures contained drawings of the constellations, intended as a guide for people to watch the stars.

Los Andes Newspaper, Wednesday 20th April 2005
 Mendoza, Argentina



FIELD STUDIES

The city is our standing point for a novel experience, related to the control of street lightning. Depicted in **Figure 1**, a night view of Sarmiento square, recently built with balloon lights, mirrored on their upper half.

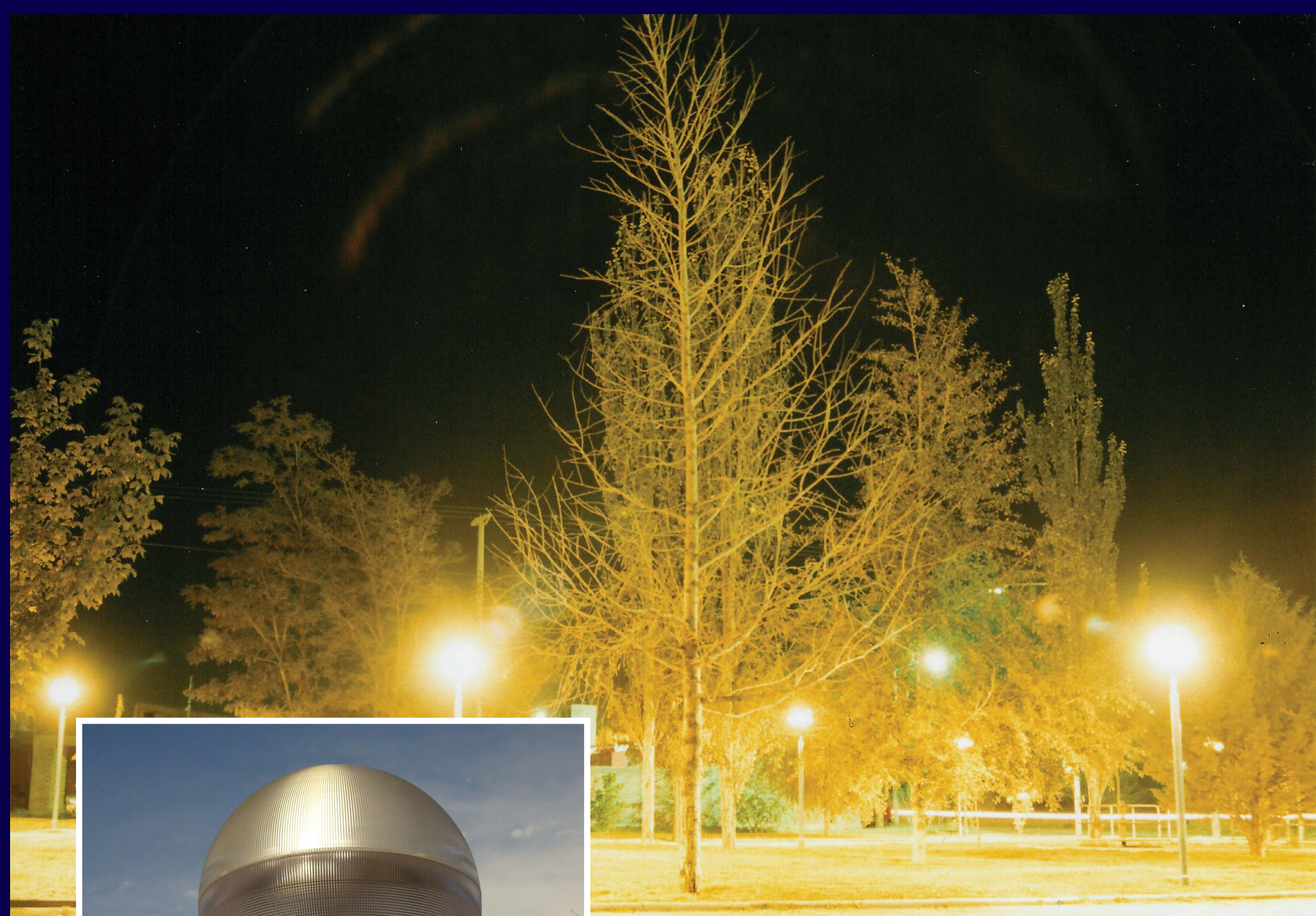


Figure 1 - Sarmiento square - Mirrored balloon lights

In **Figure 2**, San Martín square, the main square of the city, is shown with traditional balloon lights. Both pictures were taken with the same settings and the same camera.



