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SSOCA (SYSTÈME SOLAIRE DE LA CÔTE D'AZUR) : THE FRENCH RIVIERA SOLAR SYSTEM

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Abstract. We present SSOCA, the project of a representation of the Solar System to scale unique in its kind. The scale will be the same for the distances and the sizes of the bodies : 1:60 000 000. The Sun will be represented by the great dome of Nice Observatory (23m diameter) and the planets will be spread in the city of Nice and the French Riviera, at locations visible from the Observatory (and reciprocally). This will make SSOCA the world largest scale model of the Solar System that can be seen as a whole in one glance.

Keywords: Solar System, miniature model, outreach, scientific tourism

1 Introduction

Many miniature Solar System models exist. Most of them use a different scale for the sizes of the planets and for the distances, because of the hard constraint of the Earth's size compared to the astronomical unit (10^4 times smaller), so that the Earth is only a millimeter large if the astronomical unit is 10 meters long (which does not fit in most rooms) and the Sun-Neptune distance is 300 meters (which does not fit in many courtyards). But exaggerating the sizes compared to the distances gives people the wrong impression that the distances are not that long, and the Solar System not that empty.

There exists also a lot of models which respect the same scale for the sizes and the distances. All of them suffer either one of the two following issues, though : (i) the planets are too small to see details on their surfaces*, or (ii) the miniature is so expanded that one can not see any celestial body from an other one, making the distances hard to perceive†.

The Système SOlaire de la Côte d'Azur (SSOCA) will be the first to circumvent both disadvantages, while being the third largest Solar System scale model in the world. This facility will be accessible in public space and offer a lot of outreach possibilities, from scientific tourism to guided tours for classes or general public.

2 What is SSOCA ?

The headquarters and many researchers of the Observatoire de la Côte d'Azur are located on the gorgeous site of the Observatoire de Nice. This observatory was built thanks to sponsor Raphaël Bischoffsheim at the end of the XIX$^{\text{th}}$ century on a small mountain on the east side of the city. The site still harbours the fifth largest refracting telescope ever built. To host this huge instrument, with 17.89 m focal length, a huge dome was necessary. It has been designed by the famous engineer Gustave Eiffel, on top of a majestic building designed by the non less famous architect Charles Garnier. The resulting dome is 23 m in diameter (see Fig. 1). Implanted on the crest of the Mont Gros, at 380 m altitude, it is visible from all the city of Nice which lies at its feet, and from large distances along the French riviera.

We can use this dome as the Sun, defining a scale of 1:60 000 000. At this scale, an au is about 2.5 km so that the planets will not fit on the site of the Nice observatory, and our model should extend to 75 km. Fortunately, the Mont Gros site had been described by Garnier himself as "*the most beautiful balcony over the Côte d'Azur*". The view from here dominates the city of Nice, and provides a great overview of all the coast all the way to

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*E.g.: Sagan planet walk in Ithaca (USA) (scale: 1 to 5 billions) is 1.2 km long with a 3 mm Jupiter.
†E.g. : the largest of all, the Sweden Solar System (scale: 1 to 20 millions). See http://www.swedensolarsystem.se/en/ .

Fig. 1. Left : Great dome of the Nice observatory, SSOCA's Sun. **Right:** Large refracting telescope inside the dome.

beyond Saint-Tropez when the sky is clear, through the Cap d'Antibes and the bay of Cannes. This offers the possibility to place the model planets in strategic locations from which the observatory can be seen, and that can be recognised from the observatory. Fig. 2 shows the places we foresee at the moment. The four terrestrial planets will be in Nice, and the four giant planets outside the city, at mountain tops or by the sea, all in spots accessible after a nice and easy hike.

In this way, visitors of the Observatory of Nice will be able to see at the same time the great dome and the places where the planets are displayed. The planets themselves, which will be between 10 cm and 2.2 m won't be visible with the naked eye, just like the real planets. Nonetheless, their position will be clearly identifiable, providing people with a great sense of the real immensity of the Solar System.

Reciprocally, hikers or pedestrians who stand by the representation of a planet will be able to appreciate how large the real Sun would appear from this planet by looking at the great dome of the Nice Observatory.

3 Models of the terrestrial planets

The four terrestrial planets should have diameters of 8.1, 20.2, 21.3 and 11.3 cm for Mercury, Venus, the Earth and Mars, respectively. These are sizeable, but not huge. Hence, their insertion in the urban landscape needs to be thought through. The sustainable design company *Le Collectif* (`http://www.lecollectif-sd.com`) proposes that each planet lays on a circular orientation table, on which the positions and distances of the other planets will be shown, thanks to a simplified fish-eye map of the surroundings and the region. In addition, we hope to have a two to three meters post with a recognisable sign on top to ease finding the planet from the distance. Each planet will be accompanied by two metallic plates engraved with information, one on the global SSOCA project and the Observatoire de la Côte d'Azur, and one on the planet itself, with scientific data and fun facts.

On top of that, each planet should have a unique animation. We have thought of the following.