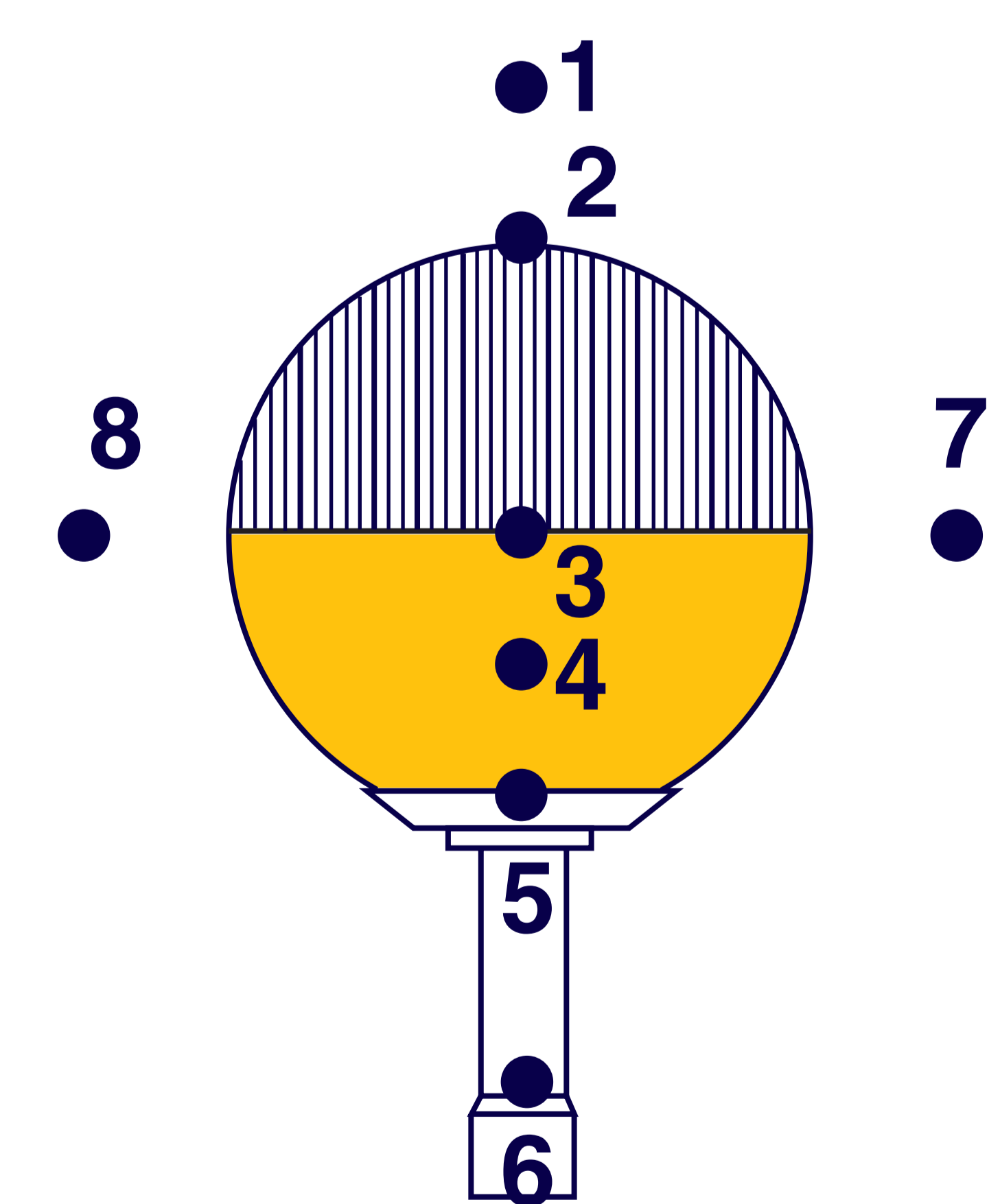
Figure 2 - San Martín square -Traditional balloon lights

LIGHT POLLUTION MONITORING PROTOCOL IN THE SQUARES OF THE CITY

In this first stage, we conducted a survey in order to obtain quantitative data for later analysis. For that purpose, a comparative study of the street lamps for exteriors has been conducted in two squares of the city. Apart from surveying the physical aspects of the squares (as its morphology and the tree species on it) several photometric measurements were taken:

Lamp luminance measurements (during night time)

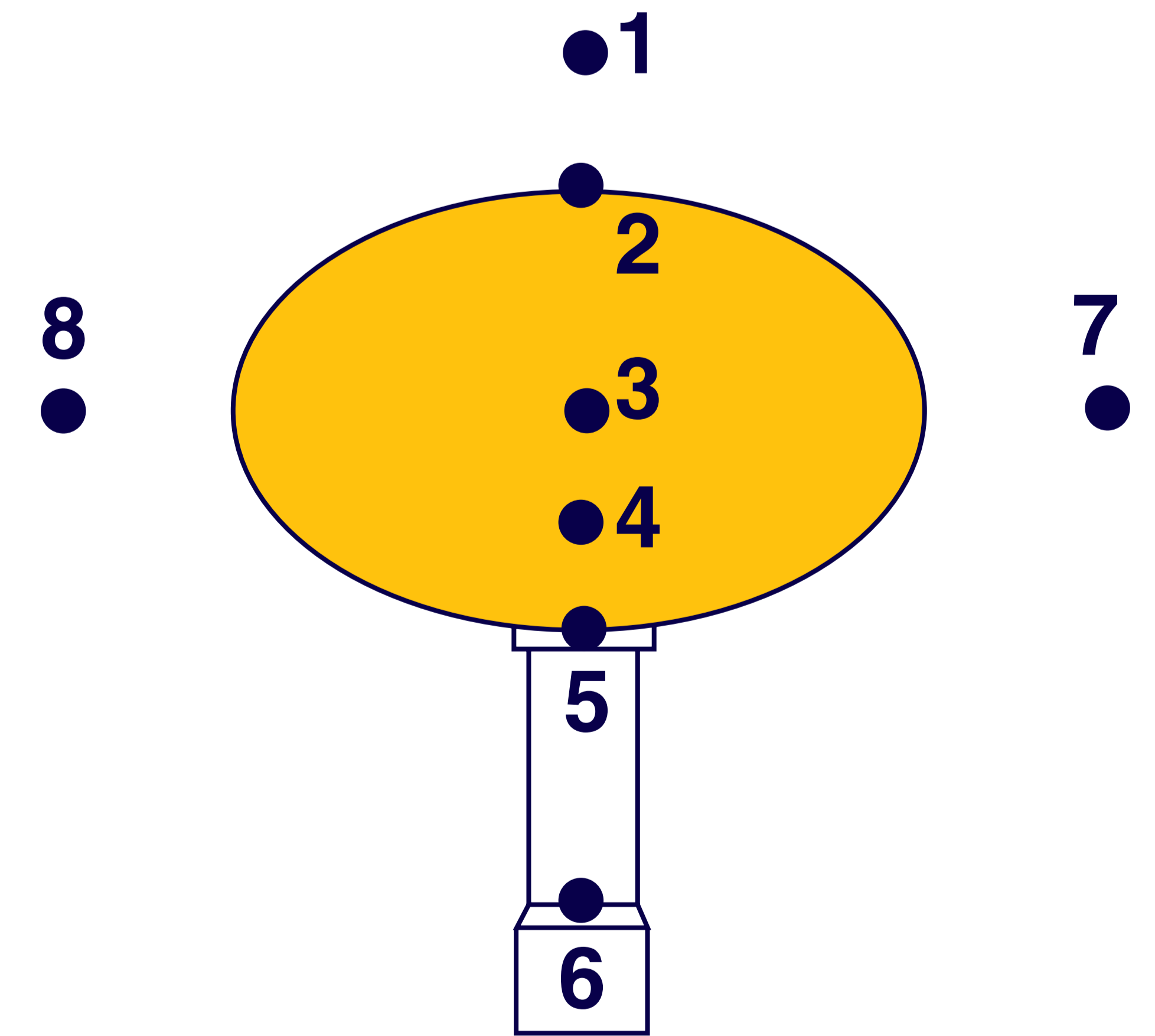
Luminance data were acquired (cd/m²) in seven points per lamp (a traditional one and one with pollution prevention). The luminance meter was pointed towards the areas shown in figure 8, always taking care to focus the lens before starting the measurement.



Mirrored balloon lights - 70 Watts



Luminance measurements		
Table 1: Luminance values according to the type of lamp		
Points	San Martín (cd/m ²)	Sarmiento (cd/m ²)
1	142	1.72
2	3992	23.52
3	4747	3739
4	4813	7421
5	3328	1375
6	5.16	2.36
7	1	0.73
8	2.04	2.24