Mercury The smallest planet will be located at Pont-Michel, a very animated crossroad next to a tram stop, in a popular neighbourhood. The tramway here drives at about 18 km/h, which turns out to be the speed of light at our scale: $\frac{3{\cdot}10^8 \text{ m/s}}{60\,000\,000} = 5 \text{ m/s} = 18 \text{ km/h}$. Looking at the tramway will therefore give people an idea of how long it takes for light to travel in the Solar System.

We plan to challenge visitors to run at the speed of light, by passing a few 5 m spaced lines on the walkway every second.

Venus For this planet, our preferred site is the garden of the Cimiez monastery, a peaceful place on a hill opposite the observatory. From here, one sees clearly the great dome just in front, but also the locations of Mercury and the Earth. Hence, we would like to have 3 fixed small spotting scopes pointed at these places.

Earth and Moon A perfect location for the Earth is the Nice-Riquier train station, which is the second busiest one in the Alpes-Maritimes département, and also the starting point of the bus line that goes to the Nice Observatory. Here, the plan is to recreate the conditions of a Sun eclipse, by putting the Moon between

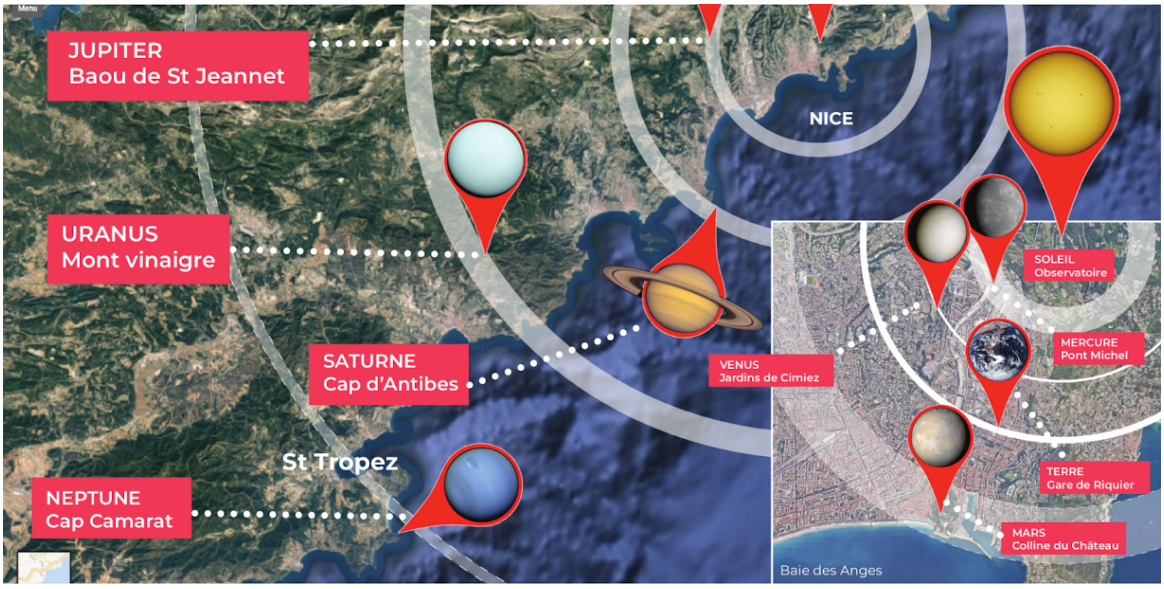

Fig. 2. Possible localisations of the planets in Nice and along the French Riviera. Grey circles represent the orbits.

the Earth and the Observatory, so that visitors sitting in a dedicated chair next to the Earth will see the Moon just in front of the great dome, with exactly the same angular diameter (as the scale will be respected).

Mars The castle hill in Nice, which is a nice and popular park between the harbour and the old town offers on its top a great spot to put Mars model, with view over the observatory and the Baie des Anges. We would like to use this space to put a seesaw in which the two arms would be of uneven length to recreate the gravity difference between Mars and the Earth. The necessary pedagogical explanation about the difference between the mass and the weight will be carefully displayed.

Main Asteroid Belt Many asteroids of the Main Belt have an orbit that, at the scale of SSOCA, runs through the western part of Nice, including the world famous Promenade des Anglais. In many points on the western hills or on the sea front, we would like to insert on the ground a metal plate on which the name of the asteroid would be engraved, together with its orbit and main physical characteristics. The asteroid itself would be a simple point.

Beyond the main asteroids (Ceres, Vesta, etc.), we are thinking of selecting also asteroids named after persons who marked the history of astronomy in Nice. Some of them do not have an asteroid named after them yet, so we are working on a proposal to the IAU for naming asteroids with adequate orbits after them.

4 Status of the project and perspectives

As this proceeding is written, this is still only a project. The sites are chosen, and the design is ready for the terrestrial planets. The giant planets, being of the scale of the meter (2.2 m for Jupiter) should be made differently and will be designed later. We hope to get authorisations and money to build the inner Solar System (up to the Main Asteroid Belt) in early 2020. This should lead to an official inauguration, and trigger the construction of the giant planets in the following years.

To follow the project, please see `https://www.oca.eu/ssoca/`.
Do not hesitate to contact us[1] and provide feedback (or even a sponsoring offer)!

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