Traditional balloon lights

SKY BACKGROUND

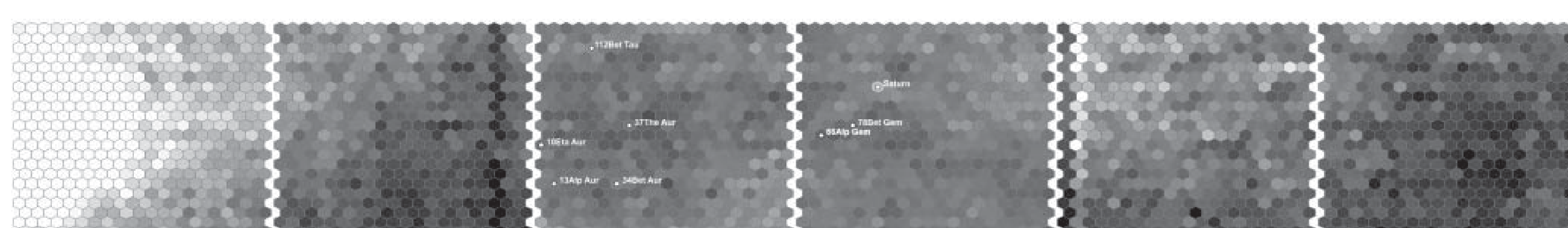


Figure 2. In one of the Fluorescence Detectors of the Pierre Auger Observatory (<http://www.auger.org>) regular sky background measurements are taken in order to monitor the brightness of the night sky. A snapshot of the sky brightness is shown as seen by the six cameras of the Detector, spanning very close to 180°. The camera in the far left is the one pointing very close to the city, 18 km away, and is clearly influenced by the light pollution of Malargüe.

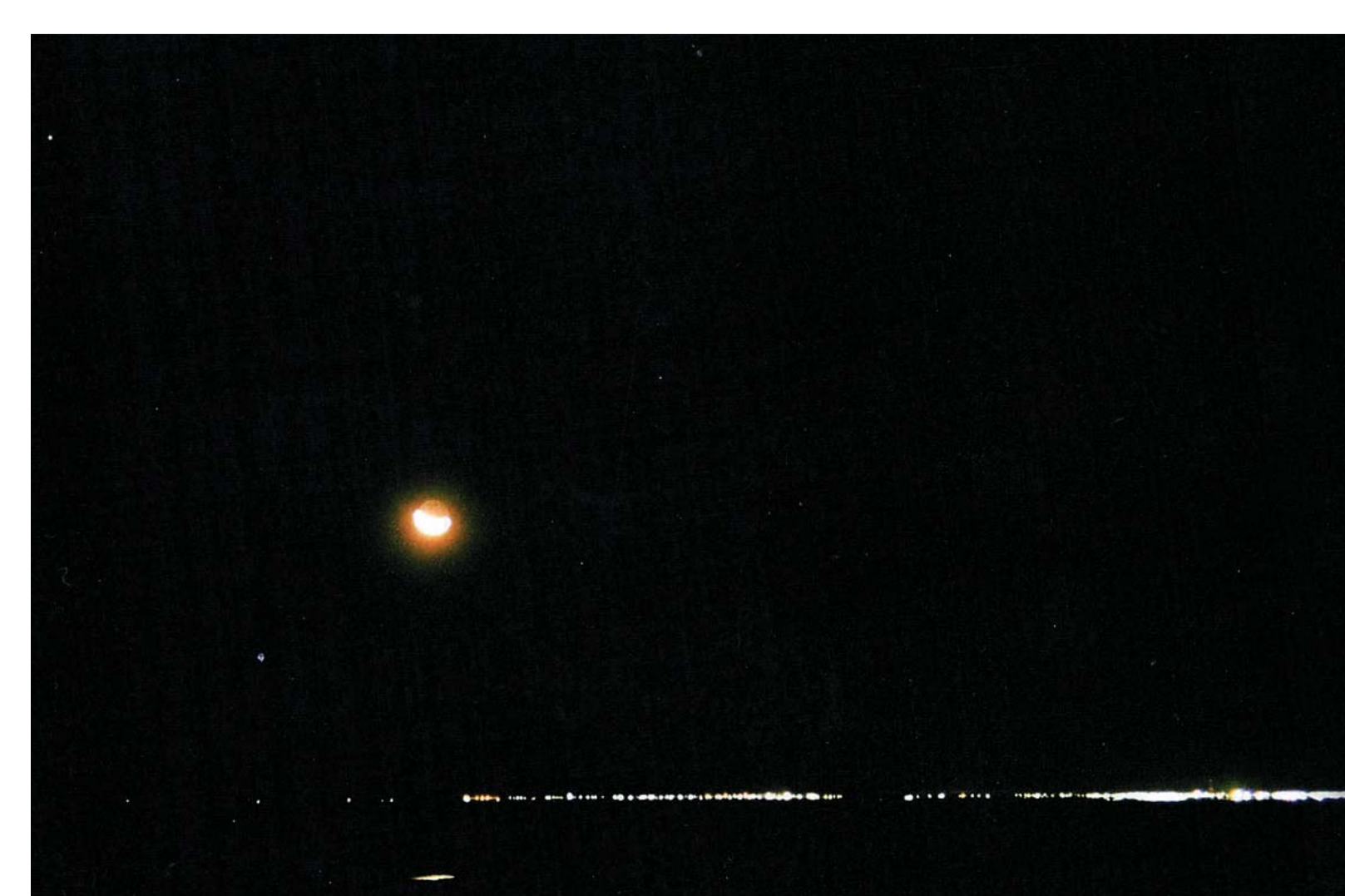


Figure 1 - Malargüe - Year 2000 - ASA 400/ Exp/20 seg

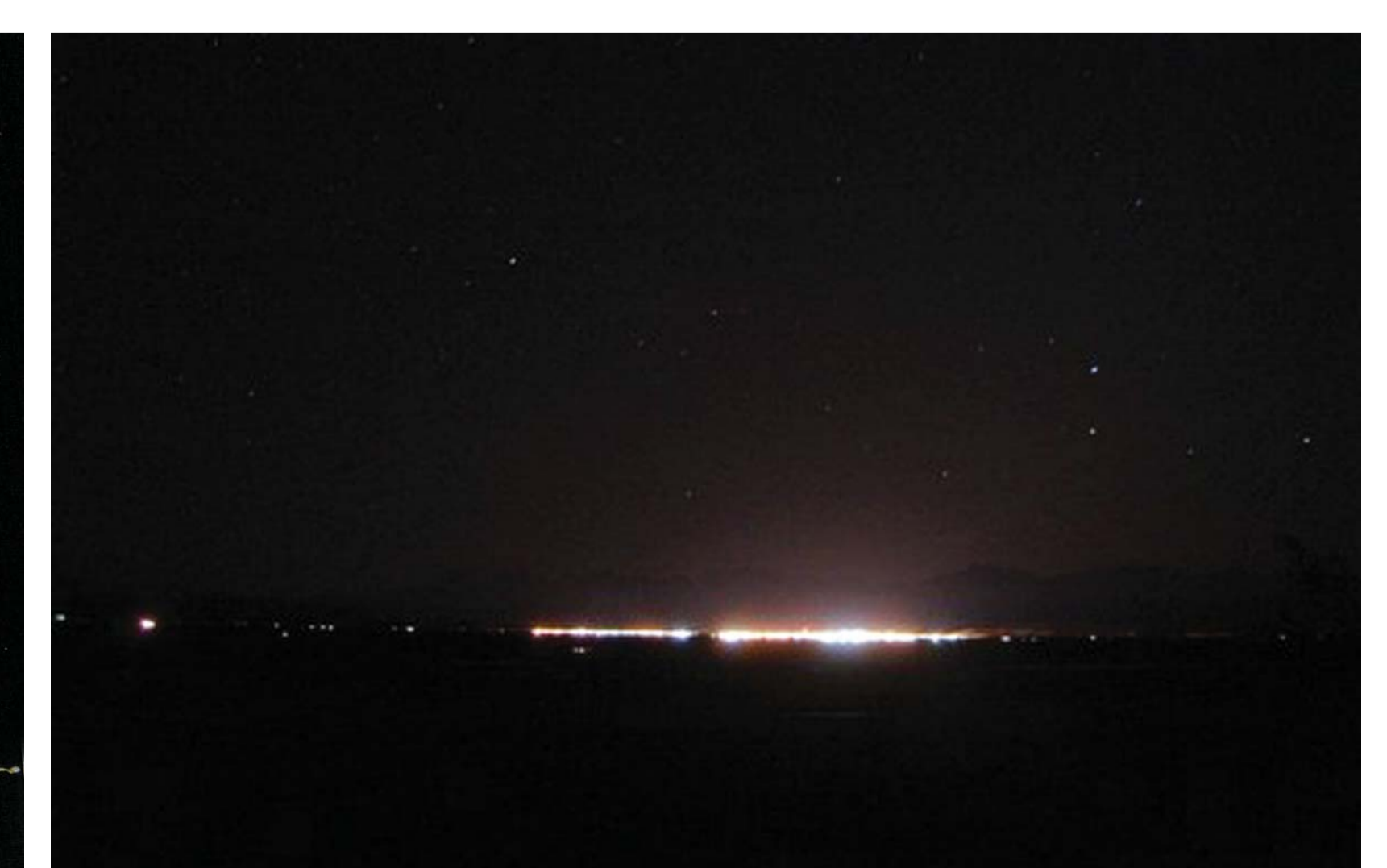


Figure 2 - Malargüe - Year 2006 - ASA 400/ Exp/30 seg